SOC2023
Session Abstract List

Managing Rivers for Multiple Uses

Panel, Session #1

Introducing the Mississippi River Delta Transition Initiative

The National Academies Gulf Research Program has asked LSU and Tulane to form an integrated research consortium to carry out the Mississippi River Delta Transition Initiative (MissDelta). This five year program, anticipated to begin in late 2023, will be focused on the future of the lowermost delta plain area adjacent to the Mississippi River: this encompasses the river corridor below the end of east bank MR&T levee, the birdsfoot subaerial delta, and the subaqueous delta front. The consortium will address four objectives: future projection of the evolution and stability of the system between now and 2100, a management evaluation that includes strategizing about how negative impacts of the degradation of the lower river promontory can be forestalled or minimized, workforce diversity, and socioeconomic resilience. To date, while there has been significant investment and extensive research conducted on the Mississippi River Delta, led by the Louisiana CPRA and the U.S. Army Corps of Engineers, there are limited studies focused on projections for the terminus of the Mississippi River Delta, including the subaqueous platform. As this region experiences rapid physical changes, understanding the rates, intensity, and consequences of impacts like sea level rise, subsidence, land loss, ecological health, channel shoaling, and other processes is pivotal in building a resilient coastline and protecting Gulf ecosystems. MissDelta will also dovetail with existing and planned technical and resilience efforts being carried out on the region by government agencies, NGO's and the academic community. The goal of this session will be to (1) report on troubling trends on the stability of this region that suggest its future is problematic and the need for MissDelta, (2) report on the significance of this region to the health of the delta and wider surrounding areas of the northern Gulf, and (3) outline a proposed consortium workplan to address the objectives.

Session Organizer: Mead Allison | Department of River-Coastal Science and Engineering, Email: meadallison@tulane.edu

Moderator: Samuel Bentley | Department of Geology & Geophysics, sjb@lsu.edu

Presenter or Panelist 1: Mead Allison | Department of River-Coastal Science & Engineering, meadallison@tulane.edu

Presenter or Panelist 2: Ehab Meselhe | Department of River-Coastal Science and Engineering, emeselhe@tulane.edu

Presenter or Panelist 3: George Xue | Department of Oceanography and Coastal Sciences, zxue@lsu.edu

Presenter or Panelist 4: Carol Wilson | Louisiana State University, carolw@lsu.edu

Presenter or Panelist 5: Barbara A. Kleiss | Tulane University, bkleiss@tulane.edu

Human Dimensions

Panel, Session #2

The NASEM Gulf Research Studios: Building on Lessons from the Pilot Year

For the 2022-2023 academic year, the National Academies of Sciences, Engineering, and Medicine's (NASEM) Gulf Research Program (GRP) awarded five universities funding for creating interdisciplinary architectural and landscape architectural design studio courses that engage with the unique features of the Gulf of Mexico region. The five schools, Auburn University, Louisiana State University, Mississippi State University, University of Florida, and Tulane University, each offered studios for graduate and undergraduate students that provided the opportunity for students to apply creative design approaches to address major regional issues in three GRP areas of focus: Future of the Energy Transition, Future of a Changing Gulf Coastline, Future of Healthy and Resilient Communities.

While each school took on a different scope and scale of work within the studios, they all used collaborative, interdisciplinary approaches that incorporated design, science, and engineering to think critically about the design opportunities in coastal communities. Moderated by Gulf Research Program Executive Director Lauren Alexander Augustine, this panel will engage faculty members from each of the five schools in a conversation about:

- Their unique approaches to this initial interdisciplinary studio

- The value of design research in the Gulf of Mexico

- Lessons learned from the pilot year and

- Next steps for future iterations of this multi-year endeavor.

Session Organizer: Liz Camuti | Tulane University School of Architecture, Email: ecamuti@tulane.edu

Moderator: Lauren Alexander Augustine | Gulf Research Program, National Academies, laugustine@nas.edu

Presenter or Panelist 1: Jeffrey Carney | University of Florida - School of Architecture, Florida Institute for Built Environment Resilience (FIBER), j.carney@ufl.edu

Presenter or Panelist 2: Rob Holmes | Auburn University - School of Architecture, Planning and Landscape Architecture, rbh0012@auburn.edu

Presenter or Panelist 3: Traci Birch | Louisiana State University - LSU Coastal Sustainability Studio, tbirch@lsu.edu

Presenter or Panelist 4: David Perkes | Mississippi State University - Gulf Coast Community Design Studio, dperkes@gccds.msstate.edu

Presenter or Panelist 5: Liz Camuti | Tulane University School of Architecture, ecamuti@tulane.edu

Preparing for Climate Change: Renewable Energy, Mitigation and Adaptation

Panel, Session #3

Building Resilient Communities and a Regenerative Blue Economy for our Gulf Coast Communities

As goes the resiliency of our gulf coast communities, so goes the future of Louisiana. I am proposing a panel discussion on the status and potential of the Blue Economy and Blue Tech development, deployment, and scaling in the Louisiana Estuary. In this context the Blue Economy includes initiatives related to 'regenerative' ocean industries, ecosystem services, and environmental restoration, e.g.:

- Sustainable aquaculture and mariculture, including fisheries management, algae, and seaweed farming for food, feed, and energy;

- Renewable 'Blue' energy such as ocean-based biofuels, wind, hydrogen, wave, current, thermal ocean-tech, and tidal generation;

- Coastal bulwark protection, engineering, and reinforcement including waste water assimilation wetlands, habitat and wetland restoration, protective oyster reefs, mangroves, and wetland forest planting;

- Regenerative floating infrastructure, including "rigs to reefs", floating communities (residential and civic buildings), and utility services;

- Algae bloom prevention and mitigation, including nutrient harvesting, deepwater biomass sequestration, and upriver sustainable agriculture initiatives.

The discussion would contextualize our regional outlook within the global climate crisis, tie together the component roles of key Blue Technology verticals with a keen eye toward the potential of Regenerative Marine Infrastructure models, describe the interplay of critical components of developing an integrated supportive Innovation Ecosystem, and layout an economic development-based roadmap towards the region establishing global leadership in community-based climate resilience solution sets, and Disaster Risk Reduction initiatives (applicable around the world).

Session Organizer: Gregory Delaune | Deep Blue Institute, Email: greg@deepblue.institute

Moderator: Gregory Delaune | Deep Blue Institute, greg@deepblue.institute

Presenter or Panelist 1: Rebecca Conwell | The Beach at UNO,

Rconwell@unofoundation.org

Presenter or Panelist 2: Mark Kulp | The University of New Orleans, mkulp@uno.edu

Presenter or Panelist 3: Jon Atkinson | CEO and President of the Board at The IDEA Village, jatkinson@ideavillage.org

Presenter or Panelist 4: John Day | Distinguished Professor in the Department of Oceanography and Coastal Sciences and the Coastal Ecology Institute, School of the Coast & Environment at Louisiana State University, johnwday@bellsouth.net

Presenter or Panelist 5: Harry Vorhoff | Deputy Director Office of the Governor, Coastal Activities, Harry.Vorhoff@la.gov

Coastal Law, Policy & Funding

Panel, Session #4

Bipartisan Infrastructure Law: Accessing Federal Funds for Resilient Coasts and Communities

Recent years have seen significant federal investment in coastal restoration and resilience through the 2021 Bipartisan Infrastructure Law (with $3 billion for coastal restoration), the 2022 Inflation Reduction Act (with $2.6 billion to protect and restore coastal ecosystems), and the 2022 Omnibus Spending Bill (with $926 million for RAE priorities), as well as funds that are going to infrastructure more broadly. In this panel, you will hear from NOAA's Office of Habitat Conservation's Restoration Center (RC) discuss on four funding opportunities managed by the RC (Fish Passage; Tribal Fish Passage; Transformational Habitat Restoration and Resilience; and Coastal Habitat Restoration and Resilience Grants for Underserved Communities). This panel will also include a discussion on lessons learned for funds that have already been awarded and other funding opportunities ahead, with a focus on how to identify projects, staffing plans, scientific approaches, and monitoring approaches to use to submit successful proposals for high-impact projects.

Session Organizer: Daniel Hayden | Restore America's Estuaries, Email: dhayden@estuaries.org

Moderator: Daniel Hayden | Restore America's Estuaries, dhayden@estuaries.org

Presenter or Panelist 1: Carrie Selberg Robinson | Director, Office of Habitat Conservation

NOAA Fisheries, carrie.robinson@noaa.gov

Presenter or Panelist 2: Marc Wyatt | EPA Director, Gulf of Mexico Division, Wyatt.Joe@epa.gov

Presenter or Panelist 3: Chad Kacir | NRCS State Conservationist (LA), Chad.Kacir@usda.gov

Presenter or Panelist 4: Mark Berte | Executive Director - Alabama Coastal Foundation, mberte@joinacf.org

Presenter or Panelist 5: Michael Biros | Coalition to Restore Coastal Louisiana, michael.biros@crcl.org

Presenter or Panelist 6: Zach Monroe | Office of Resilience and Sustainability, IIJA Task Force - City of New Orleans, zach.monroe@nola.gov

Presenter or Panelist 7: Ron Howard | USDA Gulf Coast Ecosystem Restoration Team, ron.howard@usda.gov

Hydrology, Geomorphology, and Ecology of the Coast

Standard, Session #5

Understanding influences of biogeochemical cycles in the coastal and offshore environment

"Information on coastal and open ocean to better constrain carbon budgets and understand carbon capture and storage in these systems. In this session, speakers will present on the implication of the planned Mid-Barataria Sediment Diversion on carbon accumulation, explore carbon export to the Gulf of Mexico from wastewater treatment plants, assess factors driving carbon dioxide air-sea fluxes and variability, the impact of the Caernarvon Freshwater Diversion on bacterioplankton, and an investigation into the potential role of mangroves and submerged aquatic vegetation in carbon sequestration in the coastal environment. "

Moderator: John White | LSU, jrwhite@lsu.edu

Presenter or Panelist 1: Anamika Dristi | Graduate Research Assistant, School of Renewable Natural Resources, Louisiana State University, adrist1@lsu.edu

CULTURAL CARBON EXPORT TO THE GULF OF MEXICO FROM THE MISSISSIPPI RIVER

Louisiana's coast receives the largest quantity of freshwater discharge of any estuarine and coastal section of the North American continent. Human activities such as intensive agriculture, urbanization and industrial development in the Mississippi River Basin have resulted in the highest riverine loads to the coastal area. Carbon is a major component of all organic compounds, playing a vital role in food web processes and trophic interactions in coastal ecosystems. However, unlike our knowledge of the sources of nitrogen and phosphorus in the Mississippi River, little is known about the direct human input of carbon from wastewater treatment plants (WWTP), a source of Cultural Carbon. Currently, there exists no published report on the level of dissolved carbon from wastewater treatment plants in the Mississippi River Basin. In this ongoing study, we conducted monthly sampling of effluent waters from two WWTPs in East Baton Rouge Parish, Louisiana. These two WWTPs, the North Baton Rouge Wastewater Treatment and South Baton Rouge Wastewater Treatment Plant, have a combined treatment capacity of up to 400 million gallons of wastewater each day, and discharge on average 200 million gallon of effluent daily into the Mississippi River. All samples were analyzed for concentrations of dissolved organic carbon and dissolved inorganic carbon. Our initial results support our hypothesis about the considerable amount of cultural carbon inflow in the Mississippi River Basin. This presentation will provide insights into direct human contribution to riverine carbon and will discuss how the first-hand data generated from the study will be utilized to produce a large-scale estimate for the entire Mississippi River Basin. Such information will be useful for federal and state policy makers as well as researchers, engineers, and resource managers involved in carbon science and climate change in the Northern Gulf of Mexico, and beyond.

Presenter or Panelist 2: Bingqing Liu | The Water Institute, bliu@thewaterinstitute.org

Integrating deep learning, remote sensing, and field observations to study blue carbon capture

Tidal wetlands along with aquatic vegetation are among the most important geomorphic and ecological features of coastal ecosystems, some of which are also known as coastal blue carbon habitats (e.g., salt

marshes and mangrove forests), serving an important role in climate change mitigation due to their disproportionately large contribution to global sediment/soil (sed/soil) carbon burial. Mangroves and salt marshes fix a large amount of carbon dioxide (CO2) from the atmosphere during photosynthesis to support their growth, thus sequestering carbon into their aboveground (AG) and belowground (BG) biomass (e.g., leaves, branches, stems, and roots) and underlying soils. In comparison to blue carbon habitats (i.e., salt marsh, mangrove, and seagrass), the carbon sequestration potential of non-seagrass Submerged Aquatic Vegetation (SAV) in fresh-brackish estuarine areas has not been widely quantified, partially because these SAV habitats are highly spatially dynamic over timescales that range from days to decades. Remote sensing provides unique capabilities for mapping land surface characteristics. Over the past few years, the emergence and advancement of deep learning techniques (e.g., deep convolutional neural network, DCCN) has become prominent in the field of land use land - land cover (LULC) mapping. In particular, these methods perform better with remote sensing imagery compared to the traditional pixel-based methods and show greater success at extracting image features without human intervention. This study aims to assess the spatiotemporal variations of black mangrove and SAV distribution to investigate the potential role of mangroves and SAV in carbon sequestration in wetland-estuarine ecosystem of coastal Louisiana, USA. using a novel combination of DCNN technique and field and remote sensing observations (Landsat 8/9-OLI and Sentinel 2-MSI).

Presenter or Panelist 3: Brian Matherne | Louisiana State University, bmath27@lsu.edu

A Multi-year Freshwater Diversion Impact Study on Bacterioplankton in Breton Sound

River flood protection offered by the levee system in Louisiana has come at the expense of the state's coastline. Consequently, coastal marshes have long been starved of new river sediment. Vanishing wetlands have decreased productivity of the estuaries and heightened flood risks for coastal residents. Freshwater diversion points have been introduced to keep the levee system in place, while targeting areas needing sediment for wetland building. The fear is that these diversions, while well intentioned, may change salinity regimes and nutrient cycles which stress inshore fisheries. This study of the Caernarvon Freshwater Diversion uses an integrated approach to look at multiyear hydrological impacts of the diversion on water chemistry and bacterioplankton. Water samples were collected monthly along a salinity transect. Sterivex filters were used to collect bacterioplankton, with high throughput gene sequencing carried out on DNA extracted from the biomass. Collected water chemistry data were compared to publicly available USGS hydrological datasets and CRMS monitoring stations. Microbial sequencing results were analyzed using both traditional ecological diversity analyses and combined with water chemistry and hydrological data using a machine learning feature classifying model. These results show that while microbial diversity remains similar throughout the marsh during pulse events, there are localized impacts through changes to species composition. Furthermore, when the diversion flow is low the marsh bacterioplankton populations can be divided into coastal and inshore populations. The machine learning model was able to identify water quality conditions that define these populations. Periods of high diversion flow create a freshening event throughout the marsh. Subsequently, freshwater microbe populations were found further towards to mouth of the marsh, showing that the diversion also has impacts on primary producers, like cyanobacteria, in Breton Sound.

Presenter or Panelist 4: Claire McGuire | University of Southern Mississippi, claire.mcguire@usm.edu

Assessment of factors driving CO2 air- sea flux on the Louisiana Shelf

Historically the coastal waters of the northern Gulf of Mexico (GoM) have acted as a sink for carbon

dioxide. In many parts of the ocean, studies have found temperature to be the main driver of CO2 flux because of the dependency on temperature of gas solubility. However, when focusing regionally in the northern GoM, specifically the Louisiana shelf, there are other factors that must be considered. The Louisiana shelf experiences hypoxia, hurricanes, and freshwater input, that all can play a role in changing the CO2 air-sea flux. As conditions in the area change due to climate change it is important to identify the main factor or factors of CO2 flux on different timescales to better predict and adapt in the future.

In July 2017 a surface buoy measuring surface seawater and atmospheric CO2 was deployed on the Louisiana shelf. Since its deployment, the buoy has been continuously recording real-time data that can inform how these different factors like salinity, temperature, hypoxia and hurricanes impact the air-sea carbon flux on the Louisiana shelf. This presentation will use calculated air-sea CO2 flux from the buoy's air-sea CO2 data and use it to identify the local variability in CO2 flux from July 2017 to December 2022. This presentation will also aim to understand regionally how CO2 fluxes change on annual, seasonal, and short-term time scales and the driving factors that influence the data.

Presenter or Panelist 5: Kelly Sanks | Tulane University, ksanks@tulane.edu

Implications of the Mid-Barataria Sediment Diversion for carbon accumulation

The rapid loss of wetlands in coastal Louisiana has prompted restoration plans, such as sediment diversions. The Mid-Barataria Sediment Diversion (MBSD) aims to counteract this land loss by promoting rapid deposition of sediment in the bays and wetlands of Barataria Basin. Sediment diversions aim to mimic processes that form crevasse splays, or natural breaches of levees. Previous research has shown that wetlands in coastal Louisiana sequester a significant amount of carbon and act as blue carbon sinks, but despite their prevalence, the ability of other coastal environments (crevasse splays, bays, etc.) to act as carbon sinks is less clear. We collect sediment cores from Barataria Basin to determine the amount and rate of carbon storage in different depositional environments. We combine these data with sediment collected from a natural crevasse splay that formed in the previous Lafourche delta lobe (active ~1600 - 600 years ago). We measure sediment deposition rates and organic carbon (OC; %) to estimate carbon accumulation rates for the different environments. Deposition rates are obtained on short and long timescales using short-lived isotopes (210Pb and 137Cs), as well as 14C and optically stimulated luminescence dating. We find significant differences in OC for different sediment types in both Barataria Basin and the Lafourche deposits, where OC decreases as grain size increases. The combination of sedimentation rates and OC, which tend to vary inversely with sediment type, produce carbon accumulation rates that are similar in crevasse splay and flood basin deposits. These carbon accumulation rates (~300 tCkm-2yr-1) are similar to modern Louisiana organic wetland deposits (~370 tCkm-2yr-1), as estimated from the Coastwide Reference Monitoring System data. Contrary to traditional definitions of blue carbon environments, this work shows that deltaic deposits, such as those that will be formed by the MBSD, may have significant potential to act as a carbon sink.

Ecosystem Restoration

Standard, Session #6

Ecological and Social Dynamics of Natural and Restored Coastal Ridges

Ridges are historically important coastal landforms in Louisiana that provide ecosystem services, such as primary production, habitat provision, carbon sequestration, and mitigation of erosive forces. Creation and restoration of ridges has become an increasingly important component of coastal restoration in Louisiana, as evidenced by the increasing inclusion of these projects in the state's Coastal Master Plan. However, there is a dearth of knowledge regarding trajectories in vegetation community composition and associated ecosystem functions of ridges in coastal Louisiana. These data gaps hinder general restoration planning as critical information is lacking on appropriate target vegetation community composition and productivity, as well as supported faunal assemblages. In addition, there is minimal understanding of how coastal ridges differ from analogous coastal landforms, such as spoil banks, in vegetation community composition and ecosystem functions, making difficult the simple act of defining a coastal ridge and differentiating the role of similar landforms. This is further exacerbated by the myriad environmental settings (e.g., salinity gradients, soil types) under which ridges historically developed and where they are likely to be constructed during coastal restoration activities. The collection of data gaps must be addressed to inform effective coastal ridge restoration efforts in Louisiana. This session provides updates on a year of sampling natural and restored ridges, as well as spoil banks, of varying ages and salinity regimes in the Terrebonne and Barataria Basins. Terrestrial, emergent, and submerged vegetation associated with the ridge, soil characteristics, and elevations of the vegetation communities are being sampled. In addition, we will present on the history of Smith Ridge, a historically Black community in Terrebonne Parish, and the changing patterns in housing and migration in and out of the community.

Session Organizer: Giovanna McClenachan | Nicholls State University, Email: giovanna.mcclenachan@nicholls.edu

Moderator: Giovanna McClenachan | Nicholls State University, giovanna.mcclenachan@nicholls.edu

Presenter or Panelist 1: Carissa Thiel | Nicholls State University, cthiel@nicholls.edu

Ecological characteristics and soil processes in terrestrial forest habitats on coastal ridges

Coastal ridges provide an abundance of environmental, economic, and cultural services. However, scientific understanding of the ecological processes that contribute to these are limited. Data gaps exist for trajectories of terrestrial vegetation succession for coastal ridges, and the role of abiotic factors in structuring vegetation community composition in these habitats. The research presented here is intended to address several of these data gaps and provide a conceptual basis for coastal ridge restoration projects and terrestrial ridge forest community composition succession over time. In the fall of 2022 ten sites were selected within the Barataria-Terrebonne National Estuary System to obtain a diversity of abiotic influences. Four, 64-m2 plots approximately 20 meters apart were established at each site to assess terrestrial ridge habitat characteristics. Terrestrial vegetation overstory community composition and diameter at breast height of trees five cm or greater, as well as understory cover and soil characteristics, were determined at all sites in late summer/fall of 2022 and will be re-measured in the fall of 2023. Findings thus far indicate an increase in the presence of Ilex vomitoria and lower

average DBH measurements at sites with increased salinity and habitat degradation, in addition to variations of overstory composition and understory cover as well as higher abundance of mature Quercus virginiana at reference sites. Data collection is ongoing and will enable assessments of the modulating role of site characteristics on terrestrial vegetation growth and community composition through ordination, as well as soil development through a space-for-time substitution approach. The results of this research effort will enable additional, data-based estimations of the likely benefits of coastal ridge restoration projects in Louisiana as well assist with ongoing updates to the adaptive management of the Louisiana Coastal Master Plan.

Presenter or Panelist 2: Shae Smith Cox | Nicholls State University, Shae.cox@nicholls.edu

A Community History of Smith Ridge, Louisiana

Dr. Shae Cox and Dr. Kevin McQueeney are working with a group of students to document the history of Smith Ridge, a historically Black community in Terrebonne Parish founded by formerly enslaved African Americans after the Civil War. The team has been doing archival research and collaborating with community members to preserve their history by conducting oral histories, digitizing items, and providing means to assist their community in making those valuable stories accessible. Our project is focused on several areas, including the antecedents of the community as Smith Ridge Plantation; the transition from enslavement to freedom; the changing patterns in housing and migration in and out of the community; farming practices; and the impact of coastal wetland erosion and the petrochemical industry. Smith Ridge is a significant site due to its continuance as a historically Black community that traces back to the period of enslavement. During Jim Crow, Smith Ridge was one of the few communities in which African Americans were significant landowners, including farms. Additionally, Smith Ridge demonstrates the direct impact of coastal erosion on communities of color. The team will discuss our research thus, highlighting the most significant and interesting findings, and where we hope the project leads.

Presenter or Panelist 3: Kevin McQueeney | Nicholls State University, kevin.mcqueeney@nicholls.edu

A Community History of Smith Ridge, Louisiana

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Presenter or Panelist 4: Erik Nati-Johnson | Nicholls State University, ejohnson45@nicholls.edu

Determining drivers of community composition in ridge-associated marsh communities

Ridges are natural elevated landforms found throughout Louisiana's deltaic coast that provide

ecosystem services by mitigating erosion and storm surge, as well as providing habitat for species vulnerable to inundation. Anthropogenic changes to hydrology in Louisiana have disrupted the natural processes of overbank flooding and sediment deposition that form ridges, and existing ridges have degraded in response to the factors driving local land loss. Since 2007, the Coastal Restoration and Protection Authority (CPRA) has funded ridge creation and restoration projects at Bayou Dupont and Grand Liard, and the Barataria-Terrebonne National Estuary Program (BTNEP) built a ridge near Port Fourchon. There is a need for assessment of the vegetation succession and elevation trajectories of the restored ridges and associated marsh habitat to inform the decision-making surrounding future allocation of resources for coastal restoration. This study documents the emergent vegetation communities associated with 8 coastal ridges of different ages in the Barataria and Terrebonne Basins and determines the drivers of community composition across elevation and salinity gradients. The natural and man-made ridges range in age from ~1,000 to 5 years old. Plots are sampled for species composition, percent cover, average height and soil characteristics. Additionally, Real-Time Kinematic positioning is used to accurately measure elevations. Initial results indicate that variations in elevation and salinity have significant effects on marsh plant community composition. LiDAR and hyperspectral imagery captured from unmanned aerial systems (UAS) will be used to scale up plot level data, and vegetation-class-specific corrections will be developed to create a ground-level DEM of the ridge and associated marsh. A model using a classification and regression tree will be developed to predict marsh plant community change under different sea-level-rise scenarios.

Presenter or Panelist 5: BALAJI RAMACHANDRAN | Nicholls State University, balaji.ram@nicholls.edu

Coastal ridge characterization using lidar and hyperspectral sensors mounted on a small Uncrewed

To enhance a collaborative ecological field study that will characterize nine ridges along the Louisiana coast, we have selected a subset of these ridges for evaluation using uncrewed aerial systems (UAS) with lidar and hyperspectral sensors. These sites include Isle de Jean Charles in the Terrebonne Basin, along with the Elmer's Island Refuge, BTNEP Maritime Ridge, and Grand Isle State Park within the Barataria Basin. The primary objective of the study is to fuse data from hyperspectral and lidar sensors for accurate ridge characterization. To fulfill this objective, we have conducted four types of surveys simultaneously. First a field vegetation sampling plot was georeferenced using a high precision Real-Time Network (RTN) GNSS Survey. This was followed by multiple missions using our MicroDrone MD3000LR quadcopter with Riegl Lidar VUX-1UAV sensor to capture the digital surface model (DSM) of the ridge and use lidar intensities in cover classification. On the same day several missions were flown using our DJI Pro M600 hexacopter with RESONON Pika-L Hyperspectral sensor (spectral wavelength range 400NM-1000NM with individual band sensitivity of 2.1NM) to collect data on floral and faunal cover class. This was followed by a low altitude flight along random transects using a DJI Mavic Pro for ground truthing and quality control. The data collection was completed over habitats in their Fall-2022 / Winter-2023 phases of growth. This data will be compared to the same habitats during their Spring-2023 / Summer-2023 phase of growth, allowing a comparison between different seasons across different habitats. The preliminary results show lidar data has allowed us to resolve the elevation changes from the crown of a forested ridge to the adjacent intertidal marsh. Fusion of hyperspectral and lidar intensities has allowed us to resolve the vegetative cover classes including the canopy created by trees compared to the cover created by coastal plants.

Presenter or Panelist 6: Angelina Freeman | CPRA, angelina.freeman@la.gov

The Concept of Land Bridge Marshes in the Mississippi River Delta and Restoration Implications

Louisiana has high coastal wetland loss rates due to natural processes and anthropogenic activities. With the exception of the Atchafalaya River discharge area, most of Louisiana's marsh coastline is retreating and coastal marshes are degrading. In the inactive degrading delta regions, there exists a previously uncharacterized landform referred to colloquially as coastal 'land bridge' marshes. Land bridge marshes are saline or brackish marshes fronting large estuarine bays or lakes with sufficient fetch and wave energy to supply high levels of resuspended sediments to the marsh surface. They are generally linear features that are oriented parallel to the coast and the shoreline front retreats landward due to erosion from wave energy. These marshes persist over time vertically due to input of resuspended sediments but are experiencing rapid edge erosion due to wave action. Comparison of data from Louisiana's Coastwide Reference Monitoring System sites show that land bridge marshes have a greater frequency of higher soil surface elevation and higher soil bulk density than non-land bridge marshes. Because land bridges are vertically stable relative to other coastal wetlands, identification of measures to sustain these landscape features is important. Simulations using MarshMorpho2D, a process-based reduced-complexity morphology model, suggest that protection barriers installed on the seaward side of land bridge marshes will attenuate wave energy and, thus, edge erosion. Shoreline protection that can reduce wave energy but still allow sediment input to marshes include living shorelines, rock barriers, and/or breakwaters. Periodic thin layer nourishment of the marsh surface may be necessary to help sustain vertical growth. Further, marsh creation projects directly landward of land bridge marshes may benefit from their protection from waves and as a source of sediment. We recommend that land bridge marshes be considered as distinct marsh types in restoration planning.

Predicting and Planning for the Future of the Coast

Panel, Session #7

Coastal Resiliency Efforts in Texas Chenier Plain

Panel Session Outline (Total 90 min)

1. Session and Panelists Introduction (Moderator – 15 min) - The focus of the State of the Coast (SOC) Conference, has historically for the most part, concerned itself with the future of the Louisiana coast, however this SOC 2023 Conference expanded the focal point to include the Coastal Chenier Plain, thereby including the southeastern Texas coastline. The intent of this "Inaugural" session (1.5 hours) is to provide the audience with an overview of the scope of coastal resiliency efforts that Southeast Texas has been planning and developing, with the intention of launching a collaboration to share and learn from each other. The panel would provide the opportunity for session attendees to actively engage with key agencies involved in executing high-profile resilience projects in Texas.

Moderators- Greg Grandy and/or Scott Kirkpatrick will introduce and provide a short biography of each of the five panelists.

2. Panelist Remarks (10 min@ Total 50 min) Each panelist will take up to 10 minutes to provide an overview of their respective agency's mission in contributing and ongoing initiatives to improve resiliency along the Texas coast.

3. Questions/Answers (25 min)

a. Moderator

b. Audience

Session Organizer: Augusto Villalon | Freese & Nichols, Inc, Email: Augusto.villalon@freese.com

Moderator: Greg Grandy | Coastal Protection and Restoration Authority of Louisiana, Gregory.grandy@la.gov

Presenter or Panelist 1: Nicole Sunstrum | Gulf Coast Protection District, Nicole.sunstrum@gpcdtexas.com

Presenter or Panelist 2: Caimee Schoenbaechler | Texas Water Development Board, Caimee.schoenbaechler@twdb.texas.gov

Presenter or Panelist 3: Ray Newby | TxDOT Maritime, Edward.newby@txdot.gov

Presenter or Panelist 4: Tony Williams | Texas General Land Office, tony.williams@glo.Texas.gov

Presenter or Panelist 5: Kelly Burks-Cope | USACE - Galveston District, Kelly.a.burks-copes@usace.army.mil

Presenter or Panelist 6: Augusto Villalon | Freese & Nichols, Augusto.villalon@freese.com

Disaster Impacts, Mitigation and Recovery

Standard, Session #8

Ida Over Lafourche

The panel team for "Ida Over Lafourche" consists of four individuals involved in preparation for, response to, and recovery from August 2021's Hurricane Ida as it impacted Lafourche Parish and surrounding areas. Leaders from Lafourche Parish Government, the South Lafourche Levee District, the North Lafourche Levee District, and Nicholls State University, each of whom are also residents of Lafourche Parish, describe the impact of Hurricane Ida on the parish from a variety of perspectives and present progress on future projects, like the Morganza-to-the-Gulf levee project.

Session Organizer: John Doucet | Nicholls State University, Email: john.doucet@nicholls.edu

Moderator: Gary LaFleur | Nicholls State University, gary.lafleur@nicholls.edu

Presenter or Panelist 1: John Doucet | Nicholls State Univeristy, john.doucet@nicholls.edu

Beneath Ida's Gyre: Storm-Borne Villages of Coastal Lafourche

Hurricane Ida carved a direct and slow path through much of Lafourche Parish in late August 2021. The faster and weaker Zeta in 2020 notwithstanding, residents of villages along lower Bayou Lafourche had not experienced such a direct storm path since 1965's Betsy, which struck a half century and multiple generations ago. The people of lower Lafourche are largely descended from a generation that suffered a triumvirate of severe, killer storms at the turn of the 20th century (1893, 1909, and 1915). These storms sequentially destroyed coastal Lafourche and determined subsequent coastal resettlement patterns in the region. Hurricane Ida affected the area in a similarly destructive and determining way.

Striking over a century following the last of the triumvirate, Hurricane Ida caused a type of destruction that attacked the heart of Coastal Lafourche culture and heritage. Beyond home, business, and aerial transmission infrastructure, the storm destroyed cultural artefacts, including items from their long storm history and coastal residence. As we urgently face climate change and prospects of community resettlement, the fall and rise of Lafourche coastal settlements remains after 130 years an important illustration of community and familial resilience.

Presenter or Panelist 2: Windell Curole | South Lafourche Levee District, wcurole@slld.org

Katrina Illusions, Ida Solutions

The South Lafourche Levee District (SLLD) studied the effect that Hurricane Katrina's storm surge had on flood protection projects in New Orleans as well as St. Bernard and Plaquemines Parishes. SLLD found that the flood protection projects in St. Bernard and Plaquemines Parishes were overwhelmed by the height of the storm surge. The issues in New Orleans were not the levees but rather floodwalls that failed to protect the city. The I-walls along drainage canals incurredstructural problems that lead to protection breaches at 17th Street Canal and London Avenue Canal.

After assessing these issues and the need for more dependable funding, SLLD's board of directors proposed to the public and received a one-penny sales tax to add to the 9.68 mill property tax already being collected in South Lafourche. With critical but sporadic funding assistance from Federal and State governments, as well as a steady yearly stream of local tax money, the board proceeded to increase the

height of the local levee system by five feet. The Board also supported the Corps' recommendation to construct H-beam supported I-walls. The last improvement instituted by the Board was to harden the intersection of levees with I-walls. The Board also concluded there was no need to alter the basic design of levees other than increased elevation.

This work became much more efficient due to the accuracy and economy of GPS-based elevations available to the SLLD beginning in 2004. This groundbreaking technology correctly identified and measured that the hurricane levee system was 18 inches lower than designed. Armed with accurate, detailed elevations, it became easy to identify and improve low areas on the levee and to accurately raise elevation. This was the last piece of the puzzle that allowed a positive outcome when Hurricane Ida hit.

Presenter or Panelist 3: Dwayne Bourgeois | North Lafourche Levee District, dwayneb@nlcldd.com

A Look Back at Hurricane Ida and the Future of Morganza-to-the-Gulf Hurricane Protection System
North Lafourche Levee District (NLLD) Executive Director Dwayne Bourgeois will present on the storm water floods from Hurricane Ida in northern Lafourche Parish and the Morganza-to-the-Gulf (M2G) Hurricane Protection System. He will briefly describe the levee district's work currently being constructed in the district areas that flooded during Hurricane Ida. The work in these areas was planned to be constructed prior to the storm, demonstrating that the projects would have prevented flooding during Ida and will prevent flooding in the future. He will also explain the M2G Project and the benefits of having the project completed for the whole region of Terrebonne and Lafourche Parishes. He will show the entire system on a map and the portion of the project that is specifically in the NLLD. He will further describe funding and milestone achievements of the project to date and expected in the future.

Presenter or Panelist 4: Archie Chiasson | Lafourche Parish Government, chaissonap@lafourchegov.org

Lafourche Parish: Managing a Working Coast Through Response, Recovery, and Resiliency
This presentation will focus on Lafourche Parish's initial response to Hurricane Ida in 2021 and the actions we took as a parish to get back to normalcy after the strongest storm to ever hit Lafourche Parish. We will highlight the initial issues the in moments of the storm and the days after. We will touch on the wetland loss that we saw after the storm and what those areas looked like before and now. The area lost surrounding Lafourche Parish has been estimated to be about 60 square miles out of a total 110 square miles lost as a result of the storm. The presentation will highlight issues we experienced with our communication network, business, and public facilities.

The presentation will then discuss recovery from the storm, including the housing initiative that we developed with GOSHEP and FEMA. This effort was critical to assist displaced residents with temporary housing so they can begin the individual recovery process.

Finally, the presentation will discuss resiliency, discussing new projects that will aid transportation (both normal, day-to-day traffic and aids to evacuations), drainage, and coastal restoration. We will show the economic improvements we have seen happening both pre- and post-storm and how Lafourche has succeeded in grant funding. We will end with the future and how Lafourche is looking at greener industries, such as offshore wind as well as thinking creatively about Carbon Capture Utilization and Sequestration (CCUS) to help rebuild our wetland ecosystem.

Flood Risk Management: Coastal and Inland

Panel, Session #9

Understanding Stormwater Flood Risk in New Orleans

3 Presentations + Panel Discussion

New Orleans faces significant challenges in managing flooding from extreme rainfall events – including the capacity of the drainage and pumping system, aging infrastructure with deferred maintenance, and fragmented governance. Future climate change and demographic trends are likely to exacerbate these challenges in the decades to come.

The Water Institute has partnered with the Iowa Flood Center and SCAPE to undertake a research effort using integrated modeling and Robust Decision-Making methods to:

1.Better understand and communicate the key drivers that exacerbate stormwater flood risk

2.Provide more rigorous estimates of future stormwater flood risk

3.Help decision makers and residents plan for stormwater flood risk under a range of uncertain future conditions

The project team explored how variables like rainfall, climate change, pipe conveyance, pumping outages, storm surge, and sea level rise impact stormwater flooding in New Orleans. The team also conducted vulnerability analyses at both the city and the neighborhood scale in New Orleans using three discrete methods: CART to identify the combination of factors that produced vulnerable scenarios, PRIM to identify the scenarios in which a neighborhood or the city is vulnerable, and Logistic regression to understand the importance of each uncertain factor in predicting vulnerability or invulnerability.

The team also explored the most effective ways to communicate flood risk to decision makers and residents and developed graphics and visualizations to make sense of the research findings.

In this session, project team members will present findings and outputs from this research effort. Following these short presentations, a panel including representatives from the City of New Orleans and the Sewerage and Water Board of New Orleans will reflect on how these findings can inform future decisions about investments in the city's stormwater management system.

Session Organizer: Colleen McHugh | The Water Institute, Email: cmchugh@thewaterinstitute.org

Moderator: Colleen McHugh | The Water Institute, cmchugh@thewaterinstitute.org

Presenter or Panelist 1: Patrick Kane | The Water Institute, pkane@thewaterinstitute.org

Presenter or Panelist 2: Nastaran Tebyanian | The Water Institute, ntebyanian@thewaterinstitute.org

Presenter or Panelist 3: Nans Voron | SCAPE, nans@scapestudio.com

Presenter or Panelist 4: Tyler Antrup | Sewerage and Water Board of New Orleans, tantrup@swbno.org

Presenter or Panelist 5: Meagan Williams | City of New Orleans, memwilliams@nola.gov

Renewable Energy

Panel, Session #10

Offshore Wind in Louisiana: Planning for the Future

This panel discussion will explore the current status of offshore wind in Louisiana and topics specific to the growth of the industry in Louisiana. Conversation will focus on an overview of both state and federal leasing processes, environmental considerations specific to each, and scientific needs for the advancement of the industry. After this panel, the audience will have a complete picture of the status of offshore wind development in the Gulf of Mexico and an awareness of upcoming events that will dictate the future of offshore wind in Louisiana.

This panel will cover regulations expected in the months between this submission and the conference. Specifically, the State of Louisiana is expected to promulgate rules for development in state waters that will have a notice and comment period and the Bureau of Ocean Energy Management (BOEM) will release a Proposed Sale Notice (PSN) for the two Wind Energy Areas in the Gulf of Mexico. It is impossible to anticipate what these items will look like once released, but our panelists are all subject matter experts who are well-versed in the potential outcomes and their ramifications.

This panel will also provide background information on the specific technological needs for wind turbines in the Gulf of Mexico, information on the environmental impacts of development in state waters and federal waters, and supply chain needs for the development of an offshore wind industry in Louisiana.

Session Organizer: Jenny Netherton | Southeastern Wind Coalition, Email: jennyn@sewind.org

Moderator: Jenny Netherton | Southeastern Wind Coalition, jennyn@sewind.org

Presenter or Panelist 1: Helen Rose Patterson | National Wildlife Federation, pattersonh@nwf.org

Presenter or Panelist 2: Amy Reed | Environmental Law Institute, reed@eli.org

Presenter or Panelist 3: James Martin | Gulf Wind Technology, james.martin@gulfwindtechnology.com

Presenter or Panelist 4: Joseph Orgeron | Louisiana House of Representatives, jorgeron@legis.la.gov

Presenter or Panelist 5: Jenny Netherton | Southeastern Wind Coalition, jennyn@sewind.org

Hydrology, Geomorphology, and Ecology of the Coast

Standard, Session #11

A bird's eye view of changes to the Mississippi River Delta region

Remote sensing is an important tool that can be used to evaluate large-scale changes to coastal and riverine systems. In this session, presenters will discuss how remote sensing has been used to better understand the damage and recovery of wetlands to tropical storm impacts, changes in vegetation over time in the outfall area of Mardi Gras Pass, multi-year monitoring of vegetation dynamics in the Atchafalaya and Terrebonne Basins, the evolution of Neptune Pass in the lowermost river, and a new method to monitor and classify rapidly changing coastal habitats.

Session Organizer: | , Email:

Moderator: Natalie Snider | EDF, Nsnider@edf.org

Presenter or Panelist 1: Alexandra Christensen | Jet Propulsion Laboratory, California Institute of Technology, alexandra.l.christensen@jpl.nasa.gov

Wetland Vegetation Dynamics in Coastal Louisiana Using Satellite Remote Sensing

With climate change and sea level rise, coastal wetlands will experience increased flooding, salinity, edge erosion, and frequency and intensity of storm events such as hurricanes. In coastal Louisiana, wetlands are particularly vulnerable due to decreasing sediment deposition and increasing subsidence, which control marsh elevation and therefore the resilience of marshes under climate change scenarios. NASA's Delta-X mission collected field and airborne data in spring and fall 2021 to characterize surface water hydrology, water quality, vegetation productivity, and coastal geomorphology in coastal Louisiana. Two hydrologic basins, the Atchafalaya and Terrebonne represent distinct coastal landscapes at the opposite ends of the delta cycle. The Atchafalaya basin maintains a strong river connection, which continuously supplies sediment to wetlands, and leads to aggradation and progradation. Conversely, the Terrebonne basin is disconnected from a river source and sediment starved, which leads to land loss and marsh fragmentation.

We will present results of multi-year monitoring of vegetation dynamics for both hydrologic basins. To complement the Delta-X field and airborne data and increase the spatial and temporal resolution, we also use optical imagery from Sentinel-2 (comparable to hyperspectral imagery from AVIRIS-NG in Delta-X) and C-Band radar imagery from Sentinel-1. Seasonal satellite imagery captures plant phenology and highlights the impact of salinity, flood frequency and duration, and sediment delivery on vegetation across the Atchafalaya and Terrebonne basins. With a 5-6 day revisit time and moderate spatial resolution (~10m), Sentinel-1 and Sentinel-2 provide ample data for time series vegetation analysis from 2017-2021. We develop maps of vegetation functional groups and assess interannual variability of productivity. We also investigate the impacts from Hurricane Barry (2019) and Ida (2021) and monitor and recovery after these disturbance events.

Presenter or Panelist 2: Michael Hopkins | Pontchartrain Conservancy, michael@scienceforourcoast.org

Vegetation changes in the Mardi Gras Pass outfall area from 2008 to 2021

Mardi Gras Pass (MGP), a distributary on the east bank of the Mississippi River (MR), is located about river mile 43 above Head of Passes within the Bohemia Spillway. During the flood seasons of 2011-12, floodwaters eroded around a control structure on an existing canal and formed a free-flowing connection from the MR to open water. The resultant waterway has allowed river water and sediment to flow unimpeded through a series of natural channels and canals to Breton Sound. The impact of a decade of unrestricted MR flow to intermediate and brackish marsh is explored using 4-band NAIP imagery from 2008, 2013, 2015, 2017 and 2021. Normalized Difference Vegetation Indices (NDVI) were calculated for each year using NAIP imagery. NDVI results were then classified in ENVI software and manually inspected in ArcGIS to delineate water, mudflats, floating and submerged aquatic vegetation from rooted-subaerial vegetation (outfall vegetated area). Results show that between 2008 and 2021, the MGP outfall vegetated area decreased from 33.1 km2 to 30.0 km2, which indicates a net loss of ~3km2 vegetated area over that time span. Between 2008 and 2017, outfall vegetated area decreased about 1 km2 during each period 2008-13, 2013-15, and 2015-17. However, from 2017 to 2021 vegetated area only decreased 0.3 km2. Preliminary results indicate that vegetated area decline has nearly halted as newly emergent wetlands from sediment deposition due to MGP is balancing wetland losses.

Presenter or Panelist 3: Christopher Potter | NASA Ames Research Center, cspotter5@hotmail.com

Remote sensing of damage afflicted on coastal wetlands of southeastern Louisiana from tropical storms

Coastal ecosystem loss in Louisiana represents more than 80% of wetland loss in the continental United States since the 1930s. Land loss threatens the future of the state's economy that is heavily weighted toward coastally linked jobs in the fishing, hydrocarbon (oil and gas) extraction, and waterborne transportation industries. The degradation of wetland buffer zones has been at the heart of the state's response to protect coastal communities and urban areas from tropical cyclone surges and rising relative (ocean + subsidence) sea levels (RSLR). Our current study results build on previous satellite remote sensing studies over the Mississippi Delta region. To begin to identify and characterize coastal wetland damage from Hurricanes Katrina (Category 5 in 2005) and Gustav (Category 2 in 2008), Potter and Amer (2020) utilized a multiband-subtraction methodology developed by Amer et al. (2017) that calculates a Normalized Difference Water Index (NDWI) from Landsat-8 Operational Land Imager (OLI) images. The primary objective of this presentation is to answer two questions using updated NDWI time series analysis:

- *What is the nature (bio-physical type) and the areal extent of damage afflicted on coastal wetlands of southeastern Louisiana from tropical storms of differing categories?*

- *What is the rate and duration of recovery (sq. meters per year) from damage afflicted on coastal wetlands of southeastern Louisiana from tropical storms of differing categories?*

Presenter or Panelist 4: Elizabeth Prior | Biological Systems Engineering Department, Virginia Tech, eprior@vt.edu

Straying from the Mississippi River: A Case Study on Avulsion at Neptune Pass

River avulsion–rapid new channel formation–can dramatically reconfigure the ecological and economic functions of surrounding landscapes. Despite the importance of avulsions, infrequent or sparse ground data collection has limited our ability to observe their dynamics.

In 2016, a small channel in the lowermost Mississippi River–Neptune Pass–has widened over five-fold. In 2015, a satellite mission began acquiring 10m imagery across the globe every 5–10 days. Its high-resolution data paired with cloud computing resources opens an opportunity to observe this avulsion, which is now over 244m wide and rerouting ~16% of one of the U.S.'s largest and most important rivers. This avulsion is not only eroding the pass, but also depositing sediment causing wetlands, deltas and mouth bars to form in Quarantine Bay and Bay Denesse.

We conducted landcover classification using a random forest model on summertime, cloud-free Sentinel-2A Top-of-Atmosphere images at low water level from 2016 to 2022 on 4.3 km2 surrounding Neptune Pass. We then examined the temporal landcover trajectory of each pixel to quantify distinct change sequences between water and non-water pixels.

Our analysis sheds light on the magnitude and pace of this avulsion: the pass widened the most between 2019 and 2020 (0.15km2), compared with an average of >0.01km2 in all other years. Quantifying the extent of distinct sequences reveals that 2.0% represented a change from land to water and 2.2% from water to land. However, nearly 15% of the study area (0.63 km2) did not exhibit a singular transition sequence, indicating the dynamic nature of water level and land building. By visualizing pixel landcover trajectories, we demonstrate the spatio-temporal dynamics of this area which is not seen in other change detection analyses, such as the Couvillion et al. (2011) USGS map. We employed techniques that enhance our ability to monitor, manage, and—in the future–predict changes associated with avulsions.

Presenter or Panelist 5: Christy Swann | RCOAST, swann@r-coast.com

Monitoring and classification of rapidly changing habitats in the Lower Mississippi

The rapid and precise classification and monitoring of habitats is critical for understanding the numerous changes that can occur along Louisiana's coast, including coastal restoration projects, natural river crevassing, hurricane impacts, dredging projects and long-term land loss. And yet, the deployment of rapid, precise, and spatially broad techniques in Louisiana has remained elusive.

Here we present we believe to be the first-of-its kind in Louisiana method for the rapid and precise habitat monitoring. Deploying a drone equipped with both LIDAR and visible light sensors, we were able to monitoring two developing systems in the lower Mississippi River Delta, in Quarantine Bay and Bay Denesse, which are both offshoots of Neptune Pass (the largest new distributary of the Mississippi River). Our methods are able to provide maps of surface topography and elevation that are accurate to within < 5 cm. Furthermore, by combining these maps with data available in red, green and blue (RGD) bands, we are able to identify individual habitat features- including various emergent plant communities, as well as submerged aquatic vegetation. Imagery is useful for faunal monitoring as well, allowing for accurate counts of some avian and reptilian species. These finding provide critical information that can be used to determine the success of various restoration projects; in this case, the development of a terrace field that was constructed in Quarantine Bay, and the emergence of a developing delta in Bay Denesse - which mimics natural land building processes.

Managing our Rivers for Multiple Uses

Panel, Session #12

Lower Mississippi River Science Symposium: State of Knowledge & Future Challenges

Unlike the Upper Mississippi River, where state and federal agencies are highly coordinated, there are no science conferences which gather academic and government researchers and managers from across the lower Mississippi valley to discuss science issues associated with the river. This has been due in part to the general lack of resources of many state and local governments. In 2020, a Lower Mississippi River Science Symposium has been established through a donation from the Charlotte Beyer Hubbell Foundation. An interagency steering committee from state, federal, non-profit and academic institutions have been organizing annual symposiums focusing on the Lower Mississippi River. The symposium covers topics related to the existing hydro, sediment and water quality monitoring system; future plans to address gaps in the monitoring system; existing predictive numerical modeling and forecasting tools. Some of the objectives of the symposium include dissemination of scientific information about the Lower Mississippi River, fostering collaboration among the various government agencies and academic institutions; and identifying opportunities for enhancing the monitoring system and numerical models of the Lower Mississippi River. This panel session will present a synthesis of main findings and outcomes of the 2023 Science Symposium. The panel will also solicit input from the attendees on future topics to be addressed through the Science Symposium in upcoming years.

Session Organizer: Ehab Meselhe | Tulane University, Email: emeselhe@tulane.edu

Moderator: Mead Allison | Tulane University, meadallison@tulane.edu

Presenter or Panelist 1: David May | Mississippi Valley Division - USACE, David.P.May@usace.army.mil

Presenter or Panelist 2: David Welch | NOAA - National Weather Service, david.welch@noaa.gov

Presenter or Panelist 3: Barb Kleiss | Tulane University, bkleiss@tulane.edu

Human Dimensions

Panel, Session #13

Seeds of Innovation: Resilient Design Competition

This panel would cover the different partners and aspects of the 2022 Seeds of Innovation: Resilient Design Competition that helped design floating planter boxes for the Grand Bayou Tribe. Panelist would include representatives from the Water Collaborative (TWC), Louisiana's Coastal Protection and Restoration Authority (CPRA), Grand Bayou Tribe, Attakapa Ishak and other competition partners.

TWC is a New Orleans based non-profit that works to ensure water management is climate resilient, accessible, affordable, and clean for all residents living in the Greater New Orleans Region. In 2022 TWC led their second Edible Planter Box Competition in partnership with CRPA and the Grand Bayou Tribe. This competition worked to support the Mid-Barataria Sediment Diversion mitigation efforts by encouraging professional landscape architects to design floating planter boxes. During previous outreach by CPRA it was identified by the tribe that increased flooding and salt water intrusion was preventing them from growing food and ceremonial plants. This competition brought together a diverse group of partners to think creatively about address this issue. The winning design will be installed in Grand Bayou this spring with hopes that they may one day be used across the coast.

This panel would cover the competition itself, land loss and restoration impacts on native communities, and innovative partnerships that are creating real tools for our changing coast.

Session Organizer: Samantha Carter | National Wildlife Federation, Email: carters@nwf.org

Moderator: Kellyn LaCour-Conant | Taproot Earth, kellynlacour@gmail.com

Presenter or Panelist 1: Jessica Dandridge | The Water Collaborative, jessica@nolawater.org

Presenter or Panelist 2: Rosina Philippe | Atakapa-Ishak/Chawasha Tribe, rpatakapa@yahoo.com

Presenter or Panelist 3: Gaylan Williams | Landscape Architect, Gaylan.Williams@gmail.com

Presenter or Panelist 4: Joel Franske | Green Theory, joel@greentheorydesign.com

Presenter or Panelist 5: Samantha Carter | National Wildlife Federation, carters@nwf.org

Preparing for Climate Change

Standard, Session #14

Place Based Adaptation Strategies in New Orleans

The session opens with a brief and powerful video, "The New Possible: New Orleans", which introduces how community-driven stormwater resilience projects work synergistically with large-scale drainage and pumping systems, combining grey and green infrastructure to reduce flooding and improve community resilience. The film also features a solar + battery microgrid affordable housing project that supported residents through the nine-day power outage after Hurricane Ida in 2021. After the film, detailed presentations show where these New Orleans-based projects are now and their influence on new projects, including a network of community resilience hubs rolling out across the city and the state.

The session concludes with a visionary look at how we might inhabit New Orleans and the south Louisiana coast far into the future. These provocative architectural designs evolved as a follow-on to an award-winning installation at the Venice Biennale entitled "Submerged Experience", drawing and draws inspiration from the challenges and opportunities in New Orleans and Venice. These designs lay out visions of urban resilience hubs and adaptive coastal communities that work on and with the water.

Session Organizer: Dan Grandal | Stantec Consulting, Inc., Email: dan.grandal@stantec.com

Moderator: Christina Fisher | Autodesk, Inc., christina.fisher@autodesk.com

Presenter or Panelist 1: Terri Dreyer | NANO LLC - Owner + Founding Partner, nano1@nanollc.net

Sustaining the Unsustainable

Aiming to sustain what we have will not be enough for societies to survive. Communities must become more self-reliant to ensure the survival of people and cultures. To enable these communities, action needs to be taken at all levels of planning, policies and decision making. As Architects in New Orleans, we feel and see the effects of climate change firsthand. Our city is at the forefront of climate change – from hurricanes, sea level rise and subsidence, to loss of biodiversity, temperature rise and failing infrastructure. What was once more relevant to coastal cities, climate change everywhere. This problem is not exclusive to New Orleans – it affects us all. These changes do not only impact New Orleans; they are affecting coastal cities across the globe at varying rates of destruction. The framework for solutions to climate issues in New Orleans can set a precedent for other coastal cities to implement in the very near future.

Presenter or Panelist 2: Megan Williams | City of New Orleans, memwilliams@nola.gov

Community-driven stormwater resilience

Presenter or Panelist 3: Z Smith | Eskew Dumez Ripple, zsmith@eskewdumezripple.com

Resilient affordable housing

In 2020, SBP USA opened the St Peter Residential project, a 50-apartment affordable housing project targeting net-zero energy operation with battery backup that allowed the facility to operate off-grid for 9 days in the aftermath of hurricane Ida. Built for a direct construction cost of just $164 per square foot, this presentation shows how it was done and what's been learned.

Presenter or Panelist 4: Dan Grandal | Stantec Consulting, Inc., dan.grandal@stantec.com

Designing to Thrive: Empowering Coastal Louisiana Communities Through Place-Based Design Solutions

From subsidence, sea level rise, and hurricanes, to loss of biodiversity, temperature fluctuation, and failing infrastructure, coastal communities around the world are experiencing the consequences of a changing climate. Yet, each community uniquely experiences the sociopolitical, cultural, and physical impacts of Climate Change. Embracing a paradigm shift from sustainable to regenerative architectural design through place-based adaptation will empower Louisiana Coastal Communities to thrive by promoting the agency to people most impacted by climate change.

Coastal Law, Policy & Funding

Panel, Session #15

Legal Ramifications Surrounding the Latest Scientific Evidence in Pipeline Canals and Land Loss

There's no denying it: Pipeline canals are causing land loss across Louisiana. This panel provides a review of the scientific analysis and data from recent court cases, proposes viable approaches to combatting land loss, and offers insight on the legal issues surrounding the land loss caused by pipeline canals.

According to Louisiana's Coastal Protection and Restoration Authority, there are more than 125,000 miles of pipelines running across the state. As an environmental attorney at Fishman Haygood, E. Blair Schilling has brought several actions against the pipeline industry seeking restoration of the land loss caused by the pipeline canals.

Through such cases, Schilling has worked with experts, including esteemed scientists Dr. John Day and Dr. Joseph Suhayda. Drs. Day and Suhayda will present their scientific analysis of how the pipeline canals have caused significant erosion based on comprehensive data to support such findings.

What will this mean in terms of coastal law and policy? Schilling will explore the legal landscape around the pipeline industry's liability for and defenses to restoring this land loss.

Environmental attorney Tad Bartlett will moderate the panel. In addition to being part of a team teaching coastal law issues at Tulane Law School, he also was an integral part of a multi-firm team that developed the coastal litigation practice regarding land loss.

Session Organizer: Callie Kamath | Marketing Director, Fishman Haygood, Email: ckamath@fishmanhaygood.com

Moderator: Tad Bartlett | Fishman Haygood, LLP, tbartlett@fishmanhaygood.com

Presenter or Panelist 1: E. Blair Schilling | Fishman Haygood, LLP, bschilling@fishmanhaygood.com

Presenter or Panelist 2: John Day | Distinguished Professor Emeritus in the Dept. of Oceanography and Coastal Sciences at LSU, johnday@lsu.edu

Presenter or Panelist 3: Joseph Suhayda | Consulting Coastal Oceanographer, josephsuhayda@yahoo.com

Hydrology, Geomorphology, and Ecology of the Coast

Standard, Session #16

Looking below the surface to inform better restoration outcomes

The success of coastal restoration efforts depends on understanding processes that happen below of the surface. In this session, presenters will discuss high-resolution monitoring of subsidence in the outfall of the planned Mid-Barataria Sediment Diversion, dynamics and factors that influence the marsh subsurface and resiliency, measurements to understand if subsidence measurements at Coastal Reference Monitoring Stations are capturing both shallow and deep subsidence, quantifying live root biomass and structure and the marsh's ability to withstand hurricane disturbances, and an evaluation of difference in organic matter caused by a salt-induced normal fault in southwest Louisiana.

Session Organizer: | , Email:

Moderator: Michael Hopkins | Pontchartrain Conservancy, michael@scienceforourcoast.org

Presenter or Panelist 1: Claire Brovold | University of Louisiana at Lafayette, claire.brovold1@louisiana.edu

Organic Matter Quantity and Composition After a Storm Surge Event in Coastal Louisiana

Subsidence is a primary driver of land loss in coastal Louisiana. When land subsides, coastal wetlands are more vulnerable to extreme floods during tropical cyclones. The impact of these floods is exacerbated by hydrological alterations that retain water (and its relatively higher salinity) on land for prolonged periods. If the flood is particularly severe, the change in environmental condition may induce plant community changes, plant death, and buildup of organic matter (OM). We evaluated how wetland OM differs across the displacement caused by a salt-induced normal fault in southwest Louisiana. After Hurricane Rita in 2005, this site dramatically changed plant composition, replacing dense emergent vegetation with open water areas dominated by submerged and floating vegetation aligned with the fault. We measured bulk density, %C, %N, and δ13C at 2cm intervals along six (~1m) soil cores. Cores were collected in pairs (upthrown and downthrown sides of the fault) in three emergent vegetation patches (Spartina patens, Phragmites australis, and Schoenoplectus californicus). Organic soils (with low bulk density) occur in each core on the upthrown side of the fault to a depth of 34cm across all vegetation types. The highest bulk densities are in cores collected in Schoenoplectus californicus, suggesting a biotic (plant community) control on OM quantity and composition. Likewise, low C/N has been documented on the upthrown side of the fault, which could indicate increased decomposition of OM from exposure to the atmosphere, compared to the submerged downthrown side. Additionally, discrete changes in δ13C on the upthrown and downthrown sides of the fault indicate that OM is made of the previous emergent vegetation which still dominates the soil profile.

Presenter or Panelist 2: Mark Byrnes | Applied Coastal, mbyrnes@appliedcoastal.com

MOVEMENT OF UNANCHORED BENCHMARK RODS IN CONSOLIDATING DELTAIC SEDIMENT IN SOUTH LOUISIANA

A prior National Geodetic Survey subsidence study, using benchmark leveling surveys between 1965 and 1993, observed that sectional rod monuments driven to refusal measure vertical displacements similar to those recorded at surface concrete benchmarks, implying that monument rod length does not affect

subsidence rates. Our analysis of recent subsidence rates from high-accuracy Global Positioning System (GPS) surveys made similar observations for monuments in south Louisiana deltaic wetlands. In an effort to explain these observations, a field experiment was conducted at several survey benchmarks and Coastwide Reference Monitoring System (CRMS) rod surface elevation table (RSET) rod locations within Barataria and Breton Sound Basins. Shallow-rod benchmarks were established near sectional rods driven to refusal in order to monitor elevation change between February 2019 and August 2022. Our hypothesis was that downward-directed forces from consolidating Holocene sediment pull unanchored sectional rods of any length downward at a rate equal to geologic subsidence, no matter their burial depth. High-accuracy leveling surveys were completed at each site and date to document differences in elevation change between deep and shallow rods. A difference in elevation change between the paired rods would indicate that rod length impacts measured subsidence rates. Our measurements recorded no difference in elevation change between paired deep and shallow rods, verifying that sectional rod length within consolidating deltaic sediment does not impact subsidence rates. In other words, unanchored sectional rod installations of any length record total subsidence in south Louisiana coastal environments. This result is expected to improve the ability of practitioners to integrate CRMS relative surface elevation and accretion measurements within regional subsidence measurements in order to evaluate marsh surface processes and changes in relation to rising sea levels.

Presenter or Panelist 3: Elizabeth Harris | LSU Department of Oceanography and Coastal Science, eharr71@lsu.edu

Evaluating subsurface wetland dynamics and marsh resiliency to RSLR in coastal LA

Coastal wetlands provide important ecological services such as carbon sequestration and protection of coastal communities from storm impacts, yet sea-level rise may significantly reduce the area of wetlands along the coast. Generally, marshes adjust to sea-level rise through dynamic feedback between flooding, plant productivity, and surface accretion. However, elevation gain by surface accretion can be negated or even reduced by subsurface subsidence. While many studies have focused on processes influencing surface accretion, few have examined spatial patterns and factors influencing subsurface change. Here, we will examine variation in subsurface change rates across coastal wetlands in Louisiana, USA where the coastal wetland loss rates are some of the highest globally. Using a large network of monitoring stations within the Louisiana Coastwide Reference Monitoring System (CRMS), we examine patterns of subsurface change rates across wetland basins and marsh and vegetation types as well as the influence of underlying geology, hydrology, and soil characteristics. At two sets of sites, one in the Pontchartrain basin and one in the Chenier Plain region, LA, we established a field study to test whether root productivity is lower, flooding is greater, and/or soil shear strength is lower at sites experiencing subsurface subsidence compared to more stable sites and sites experiencing subsurface expansion. Overall, this investigation will expand our understanding of landscape and site-level factors influencing marsh subsurface dynamics and thereby resilience to sea-level rise.

Presenter or Panelist 4: Mohamed Hassan | Louisiana State University, mhassa9@lsu.edu

Quantification of live root biomass and structure, necromass, and macro pores in Coastal Wetland

Wetlands are examples of resilient and durable natural coastal protection strategies. However, a better understanding of the root structure architecture and strength (RSAS) is necessary to evaluate the marsh platform's ability to withstand hurricane disturbance. The Atchafalaya (active delta) and Terrebonne (continued river abandonment) Basins are the testbeds of this study to determine how the long-term

vulnerability to hurricanes, coastal erosion, and sea level rise will affect these two distinct basins. This study is synergistic towards the X-ray computed tomography (XCT) Nikon XTH 320/225 system at the Environmental Molecular Sciences Laboratory (EMSL) for nondestructive studying of root-system architecture. XCT scanning was used to quantify the micro-scale biomass, necromass, root architecture, macro pore structure, and sediment density in cores collected from 3 sites per basin across a salinity gradient of fresh to saline marsh. While still in its infancy, the use of XCT to quantify roots, rhizomes, and peat holds promise as a precise replacement for time-consuming, and highly variable traditional hand-sieving methods. Fieldwork included sampling and conducting cone penetration testing (CPTu). Samples were collected using a biomass core sampler (15 cm diameter). Afterwards, soil cores were extruded into an HDPE pipe with a diameter of 15 cm and length of 35 cm. XCT slices analysis included three steps; normalization, segmentation and quantification. In this study, an unsupervised machine learning algorithm, Gaussian Mixture Models (GMM), was used to cluster data based on the Expectation Maximization. Afterwards, the GMM output (labeled image) was used to train a random forest model along with various features (e.g., canny edge, median, gabor) to segment the 3D volume. Preliminary results show that the percentage of live biomass is about 25% of the total volume which varies with depth. The maximum percent of the live biomass is at depth of 10-20 cm as expected.

Presenter or Panelist 5: Torbjörn Törnqvist | Department of Earth and Environmental Sciences, tor@tulane.edu

High-resolution subsidence monitoring in the Mid-Barataria Sediment Diversion region

The Mid-Barataria Sediment Diversion is expected to cause rapid changes in the coastal landscape of Barataria Basin, including changes in vertical land motion. Monitoring these changes will be important, however, capturing the full range of subsidence processes in coastal wetlands (i.e., from the land surface to deep crustal motions) is challenging. In 2016, we established a novel "subsidence superstation" ~2 km from the Mississippi River near Myrtle Grove, LA, to measure compaction as a function of depth in Holocene sediments and deeper subsidence in a global reference frame. The site featured three borehole optical fiber strainmeters to obtain continuous records of displacement between ~1.3 m below the surface and depths of ~11, 26, and 38 m, providing unprecedented (micron-scale) resolution. A nearby (~200 m) CRMS station provided hydrologic data and near-surface compaction through a RSET-MH instrument. We also installed three GPS antennas, one of which was mounted to a rod cemented into the Pleistocene basement. A core from one of the boreholes provided insight into the sediment properties of the entire Holocene succession. Five years of records (2016-2021) reveal that the compaction rate in the material between 1.3 m and 38 m is likely less than 0.25 mm/yr. The GPS records yield an average subsidence rate of 2.5 mm/yr regardless of the anchor depth, corroborating the low rates observed by the strainmeters. Thus, subsidence at this location is governed mostly by deformation of the Pleistocene or underlying strata rather than compaction of Holocene material, with the exception of the uppermost meter which compacted several mm/yr according to the RSET-MH data. The instruments took major damage during Hurricane Ida but could be revived with new investments. Given the success of this initial experiment, we argue that a network of subsidence monitoring stations will be essential to fully understand the performance of the Mid-Barataria Sediment Diversion.

Ecosystem Restoration

Standard, Session #17

Coastwide avian restoration facilitated by interdisciplinary collaboration: Louisiana's success

Following the Deepwater Horizon oil spill and the formation of the Louisiana Trustee Implementation Group (LATIG), restoration, conservation and adaptive management of bird nesting and foraging habitats was prioritized as one of the principal programmatic goals throughout coastal Louisiana and the broader northern Gulf of Mexico. As an initial step, a thorough understanding of past actions and lessons learned was required, and team members were sought out to aid in the identification of informational needs to support future restoration efforts.

Strong interdisciplinary collaboration continues to play a critical role in our team's capacity to accomplish stated programmatic goals. Through active engagement, sometimes highly spirited conversations, and intentional blending of institutional knowledge, our team continues to both identify and address informational needs which directly support future restoration efforts. Further, unforeseen opportunities, often identified by individuals well outside the initial project scope, continue to bolster our team's ability to develop necessary and pragmatic tools to assist resource managers in addressing ongoing and proposed environmental issues.

In this session, the four project presentations will highlight our team's ongoing efforts to restore Louisiana's impacted avian resources and the critical habitats they rely upon. Each presentation will highlight project-specific activities as well as emphasize the strong linkages between all projects. The moderator is biologist Jon Wiebe from the Louisiana Department of Wildlife and Fisheries (LDWF), and presenters include avian and restoration specialists from The Water Institute (Eva Windhoffer and Jessica Henkel), the Coastal Protection and Restoration Authority (Katie Freer), and Louisiana State University (Aylett Lipford).

The session will be 90 minutes including a moderator introduction, 4 oral presentations of 12 minutes each, and discussion time.

Session Organizer: Eva Windhoffer | The Water Institute, Email: ewindhoffer@thewaterinstitute.org

Moderator: Jon Wiebe | Louisiana Department of Wildlife and Fisheries, jwiebe@wlf.la.gov

Presenter or Panelist 1: Eva Windhoffer | The Water Institute, ewindhoffer@thewaterinstitute.org

An Overview of the Guidance Document for Avian Habitat Restoration and Monitoring

This presentation introduces the document, Guidance for Coastal Ecosystem Restoration and Monitoring to Create or Improve Bird Nesting Habitat. This document was developed with support from the Louisiana Trustee Implementation Group as a tool for highlighting opportunities in restoration project design to enhance bird nesting habitats. This guidance document builds off the Deepwater Horizon Final Programmatic Damage Assessment and Restoration Plan as well as the Strategic Framework for Bird Restoration Activities, and was created primarily for use by restoration project teams. This was a collaborative effort between avian biologists and restoration project teams. The document focuses on habitat characteristics and monitoring guidance for three distinct habitat-based bird groups: shrub-

nesters, marsh-nesters, and ground-nesters. It is anticipated that this document will inform future restoration project design to increase benefits through the construction and enhancement of preferential avian habitat.

Presenter or Panelist 2: Jessica Henkel | The Water Institute, jhenkel@thewaterinstitute.org

Gulf of Mexico Colonial Waterbird Data Monitoring Portal

The principal means by which the Deepwater Horizon (DWH) Regionwide Trustee Implementation Group (TIG) monitors shrub- and select ground-nesting waterbird species is through aerial photographic nest surveys. Surveys are carried out from a fixed-wing aircraft, with two photographers taking contextual habitat photographs as well as individual nesting colony photographs. Nests are then manually dotted (i.e., counted) on individual photographs and assigned to species and the nesting status, allowing for the enumeration of nests and nesting pairs by species within a defined area. Aerial surveys began in 2010, resulting in seven years of data, with the survey range varying from across to the northern Gulf of Mexico to only the Louisiana coast. To date, more than 25,000 photos have been processed. This data will be critical for future evaluation of nesting waterbird species distribution trends, relative abundance, nest abundance, and breeding status in the Gulf of Mexico.

To fully leverage the utility of the data generated by this project, the Gulf of Mexico Colonial Waterbird Data Portal has been developed. This portal includes a geospatial dashboard that allows users to explore the survey data by geographic areas, year, watershed and/or species. The data portal also allows users to download the full datasets, and and download high resolution images and geodata. This presentation will present on the describe the process of aggregating the data geospatially, and will provide a demonstration of the data portal and its dashboard.

Presenter or Panelist 3: Aylett Lipford | Department of Renewable Natural Resources, Louisiana State University, alipford@agcenter.lsu.edu

If you build it, will they come? Assessing habitat quality for birds at created marshes in LA

Habitat loss from natural and anthropogenic processes threatens wetland bird populations along the northern Gulf Coast. In Louisiana, marsh creation projects are utilized to combat marsh loss, however, the effectiveness of such efforts on wetland- dependent wildlife is not well understood. Multi-scale habitat characteristics such as edge dynamics, vegetation communities, and flooding patterns affect the abundance and occurrence of wetland birds. Our study compares bird species abundance, vegetation, and site-specific hydrology between natural and created marshes across southeastern Louisiana and is a part of a broader study to evaluate marshbird habitat relationships and movements across the coast. We conducted point counts and vegetation surveys at six created and six natural marshes in 2021 and at 10 created and 10 natural marshes in 2022 and 2023. All species of birds seen and heard were recorded and a call-back survey was performed to increase detection of our five focal species: Common Gallinule, Purple Gallinule, Least Bittern, Clapper Rail, and King Rail. At each created site, a water-level recording device was set up to quantify differences in water levels and flooding frequency among sites. Our results suggest that created marshes vary widely in hydrologic regimes and vegetation communities. While some created sites had overall lower water levels than the natural marshes and therefore a more upland vegetation community, others had more variable water levels that allowed for frequent flooding and establishment of emergent vegetation. During the 2021 season, Common Gallinules, Purple Gallinules, and King Rails were more abundant at natural sites, however, during the 2022 season, all of our focal species were more abundant at created sites. Trends suggest that building marshes at an elevation that

allows for flooding and establishment of emergent vegetation may improve suitable habitat for wetland birds.

Presenter or Panelist 4: Katie Freer | Coastal Protection and Restoration Authority, katie.freer@la.gov

Bridging the Gap between Biologists and Restoration Project Teams

Despite often working towards similar goals, discussions between avian biologists and coastal restoration project teams have been historically limited in the state of Louisiana. This presentation highlights how the avian habitat enhancement/restoration efforts discussed in this session have provided a unique opportunity to encourage collaboration across these disciplines and agencies/institutions. Strengthening this collaboration has important implications for the successes of future restoration projects and similar efforts should be made across other biological disciplines and restoration project teams to maximize project benefits.

Predicting and Planning for the Future of the Coast

Panel, Session #18

Communicating the Coastal Master Plan: Graphic Accessibility in the 2023 Edition

The Coastal Master Plan has many audiences. As a state mandate, it functions as both a clearinghouse and guiding light for long-term investments in risk reduction and restoration projects. To the public, it's a crucial source for understanding the future of coastal life in Louisiana—where projects are planned, what has been accomplished already, and, more existentially, what their communities, economies, and patterns of habitation will look like in decades to come.

For the 2023 Coastal Master Plan, CPRA collaborated with a multi-disciplinary team led by Arcadis and SCAPE to craft an updated visual communications strategy across the document's fourth edition—from overall graphic identity to in-the-weeds decisions about maps, regional project views, data visualizations, engagement collateral, and general reading comprehension.

In this panel, join two members of the Coastal Master Plan team—a representative from CPRA and a designer from SCAPE—alongside an environmental journalist and a member of Louisiana's environmental advocacy community to discuss design decisions in this latest iteration of the plan and how it is interpreted by its stakeholders across the coast.

Learning goals for this session include a targeted discussion on how graphics, visualizations of all kinds, and written descriptions of restoration and risk reduction projects can be honed to maximize accessibility to the broadest possible audience, helping to demystify often complex processes; lessons learned from producing more accessible content for in-person engagement in coastal communities across the state; and how these skills and tactics can be applied in the everyday work of coastal professionals of all backgrounds.

Session Organizer: Jackson Rollings | SCAPE, Email: Jackson@scapestudio.com

Moderator: Nans Voron | SCAPE, nans@scapestudio.com

Presenter or Panelist 1: Krista Jankowski | Coastal Protection and Restoration Authority of Louisiana (CPRA), Krista.Jankowski@la.gov

Presenter or Panelist 2: Halle Parker | WWNO New Orleans Public Radio, hparker@wwno.org

Presenter or Panelist 3: Simone Maloz | Restore the Mississippi River Delta (MRD), smaloz@mississippiriverdelta.org

Presenter or Panelist 4: Jackson Rollings | SCAPE, Jackson@scapestudio.com

Disaster Impacts, Mitigation and Recovery

Standard, Session #19

Update on Deepwater Horizon NRDA Restoration in Louisiana

The Deepwater Horizon Spill began 13 years ago, but the historic Natural Resource Damage Assessment settlement wasn't finalized until 6 years later, with payments beginning in 2017 and scheduled to continue until 2032. The Louisiana Trustee Implementation Group has committed over $3 billion to habitat and resource restoration, with planning and implementation efforts keeping pace with available funds. This session will provide an overview of the work of the Louisiana Trustee Implementation Group and highlight projects restoring habitat, birds, water quality, and recreational use.

Session Organizer: Mel Landry | NOAA Restoration Center, Email: mel.landry@noaa.gov

Moderator: Maury Chatellier | CPRA, Maury.Chatellier@la.gov

Presenter or Panelist 1: Mel Landry | NOAA Restoration Center, mel.landry@noaa.gov

The Louisiana Trustee Implementation Group: An Overview

You'll learn about the funding and administrative structure of the Louisiana Trustee Implementation Group and hear a short update on projects that have been implemented to restore habitat, birds, marine mammals, water quality, oysters, and recreational use. Attendees will also learn about how to access up to date project and monitoring information via the web.

Presenter or Panelist 2: Sarah Clardy | USFWS, sarah_clardy@fws.gov

Restoration of North Breton Island

THIS PRESENTATION WAS INADVERTENTLY SUBMITTED AS A STAND-ALONE PRESENTATION. PLEASE DISREGARD THAT SUBMISSION AND CONSIDER IT IN THE CONTEXT OF THIS SESSION.

North Breton Island is a part of Breton National Wildlife Refuge (NWR) in Plaquemines Parish, LA and the second oldest national wildlife refuge in the country, established in 1904. It serves as one of Louisiana's most important brown pelican rookeries. The presentation will focus on the North Breton Island Restoration project including construction, mitigation efforts for nesting birds, hurricanes, and tropical storms, current outcomes, partnerships during the restoration, and future monitoring.

Presenter or Panelist 3: Joe Wyble | CPRA, Joe.Wyble@la.gov

Restoration of Recreational Use

The BP Oil Spill not only impacted habitat and animals, but it also directly impacted the ability of citizens to visit and enjoy Louisiana's coast. The Oil Pollution Act allows trustees and responsible parties to consider impacts to recreational use in determining an approach to restoration. In Louisiana, $38M was allocated to restoration of recreational use. Those funds have been fully allocated to projects that are complete or currently in construction. This presentation will provide an overview of projects across the state designed to restore recreational use that was impacted by the Deepwater Horizon Spill.

Presenter or Panelist 4: Scott Graham | Ducks Unlimited, Inc., sgraham@ducks.org

NRDA Nutrient Reduction Projects in Southwest Louisiana Agriculture

Through a unique partnership with Ducks Unlimited (DU), NRCS has provided over $2.8M to incentivize rice agriculture producers to voluntarily implement best management practices (BMP) that reduce nutrient and sediment runoff from agricultural fields. Implementation of BMPs into agricultural practices may help reduce the Gulf Hypoxia Zone, which annually harms marine life and negatively impacts fisheries as the result of excess nutrients causing harmful algae blooms that when decaying, deplete dissolved oxygen levels in the water column. NRCS selected three impaired watersheds in southwest Louisiana to concentrate projects in to help improve water quality by reduction of sediment and nutrient runoff from the landscape. Through established relationships, Ducks Unlimited works directly with producers to develop agreements to implement practices such as winter water holding, cover crops, pump station test, critical area plantings, pump conversions, nutrient management, wetland wildlife and habitat management, and more. This unique partnership is beneficial for all involved because migrating waterfowl depend on rice agriculture as a food source and loafing area during migration, and rice agriculture is considered a working wetland that may benefit water quality by providing ecosystem services similar to natural wetlands. To date over 55 agreements have been developed as part of the NRDA nutrient reduction initiative.

Flood Risk Management: Coastal and Inland

Standard, Session #20

Major Infrastructure Initiatives progress: Bayou Region's flood & economic resiliency

Hurricane impacts and ongoing land loss have increased flooding in rural communities, not always protected by major infrastructure. These stresses are combined with those associated with legacy oil and gas infrastructure across the coastal zone, that often impact disadvantaged communities and environmental justice areas. This session discusses several recent initiative that target the provision of new infrastructure to reduce flooding, the economic vitality of rural and ongoing emissions from abandoned industrial facilities. Presentations will discussion social, environmental, and engineering challenges of implementing these initiatives across coastal Louisiana, highlighting the need for continued attention to communities outside of the state's major urban areas.

Session Organizer: Henri Boulet | Morganza Action Coalition, Email: henri.boulet@nicholls.edu

Moderator: Dwayne Bourgeois | North Lafourche Levee & Conservation District, dwayneb@nlcldd.com

Presenter or Panelist 1: Henri Boulet | Morganza Action Coalition, henri.boulet@nicholls.edu

Flood Risk Reduction Projects in the Bayou Region

This presentation will provide a status update on construction of the $3.2B Morganza to the Gulf Hurricane Risk Reduction System and the $900M LA 1 Improvement Project. The updates will include expected economic benefits from the projects, completion timing of the LA 1 Project and timing on initial levee lifts and floodgate completions which will effectively close-in the Morganza system.

Presenter or Panelist 2: Sean Walsh | Eutis Engineering, swalsh@eutiseng.com

Geotechnical Challenges of the Maurepas Freshwater Diversion and West Shore Levee Projects

Presentation will include an overview of the geotechnical aspects and challenges of the project, with the primary focus being on challenges of incorporating the WSLP flood protection levees

into the Maurepas diversion project. Discussion will include USACE HSDRRS criteria and the USACE update geotechnical guidance for the West Shore Lake Pontchartrain project.

Presenter or Panelist 3: Leah Reed | AECOM, leah.read@aecom.com

Overview of Engineering Challenges of Integrating the Maurepas Freshwater Diversion Project with the West Shore Levee Risk Reduction Project

The presentation will provide overview of engineering challenges related to integrating both the flood control and diversion project aspects and complexities related to working with these 3rd parties and discuss project-specific requirements for railroad and highway crossings. Also, provide an overview of the Maurepas intake headworks, the required deep excavations and cofferdam system, and the complexities of installing these features within the mainline Mississippi River Levee system.

Presenter or Panelist 4: Scott Hemmerling | The Water Institute, shemmerling@thewaterinstitute.org

A Community-Informed Approach to Coastal Restoration Planning in Port Fourchon, Louisiana

Port Fourchon is a vital staging area for offshore energy production strategically located on Louisiana's Gulf coast in a biologically and economically productive ecosystem. The port and surrounding communities are highly vulnerable to tropical weather events and other impacts of climate change due to their location on a degrading part of the Mississippi Delta. Building resilience to climate-based disruptions is vital to communities and businesses operating in this dynamic landscape. Port Fourchon plans to deepen its channel to 50 feet to service larger vessels, generating millions of cubic yards of sediment and seeks to utilize this sediment to develop natural and nature-based solutions that will enhance regional resilience. To support this effort, an Environmental Competency Group consisting of residents, coastal scientists, and key stakeholders convened to co-develop a series of marsh creation projects that will maximize social and ecological co-benefits. The group utilized participatory modeling and social return on investment methods to model long-term changes to the landscape resulting from the co-developed restoration strategies and assess the social value of these strategies. Residents who live and work around Port Fourchon were included in all stages of this research, including development and prioritization of potential restoration areas, identifying important physical and ecological parameters that should be modeled, evaluation of model results, and assessment of the social values expected to be generated by each restoration alternative under consideration. The approach used in this research highlights the effectiveness of a community-informed, systematic approach to coastal restoration planning in building community resilience and ecosystem sustainability. This study provides approaches and tools that can be adapted for use elsewhere to develop holistic solutions that maximize the social, ecological, and economic co-benefits of coastal restoration.

Renewable Energy

Panel, Session #21

Developing offshore wind that prioritizes workers and communities

This summer the federal government will lease the first offshore wind areas in the Gulf of Mexico to investors. It is no longer a question of if or when offshore wind will come to the Gulf South. The questions are how will offshore wind impact our communities and who will benefit.

Without input from the public, there is little reason to believe offshore wind will be different from the offshore oil and gas industry. Absent a demand of justice and equity, profits will flow to large companies and a lucky few will get high paying jobs with benefits, while other communities--especially Black and Indigenous--are left behind.

This panel will bring together advocates who are working to organize communities who might otherwise be left out of the offshore wind boom. While they come from different sectors representing organized labor, oil and gas workers, and climate/environmental justice, they all have one thing in common: developing a new industry that puts workers and communities in the center of the conversation.

Session Organizer: Kendall Dix | Taproot Earth, Email: kdix@taproot.earth

Moderator: Kendall Dix | Taproot Earth, kdix@taproot.earth

Presenter or Panelist 1: Leo Lindner | True Transition, leo@truetransition.org

Presenter or Panelist 2: Michael Esealuka | Healthy Gulf, michaelesealuka@healthygulf.org

Presenter or Panelist 3: Khalil Shahyd | National Resources Defense Council, kshahyd@nrdc.org

Presenter or Panelist 4: Logan Burke | Alliance for Affordable Energy, logan@all4energy.org

Presenter or Panelist 5: Nicole DiPaolo | BlueGreen Alliance, ndipaolo@bluegreenalliance.org

Managing our Rivers for Multiple Uses

Standard, Session #23

Mississippi Sound Impacts of Bonnet Carré Spillway Openings and Other Freshwater Inputs.

The Bonnet Carré Spillway (BCS) is the final flood defense structure on the Mississippi River protecting the levee system of the New Orleans area from flooding during high Mississippi River flow regimes. Opening the BCS in Louisiana flushes the Mississippi Sound with river waters that are low in salinity and high in nutrient levels and suspended sediment loads, which can potentially lead to ecosystem shifts, harmful algal blooms, and hypoxia. Climate change has increased the frequency of BCS operations such that for the first time ever it was opened for three years in succession (2018, 2019 and 2020) as well as twice in a single calendar year (2019). After the double BCS openings in 2019, intense cyanobacteria blooms were observed in Lake Pontchartrain and along the Mississippi coast, causing extended beach closures and marine mortality, with detrimental effects on coastal fisheries and local tourism. Notably, harvest oyster reefs in the Mississippi Sound suffered nearly 100% mortality in summer 2019. This session seeks to understand the chronic and acute stressors to the Mississippi Sound ecosystem and its coastal fisheries and shellfisheries of historic and hypothetical (modeled) spillway openings, and other sources of freshwater input into the Mississippi Sound.

Session Organizer: Kim de Mutsert | The University of Southern Mississippi, Email: Kim.deMutsert@usm.edu

Moderator: Kim de Mutsert | The University of Southern Mississippi, Kim.deMutsert@usm.edu

Presenter or Panelist 1: Adam Skarke | Mississippi State University, adam.skarke@msstate.edu

Impact of Submarine Groundwater Discharge on Water Quality in Mississippi Sound

Effective management of rivers to achieve coastal water quality goals requires a comprehensive understanding of both riverine and non-riverine water and solute flux to the coastal ocean. Submarine groundwater discharge (SGD) is an important, non-riverine, hydrologic process that affects coastal water quality by transporting environmental stressors, such as nutrients, contaminants, and pathogens, into the ocean. Although SGD water flux to the coastal ocean is usually less than that of rivers and streams, it can often represent an equivalent or greater contribution to local nutrient budgets because solutes are highly concentrated in SGD relative to surface waters. Published hydrologic models as well as preliminary field observations have indicated that SGD occurs in the Mississippi coastal waters and may directly contribute to degradation of water quality including eutrophication, harmful algal blooms, and ultimately hypoxia. However, controls on transport pathways and the spatial variability of SGD in Mississippi Sound, as well as the specific chemical composition of the discharged water, are poorly constrained. Here we present new isotopic tracer and geochemical data, which demonstrate the presence of SGD in the western Mississippi Sound and indicate that it is the primary source of dissolved constituents, including nutrients and trace elements, into the Sound during periods of low river discharge. Additionally, we preset new geophysical survey data, which indicate the presence of low-salinity groundwater beneath the Mississippi Sound and suggest that spatial heterogeneity in subsurface hydraulic conductivity, created by infilled paleochannel drainage networks, may exert control on the distribution of SGD. These results contribute to an improved understanding of SGD processes as well as

their impact on nutrient budgets in the Mississippi Sounds and have the potential to more fully inform management of local water quality and fisheries.

Presenter or Panelist 2: Xiaodong Zhang | The University of Southern Mississippi, xiaodong.zhang@usm.edu

Assessing effect of freshwater release and food supply on oyster larvae through optical observation

Recent influx of fresh water due to the opening of the Bonnet Carré spillway has all but destroyed the adult oyster stock in the Mississippi Sound. Consequently, recovery of the estuary and rebuilding of the oyster stock depends heavily on the availability of oyster larvae and their success at metamorphosis. In addition to the physical environment, such as salinity and temperature, the quality of food source is critical in minimizing time of oyster larvae to metamorphosis (growth and development rate) and success at metamorphosis. We developed a state-of-the-art optical system in conjunction with a cutting-edge oyster larval model to identify, understand, and predict the physical and nutritional constraints on oyster larvae performance in the Mississippi Sound. We tested this approach in 2021 and 2022, measuring the inherent optical properties and collecting water samples for laboratory determination of protein, lipid, and carbohydrate concentrations of the particulates. The oyster larvae model and biochemical nutrient analysis showed that food source was relatively low in protein proportion, which in addition to frequent low salinity (< 10 PSU), might have contributed to a low rate of larval settlement throughout the region in 2021. However, there were a few locations where successful larval metamorphosis was predicted and confirmed. The optical observation showed that phytoplankton in the area are predominately macro sized (> 20 µm), but during the few cases of successful metamorphosis, there was always a concurrence of picoplankton (of sizes from 0.2 to 2 µm) as well as an overall increase of organic particles of sizes < 2 µm. In the other times, the small particles are dominated by inorganic matter, hence are inefficient for larvae to digest. Our findings suggest that the quality of food source for oyster larvae may require a protein rich diet that might be provided by small-size organic particles, including picoplankton, bacteria, and/or viruses, the availability of which presently presents a serious constraint on oyster resiliency and productivity.

Presenter or Panelist 3: Inia Soto | Morgan State University, inia.m.sotoramos@nasa.gov

Spatial and temporal characterization of cyanobacteria blooms in the Mississippi Sound and their

Cyanobacteria harmful algal blooms, known as cyanoHABs, occur worldwide affecting lakes, rivers, wetlands, and can be transported across the aquatic continuum impacting estuaries and coastal regions. The Cyanobacteria Index algorithm was used to characterize the cyanoHABs that affected the coastline along Mississippi during the summer of 2019. Data for 2018 was included to compare a "bloom" and "non-bloom" year and differences between three Bonnet Carre Spillway (BCS) openings: March 2018, February-April 2019, and May-July 2019. River discharge, salinity, and modeled-wind data were used to study the pre-conditions leading to the blooms and factors aiding the advection and maintenance. Two distinct cyanoHABs were observed in 2019, the first was near Breton Sound, Bay Boudreau, and Drum Bay in March; and a second bloom in Lake Pontchartrain late in May. Both blooms were advected into the Mississippi Sound and likely contributed to the 3-month-long beach water advisories of 2019 along the Mississippi coastline. From March to July 2019, salinity within the Mississippi Sound was consistently near 0 indicating high levels of fresh water. During that time, winds were predominantly northwestward preventing the BCS waters from flushing into the Mississippi Shelf and resulting in BCS waters remaining longer within the estuarine lakes and Mississippi Sound. In March 2018, a cyanobacteria bloom was

observed within Lake Pontchartrain coinciding with the BCS opening, however the bloom was contained in the lake. The results presented here highlight the need for better understanding of phytoplankton dynamics across the aquatic continuum, as well as the need for monitoring programs that integrate biogeochemical and hydrographic data with satellite imagery, and circulation models. Those monitoring programs should not be limited to state boundaries, and should spread across the multiple river diversions, lakes, and estuaries in the region.

Presenter or Panelist 4: Kemal Cambazoglu | The University of Southern Mississippi, kemal.cambazoglu@usm.edu

Modeling freshwater impacts on the water quality, habitat suitability, and ecosystem dynamics

The Mississippi Sound and Bight are under the natural influence of the Mississippi River and the local rivers flowing into the estuarine water bodies of Lake Maurepas, Lake Pontchartrain, Lake Borgne, Breton Sound, Chandeleur Sound, Mississippi Sound and Mobile Bay. This interconnected estuarine system also gets impacted by controlled diversion events such as the Bonnet Carré Spillway openings that divert excess Mississippi River waters into Lake Pontchartrain and subsequently into Western Mississippi Sound. It is important to understand the extent as well as the impact of the excess freshwater introduced to the system during wet years as well as how it is redistributed during diversion events. USM's Ocean Modeling Group has been working on the development of a coupled modeling framework to study the water quality, habitat suitability, and ecosystem dynamics in Mississippi Sound. We use a Mississippi Bight application of the Coupled Ocean Atmosphere Wave Sediment Transport (msbCOAWST) modeling system to find the spatiotemporal variability of water quality parameters such as temperature and salinity as well as circulation, currents and water levels. These are provided to a habitat suitability model looking at the impact of these water quality stressors on the habitat suitability of Mississippi Sound for commercially- and ecologically-important species such as oysters, blue crabs, and brown shrimp. msbCOAWST will also provide information to an Ecospace model which is an ecosystem-based fisheries model to study the effects of spillway operations and high flooding events on the ecology of the Mississippi Sound. Results of the modeling system helps us develop insight into how spillway operations under different oceanic, atmospheric, and hydrologic settings impact temperature and salinity distribution, habitat suitability and fisheries species biomass and distribution, while also guiding natural resource managers where and when the onset of hypoxia may occur.

Human Dimensions

Panel, Session #24

The Bayou Culture Collaborative: Integrating Community Voices into the Human Dimension

Coastal researchers often note the rich cultural value of the Louisiana coast; however, action plans often focus more on landscape and waterways than the heritage and community of the people. The Bayou Culture Collaborative offers a deeply intentional model for planners to include community members in planning on all levels, rooted in the idea that we need to build community in order to create a shared understanding of our coastal problems and move forward together. Our model also provides a structure allowing research scientists to network with a wide range of people involved in cultural, historical, and community work on the Coast. After our first year of work, we crafted a position statement providing a concise framework to more effectively address the human dimension in environmental planning. This panel is an introduction to and overview of the project, which launched in January 2022. The panelists, representing multiple components of the Collaborative, will explain the group's mission, how it functions (including monthly gatherings and working groups), the development of a position statement, and our vision for ongoing collaborative projects.

Session Organizer: Shana Walton | Bayou Culture Collaborative, Email: shana.walton@nicholls.edu

Moderator: Gary LaFleur | Nicholls State University, gary.lafleur@nicholls.edu

Presenter or Panelist 1: Theodore Hilton | Tulane University, thilton1@tulane.edu

Presenter or Panelist 2: Lanor Curole | United Houma Nation, lanor.curole@unitedhoumanation.org

Presenter or Panelist 3: Shana Walton | Bayou Culture Collaborative, shana.walton@nicholls.edu

Human Dimensions

Panel, Session #25

What does success look like? Perspectives on the societal impact of coastal restoration

Louisiana's coastal restoration projects are a key component of creating a thriving coast for Louisiana's communities, ecosystem, and economy. While there is existing research on some of the potential benefits to communities from these projects, limited research has evaluated the long-term societal impact on coastal communities from constructed restoration projects. This session will include perspectives from three groups with an interest in improving how Louisiana engages with and evaluates the impact of coastal restoration on communities. In this session, we focus on how we can learn from and evaluate restoration projects completed at least 5 years ago. First, graduate students from UL Lafayette's interdisciplinary Coast in Crisis course will share outcomes from History Harvests collected during the Spring 2023 semester. History Harvests are a social science collection method used to engage a diverse group of community members at public events to recall their understanding of a particular topic or event (e.g., the restoration project). Second, researchers from the Blanco Public Policy Center will discuss best practices for evaluating the societal impact of coastal restoration projects based on a literature review of relevant journal articles and environmental program evaluation reports. Finally, leaders from Restore the Mississippi River Delta, a coalition of non-profit organizations focused on rebuilding Louisiana's coastal landscape to protect people, wildlife, and jobs, will share best practices for supporting community understanding of and efforts to engage in coastal restoration. Collectively, this panel will provide an overview of different types of community engagement and a framework for evaluation of the impact of coastal restoration on Louisiana's communities.

Session Organizer: Anna Osland | Blanco Public Policy Center, UL Lafayette, Email: anna.osland@louisiana.edu

Moderator: Anna Osland | Blanco Public Policy Center, UL Lafayette, anna.osland@louisiana.edu

Presenter or Panelist 1: Chenhan Shao | Blanco Public Policy Center, UL Lafayette, chenhan.shao@louisiana.edu

Presenter or Panelist 2: Devon Parfait | Restore the Mississippi River Delta, dparfait@edf.org

Presenter or Panelist 3: Emma Willis | Department of History, UL Lafayette, emma.willis1@louisiana.edu

Presenter or Panelist 4: Katie Gruzd | Restore the Mississippi River Delta, kgruzd@edf.org

Coastal Law, Policy & Funding

Standard, Session #26

An Overview of Grant and Other Nontraditional Financing Opportunities for Coastal Projects

The restoration of coastal ecosystems is a national priority. Studies have estimated losses to economic activity, potential infrastructure rebuilding costs, and impacts further inland due to coastal erosion in the amount of $138 billion annually. Carbon sequestration and ecosystem services generated by these coastal systems can easily generate several additional billion dollars. The draft 2023 Coastal Master Plan lays out projects that are critical to the restoration of the coast and estimates restoration costs in several billion dollars over multiple years, and there are many projects in the Master Plan that will need to secure funding. This panel will explore financing and crediting mechanisms for projects that can supplement the financial shortfalls to keep the restoration activities on track with the Master Plan timeline, including how these financing and credit mechanisms may interplay with blue carbon credits; the potential to incorporate other ecosystem values, the legal mechanisms in Louisiana for financing coastal restoration through non-carbon credits; and what baseline technical and social information should be considered for choosing projects. This panel will also include a discussion of the National Fish and Wildlife Foundation's (NFWF) annual National Coastal Resilience Fund (NCRF) grant program, which provides opportunities for Louisiana communities and organizations to invest in sustainable, nature-based resilience solutions. Participants will leave this presentation with a clear understanding of the NCRF program, insight as to how to leverage NCRF funding for the greatest impact, and the ability to identify nature-based opportunities with the potential to catalyze larger resilience efforts. Finally, this panel will present a novel approach and model to quantifying social benefits for flood mitigation projects. The approach, developed by researchers at Texas A&M and Virgina Tech with support from the Harris County Flood Control District and USACE-Galveston, focuses on the habitation benefits of flood mitigation to due to impacts on shelter flooding and other critical infrastructures.

The model produces behavior over time graphs that allow policy makers to consider the improvement to habitation from protecting individual specific infrastructure assets, including homes.

Session Organizer: | , Email:

Moderator: Chris Dalbom | Tulane University, cdalbom@tulane.edu

Presenter or Panelist 1: Valerie Black | The Water Institute, vblack@thewaterinstitute.org

<u>An overview of nontraditional financing opportunities for restoration and sustainability project</u>
The restoration of coastal ecosystems is a national priority. Studies have estimated losses to economic activity, potential infrastructure rebuilding costs, and impacts further inland due to coastal erosion in the amount of $138 billion annually. Carbon sequestration and ecosystem services generated by these coastal systems can easily generate several additional billion dollars. Such a significant economic contribution has not gone unnoticed. State and regional economies have pushed for comprehensive plans to restore and preserve the coast. The draft 2023 Coastal Master Plan lays out projects that are critical to the restoration of the coast. The Master Plan estimates restoration costs in several billion dollars over multiple years. State and local governments, which are crucial partners in the restoration

activities, are cognizant that such costs cannot find a place in their already tight budget outlooks. Thus, there will be projects, listed in the draft 2023 Coastal Master Plan, that would need to secure funding. I will explore, in this presentation, financing and crediting mechanisms for projects that can supplement the financial shortfalls to keep the restoration activities on track with the Master Plan timeline. I will discuss how these financing and credit mechanisms may interplay with blue carbon credits; the potential to incorporate other ecosystem values, the legal mechanisms in Louisiana for financing coastal restoration through non-carbon credits; and what baseline technical and social information should be considered for choosing projects.

Presenter or Panelist 2: Kyle Gray | Throwe Environmental, kyle@throwe-environmental.com

National Coastal Resilience Fund: Grant Opportunity for Coastal Louisiana

As communities across Louisiana experience intensifying climate-driven and water-related coastal hazards, it is essential that long-term investments are made to enhance local resilience. The National Fish and Wildlife Foundation's (NFWF) annual National Coastal Resilience Fund (NCRF) grant program provides opportunities for Louisiana communities and organizations to invest in sustainable, nature-based resilience solutions. Over the next 3-4 years, the NCRF anticipates having over $140 million in available annual funding to support planning, design, and implementation efforts that enhance community resilience and provide benefits to fish and wildlife habitat.

In this session, the NCRF Field Liaison team led by Throwe Environmental will address capacity limitations felt by many communities and organizations applying for NCRF funding. Throwe's presentation will introduce potential applicants to the NCRF program, inform them about the type of technical assistance that is available, and share examples of nature-based solutions in the Gulf region. Participants will leave this presentation with a clear understanding of the NCRF program, insight as to how to leverage NCRF funding for the greatest impact, and the ability to identify nature-based opportunities with the potential to catalyze larger resilience efforts. General and project-specific questions are highly encouraged!

Presenter or Panelist 3: Mark Jernigan | Jacobs Engineering Group, mark.jernigan@jacobs.com

Managing the Risk of Cost Escalation during Delivery of Coastal Restoration Projects

Uncertainty about future costs and material availability in the market represents a significant risk to the implementation of our critically needed coastal restoration and infrastructure projects. In some cases, the estimated cost to construct a project when this uncertainty is factored into the budget development process during the planning and design phases may radically impact the scope of the project and even preclude the project from being built.

How big of a problem is this cost uncertainty now and will conditions improve in the future? This presentation will examine current market trends/forecasts for the cost of the resources and commodities needed such as steel, concrete, and fuel, equipment and labor, for coastal restoration and infrastructure projects. It will look at the impact of market volatility and supply chain issues on the pricing and delivery of construction materials and overall project costs.

So, given current and forecasted market conditions and supply chain challenges, how can we still successfully deliver projects? This presentation will also examine some of the different approaches that are currently being taken to mitigate this risk from the project owner perspective across multiple agencies and some historical lessons learned.

Presenter or Panelist 4: Chuck Wolf | Texas A&M University, chuck.wolf@freese.com

Modeling Residential Habitation to Quantify Mitigation Project Social Benefits

Flooding events like Hurricane Harvey often destroy residential portions of communities. In response, many public agencies have embarked on stormwater drainage improvement programs aimed at significantly reducing residential flood risk. Unlike mitigation programs targeted at major coastal industries, these projects suffer in a traditional benefit-cost analysis due to the relatively low cost of residential structures and the difficulty quantifying the economic impact of residents remaining in their homes following an event and being able to fully function as if the event did not occur.

Congress, FEMA, and the US Army Corps of Engineers have identified the inclusion of non-monetary impacts in mitigation project analysis as a major challenge for supporting communities. They are advocating for a comprehensive approach to measuring a project's benefit that accounts for environmental and social benefits as well as economic development benefits. Environmental and social benefits can be challenging to measure, however. In this presentation, a novel approach and model to quantifying social benefits will be presented. The approach, developed by researchers at Texas A&M and Virgina Tech with support from the Harris County Flood Control District and USACE-Galveston, focuses on the habitation benefits of flood mitigation to due to impacts on shelter flooding and other critical infrastructures.

The model produces behavior over time graphs that allow policy makers to consider the improvement to habitation from protecting individual specific infrastructure assets, including homes. The application of the model to the Halls Bayou watershed in Harris County generated compelling results. USACE and HCFCD are currently considering this modeling as part of other mitigation project planning efforts.

Hydrology, Geomorphology and Ecology of the Coast

Standard, Session #27

Modeling to Inform Sustainable Oyster Populations in Lousiana's Estuaries

This session describes the oyster modeling supported by LDWF as the lead implementing agency under the Monitoring and Adaptive Management Implementation Program (MAIP) by the DWH Louisiana Trustee Implementation Group (LA TIG). The coupled modeling framework under development is comprised of a hydrodynamic/water quality (Hydro/WQ) model, an oyster larval transport model, and an oyster reef individual-based model (IBM). The Hydro/WQ model generates outputs that are input to the larval transport model, which simulates oyster larval settlement from releases over space and time. Both the 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 NRDA-funded 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.

The oyster modeling builds on previous oyster studies, as well as a model review, selection, and evaluation, so presenting the model setup is important to demonstrate for oyster restoration scientists and managers that will use these tools. The first presentation provides a project background with a summary of oyster habitat requirements and existing models for Louisiana. The second presentation describes oyster larval transport models, including model testing and verification and outputs for larval recruitment and connectivity among reefs. The third presentation describes modeled reef oyster processes and the reef IBM being set up in Louisiana. The last presentation describes the oyster metapopulation model, with model outputs and simulation scenarios to help support LDWF and partner agencies (CPRA, USGS) in evaluating NRDA-sponsored oyster restoration objectives and adaptive management questions.

Session Organizer: Shaye Sable | Dynamic Solutions, LLC, Email: ssable@dsllc.com

Moderator: Shaye Sable | Dynamic Solutions, LLC, ssable@dsllc.com

Presenter or Panelist 1: Megan La Peyre | U.S. Geological Survey, Louisiana Fish and Wildlife Cooperative Research Unit, MLapeyre@agcenter.lsu.edu

Evaluation and Models for Representing Habitat and Oysters in Louisiana

The eastern oyster provides vital ecosystem services like provision of habitat, water filtration, coastline stabilization, and benthic-pelagic coupling, and supports a highly productive fishery, with Louisiana contributing an average of 43% of the total U.S. landings for the past decade. Many states in the U.S. are focusing on oyster restoration, focusing on reef networks with spatial resource areas identified for restoration, and broodstock sanctuaries to support sustained natural reproduction and recruitment through environmental variation. The development of spatial resource zones requires understanding of oyster population dynamics and their interaction with local habitat and environmental conditions. Oysters are tolerant to a wide range of environmental conditions, with salinity and temperature, and their interaction, affecting virtually every aspect of the oyster life cycle. We present some recent geospatial data and habitat suitability analyses conducted for Louisiana to identify spatial oyster resource zones, and demonstrate how oysters interact with local habitat conditions over time. As

environmental conditions suitable for supporting oysters shift across the estuarine gradient from habitat management and climate change, assessing oyster resources and managing for sustainability will also need mechanistic simulation models of oyster larval transport and reef processes. The metapopulation approach that is currently underway combines oyster larval transport and reef models to examine how individual reefs are connected and maintained through movement of oyster larvae among reefs. The connectivity of individual populations (reefs) through larval dispersal between reefs (i.e., metapopulation) provides opportunity for populations located in optimal conditions in a given year to subsidize populations located in sub-optimal conditions (i.e., subsidize across resource zones).

Presenter or Panelist 2: Tim Stephens | Dynamic Solutions, LLC, tastephens@dsllc.com

Oyster Larval Transport Model Comparison in Barataria Basin

Despite awareness of the importance of maintaining healthy oyster populations, there needs to be more data-driven and process-based information to guide oyster restoration and management efforts and optimize resources. To support decision-making for oyster populations in Louisiana, we simulated the fate, transport, and reef-specific recruitment success of eastern oyster larvae in the Barataria Basin using two different models, the Lagrangian TRANSport model (LTRANS) and the Dekshenieks (DEK) oyster larval model. The recent development of Langragian-based oyster larval transport models provides a valuable toolset to inform management decisions by simulating the fate and transport of oyster larvae in three dimensions. Nevertheless, as numerous models have been developed and applied with differing assumptions, biological and life-history functions, and computational requirements, an individual model is characterized by unique advantages and disadvantages compared to the others. LTRANS and the DEK oyster models are the most widely used models, with most recent studies using some parts to all of either of these model size-based movement routines and parameters. LTRANS is an offline model that interpolates 3D hydrodynamics outputs to estimate movement and horizontal transport of larval oysters. The DEK oyster model is embedded within the ROMS hydrodynamics model so that behavior and transport are solved at the time step of the hydrodynamics. The oyster behavioral submodel is quite different between the models. LTRANS and DEK predicted similar spatial distributions of oyster larvae at select time periods. However, results revealed marked differences in recruitment success due to model functions for simulating oyster growth and settlement. Based on our findings, we provide recommendations for future oyster larval transport modeling efforts to support restoration efforts in Louisiana. These recommendations are being used for the current oyster metapopulation modeling.

Presenter or Panelist 3: Romain Lavaud | LSU Agricultural Center, RLavaud@agcenter.lsu.edu

Modeling Oyster Reef Population Dynamics: From Individual Bioenergetics to Structural Mechanics

We present a three-dimensional individual-based model (IBM) of oyster reef mechanics. The model describes the complex processes that combine to determine reef morphodynamics and population persistence over time. The model is based on previous studies of oyster metabolism, reproduction, population dynamics, shell persistence, and shell budget maintenance. The IBM includes three principal state variables: live oysters, nonliving shell valves ("boxes"), and crushed shell substrate, with environmental and biological factors that impact the reef. Oyster physiology and metabolism are described by a Dynamic Energy Budget (DEB) model. The DEB approach is based on first principles of metabolism and can be applied to any area with salinity, temperature, and food source data. Following oyster mortality, dead shell forms the reef physical structure. Reproduction and spat settlement are included to complete the oyster life cycle. We applied the model to South Carolina to study processes of

reef "self-organization" through feedbacks between internal population dynamics and external factors, following restoration events. Self-organization of the reef depends on efficient balancing of live production and creation of new spat settlement opportunities through mortality. Results demonstrated three phases following restoration: initial transient dynamics with considerable shell loss, followed by growth and saturation of the live population, and then saturation of settlement habitat several years later. Over half of simulations recouped initial shell losses as populations grow, while others continued in decline. The balance between population density, substrate supporting the reef, and exposed surfaces for settlement is mediated by overall population size and size structure, and relative amounts of live oysters and intact dead shells. The efficiency of settlement substrate production improves through time with more complex population size structure and accumulation of dead valves.

Presenter or Panelist 4: Kenneth Rose | UMCES, krose@umces.edu

Oyster Metapopulation Modeling for Louisiana Coastal Basins

The coupled hydrodynamic and oyster metapopulation modeling in Louisiana coastal basins started in early 2023 with LDWF, and USGS and CPRA as partner LA TIG implementing agencies. This presentation describes the coupled framework set up for three priority basins with historically productive oyster leases and fishery programs, that are also prioritized for DWH NRDA oyster restoration. The coupled model framework is being designed to evaluate larval oyster release scenarios, recruitment of spat among existing reefs and planned sanctuary or brood stock reefs, and how the settled spat from the releases contribute to the oyster reef production and basin-scale oyster sustainability over time. The model simulations cover present or existing conditions that capture seasonal and interannual variation, and future foreseeable conditions that include planned oyster reef restoration project scenarios by LDWF. This coupled 3D modeling framework is complicated in order to integrate growth, mortality, reproduction, and transport across the entire life cycle and is based on carefully selected and well-supported mechanistic models. We describe the coupled model framework and highlight the various component models. When completed, the coupled models will be able to (a) simulate seasonal flows and estuarine circulation (transport) patterns with the associated spatial-temporal dynamics of temperature, salinity, and water quality in the estuaries; (b) link the hydrodynamics to an oyster larval transport model to quantify larval connectivity, source/sink reefs, and recruitment patterns under present conditions and for future wet, dry, and average hydrological conditions across the reefs; and (c) follow the newly settled spat oysters (from the transport model) through daily filtration, growth, mortality, and spawning from settlement through adults. The modeled outcomes will be used to address some of the long-term oyster restoration objectives and targets put forth by the LA TIG.

Ecosystem Restoration

Panel, Session #28

Novel and Opportunistic Approach to Restoration: River Rintroduction Into Maurepas Swamp

Coastal wetland restoration and storm risk reduction are the two goals of the Coastal Protection and Restoration Authority of Louisiana's (CPRA) coastal program. The River Reintroduction into Maurepas Swamp or Maurepas Swamp Project (MSP) is a keystone restoration project with a unique opportunity to synchronize implementation with the United States Army Corps of Engineers (USACE) lead West Shore Lake Pontchartrain Hurricane and Storm Damage Risk Reduction Project (WSLP). Both are major, landscape level projects supporting CPRA's primary goals and implementing them in tandem is mutually advantageous. Typically, the USACE uses mitigation banks to create wetlands that offset the impacts from construction. The MSP is the preferable mitigation option because it restores the ecosystem within the same watershed, and by doing so, also increases the resiliency of the WSLP project.

The MSP is a novel project to restore more than 45,000 acres of the Maurepas Swamp and WSLP is a large, critical component to the Hurricane and Storm Risk Reduction System. Implementing any major project is very complex and the additional challenges of implementing two major projects in unison requires robust coordination amongst myriad project teams. CPRA has many dedicated partners from academia, consulting, and other state and federal agencies that have worked hard to identify success criteria, model future scenarios, develop operational regimes, and integrated designs to deliver the projects.

The panel session intends to be focused on the MSP but the discussion will naturally include references to WSLP because the two projects are closely linked, particularly following the recent Record of Decision specifying MSP as the recommended plan for WSLP compensatory mitigation. The panel will provide a status update and discuss advantages and challenges from perspectives of partnering agencies, technical advisors, and subject matter experts throughout past and upcoming efforts.

Session Organizer: Kent Bollfrass | CPRA, Email: kent.bollfrass@la.gov

Moderator: Kent Bollfrass | CPRA, kent.bollfrass@la.gov

Presenter or Panelist 1: Brad Miller | CPRA, brad.miller@la.gov

Presenter or Panelist 2: Nick Sims | USACE, christopher.n.sims@usace.army.mil

Presenter or Panelist 3: Ranjit Jadhav | FTN Associated, Ltd., rsj@ftn-assoc.com

Presenter or Panelist 4: Ken Krauss | USGS, kraussk@usgs.gov

Presenter or Panelist 5: Travis Byland | CPRA, travis.byland@la.gov

Predicting and Planning for the Future of the Coast

Standard, Session #29

Coastal Master Plan Tools

The 2023 Coastal Master Plan employs a variety of advanced models and tools to predict future scenarios for Louisiana's coast and to evaluate the benefits of actions to protect it. Given the dynamic nature of these models and the data that support them, sophisticated planning tools are needed to manage data and to evaluate projects across a range of budgets. This session will highlight advancements in both modelling and planning tools for the 2023 Coastal Master Plan. Specifically, presenters will discuss the use of artificial intelligence to predict storm surge, lessons learned in managing data for the 2023 Coastal Master Plan, accessing this data through the 2023 Master Plan Data Access Portal, and how the 2023 Coastal Master Plan Planning Tool allows for the evaluation of restoration and risk projects alternatives while accounting for multiple decision criteria.

Session Organizer: | , Email:

Moderator: Jason Curole | The Water Institute, jcurole@thewaterinstitute.org

Presenter or Panelist 1: Mohammad Ahmadi Gharehtoragh | Purdue University, mahmadig@purdue.edu

Surrogate models to predict storm surge hydrodynamics over evolving landscapes and climate forci

Storm surges are a major concern for coastal communities, as they can cause significant damage and loss of life. In order to mitigate the impacts of storm surges, accurate prediction of their occurrence and severity is essential. However, existing numerical models used to simulate storm surge, particularly high-fidelity ones needed to capture dynamics near protection features like levees, are computationally expensive. Because of that, surrogate models for the prediction of storm surges are recognized as great tools for emulating the approximation of storm surges. Once these models are trained on synthetic datasets that usually come from a hydrodynamic model, they can be used to cheaply predict surge from other storms not in the training set.

However, existing research focuses on accurate prediction of storm surge on a static landscape, with storm parameters such as the track, central pressure deficit and forward velocity used as predictors. Planning studies like Louisiana's Comprehensive Master Plan for a Sustainable Coast model flood risk in a variety of future time periods and with different scenario assumptions about factors like sea level rise and land subsidence. In this research, we applied artificial intelligence to storm surge simulations from the 2023 Coastal Master Plan to predict storm surge as a function of storm parameters, geographic location, and landscape data. Additionally, we conducted a feature selection analysis to identify which parameters are critical to model accuracy.

The findings of this study demonstrate that this approach can produce acceptably accurate results useful for planning studies. As a result of this study, the developed model has no tendency to overestimate or underestimate storm surges, and it works well in both weak and strong storm events. Our method can be used to generate new landscape scenarios and estimate risk in a larger ensemble of future conditions than can feasibly be explored using expensive hydrodynamic modeling

Presenter or Panelist 2: Stuart Brown | CPRA, stuart.brown@la.gov

2023 Master Plan Data Access Portal

The Louisiana Coastal Master Plan is supported by numerical models and tools that have been developed to better understand coastal systems and to prioritize risk reduction and restoration projects. Through this process enormous amount of data and model outputs are produced that may have uses beyond the development of the master pan. CPRA is developing a data access portal to make this information publicly available to support researchers, restoration practitioners, and local, state, and federal partners.

Throughout the 2023 plan development process, a new database structure was developed to house all pertinent model output and project specifics. This database allows for automated access via a web-based portal that allows for public users to access, view, and ultimately download master plan model output from a wide range of variables across all four model platforms used: the ICM, ADCIRC+SWAN, CLARA, and the PT. Spatial data in map form (e.g., landscape composition) is accessible at specific model timesteps, with download access. Temporal data (e.g. daily water levels) is viewable at every model grid location. There is also the ability to plot timeseries from multiple model simulations (e.g. show both the lower and higher scenario water level timeseries at a given location). In addition, the statistically derived datasets that are developed for each community are provided; there is also the option to expand these data across time and statistical distributions. All of the datasets posted will be filterable to select for a multitude of environmental scenarios, with/without project simulations, as well as a variety of scenarios that are unique to the risk assessment data (e.g. with/without levee fragility).

Presenter or Panelist 3: Heather Sprague | Arcadis, heather.sprague@arcadis.com

Lessons Learned in Making Data Management a Little Less Painful for the 2023 Coastal Master Plan

For the 2017 Coastal Master Plan, the Coastal Protection and Restoration Authority (CPRA) and larger master plan team used a complex system of nearly 600 unique Excel workbooks along with dozens of shapefiles, geodatabases, and other stand-alone files to define project attributes, estimate project costs, and transfer project data between modeling groups. To streamline this process and reduce error propagation for the 2023 Coastal Master Plan, the Project Development Database (PDD) and the Project Costing Tool (PCT) were born, along with several additional automated tools for defining project attributes, processing model outputs, and generating reports at the project, parish, and community levels.

The PDD and PCT have aided CPRA in evaluating more complex project types than were seen in previous plans, such as Landbridge and Integrated Projects. They have also helped the Planning Tool optimize marsh creation projects based on sediment availability from borrow sources. The PDD has become not only a centralized source-of-truth for project-related data, but also a clearinghouse for tabular outputs from the models used in the development of the master plan. While there have been many exciting new opportunities for more efficient analyses and workflows, the transition to the new system is not without its hiccups. This talk aims to discuss the highs, lows, and lessons learned in the development of these tools, and the plan for continued future development for the 2029 Coastal Master Plan.

Presenter or Panelist 4: Michael Wilson | RAND Corporation, miwilson@rand.org

Exploring the 2023 Coastal Master Plan Planning Tool Methods and Results

The Planning Tool (PT) is a key component in selecting projects and building robust alternatives for the

draft 2023 Coastal Master Plan. Over the past decade, with the support of the RAND Corporation, the CPRA Team has assembled a computer-based tool for processing restoration and risk projects as well as selecting alternatives while accounting for multiple decision criteria. This presentation will focus on two new methodological approaches for project selection: (1) using an annual stream of project benefits across two implementation periods, and (2) including Expected Annual Structural Damage (EASD) in addition to the historic objective function of Expected Annual Damage in Dollars (EADD) alone. First, we will look at restoration projects across a range of budgets to understand how robustness minimized potential regret and improved average annual land sustainment. Second, we will look a single budget for risk reduction projects to understand how an increasing relative weight of EASD might recommend additional structural protections and outcompete a coastwide nonstructural program. Determining the balance of EADD and EASD is a critical policymaking concern for CPRA and other state agencies due to regional impacts and equity implications. Furthermore, the results may be informative to governance groups, community advocates, and coastal stakeholders who are interested in building project portfolios that incorporate decisionmaking under deep uncertainty.

Disaster Impacts, Mitigation and Recovery

Panel, Session #30

Ethical Considerations of Disaster Preparedness and Response

This session will be a panel discussion about the ethical considerations of disaster preparedness and response hosted by Common Ground Relief. We will provide an introduction to a few of the many frontline leaders engaging in disaster mitigation and response in coastal Louisiana, with representation from Southwest, South, and Southeast Louisiana and the River Parishes. We will explore the ethics of the current landscape of disaster mitigation and response in coastal Louisiana, with particular attention on Hurricane Laura and Hurricane Ida impacts and response. Goals of the session are to: (1) identify factors that increase community vulnerability to hurricanes, floods, oil spills, and other disasters, (2) identify communities and populations that are disproportionately impacted by these factors, (3) explore ethics considered in community-led responses to disasters, (4) identify ways for coastal leaders to make ethical decisions to mitigate disaster vulnerabilities, and (5) identify ways for coastal leaders to make ethical decisions during disaster response and recovery.

Session Organizer: Charlotte Clarke | Common Ground Relief, Email: charlotte@commongroundrelief.org

Moderator: Joshua Benitez | Common Ground Relief, joshua@commongroundrelief.org

Presenter or Panelist 1: Joshua Trosclair | Southwest Louisiana DSA and Housing Louisiana, jtrosclair@housinglouisiana.org

Presenter or Panelist 2: Justin Solet | United Houma Nation and Healthy Gulf, justin@healthygulf.org

Presenter or Panelist 3: Melissa Bright | Louisiana Just Recovery Network, info@ljrn.org

Presenter or Panelist 4: Sophie Zaken | Alliance for Affordable Energy, sophie@all4energy.org

Flood Risk Management: Coastal and Inland

Panel, Session #31

Updates on the Louisiana Watershed Initiative

The Louisiana Watershed Initiative (LWI) is a $1.2B, HUD-funded program to fundamentally transform water resources management in the state from a geopolitical to hydrologically-based management system based on the state's primary watershed regions. Prompted by chronic statewide flooding problems in recent years, the LWI is a comprehensive, multi-year program based on sound science, extensive modeling and the careful selection, design, and implementation of an array of projects. As one of the nation's largest and most complex watershed management efforts, the LWI approach and outcome will be of great interest to all water resources professionals. Moderated by Derek Chisholm (AECOM), this dedicated session will feature the following five speakers: LWI Overview and Progress to Date (Genea Lathers, LA Office of Community Development); Modeling Approach and Outcomes to date (Billy Williamson, Department of Transportation and Development); LWI Gauge Network and Installation Progress (Emad Habib, University of Louisiana at Lafayette); Regional Steering Committees and Region 5 Progress (Kelia Bingham- Plan Acadiana Watershed Coordinator); and LWI Coastal Transition Zone work and Alignment with the CPRA Master Plan (Brett McMann- The Water Institute of the Gulf). Collectively, these presentations will provide attendees with an excellent update on the large scale watershed management directed at flood mitigation and ecosystem restoration.

Session Organizer: Derek Chisholm | AECOM, Email: derek.chisholm@aecom.com

Moderator: Derek Chisholm | AECOM, derek.chisholm@aecom.com

Presenter or Panelist 1: Genea Lathers | Louisiana Office of Community Development, Genea.Lathers2@la.gov

Presenter or Panelist 2: Billy Williamson | Department of Transportation and Development, billy.williamson@la.gov

Presenter or Panelist 3: Emad Habib | University of Louisiana at Lafayette, emad.habib@louisiana.edu

Presenter or Panelist 4: Brett McMann | The Water Institute of the Gulf, bmcmann@thewaterinstitute.org

Renewable Energy

Panel, Session #32

OFFSHORE WIND WORKFORCE DEVELOPMENT

The rapid growth of US offshore wind within the last 4 years has resulted in a high demand for professionals and skilled labor with experience to support the Offshore Wind industry. BOEM has 24 East Coast active wind development leases, an additional 5 in Central and Northern California and intends to offer additional leasing opportunities in the Gulf of Mexico, Gulf of Maine, Oregon, and Washington State in the coming years. Government agencies, developers, and consultants currently do not have the experienced workforce necessary to move at the current pace, and certainly not moving forward with additional lease areas. Professional disciplines such as Structural and Electrical Engineering, Geology, Marine and Terrestrial Biology, Marine and Terrestrial Archaeology, Economics, Acoustics and Hydrography are needed at the earliest phases of development to support the planning, design, and permitting stages. Technical disciplines such as welders, cutters, solderers, brazers, tower and crane operators, and service technicians are needed during construction and throughout the lifespan of the facility.

The solution to this challenge is through collaboration between academic institutions, federal and state agencies, offshore wind developers, and consultants to build a workforce pipeline. Academic institutions such as universities, technical and community colleges need to develop focused curriculum to address the unique nature of offshore wind permitting, construction, and operation to give the emerging workforce the education needed. Internships should be provided by industry to compliment educational programs.

Presenter Bio: J.T. Hesse is the Offshore Wind Planning and Permitting Technical Director with Jacobs. J.T. is a former BOEM employee with over 10 years of environmental permitting experience within renewable energy.

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Session Organizer: JT Hesse | Jacobs Engineering Group, Email: JT.Hesse@jacobs.com

Moderator: JT Hesse | Jacobs Engineering Group, JT.Hesse@jacobs.com

Presenter or Panelist 1: Shafin Kahn | University of New Orleans, skhan@unofoundation.org

Presenter or Panelist 2: Alexandra St. Pe | Senior Development Manager, Offshore Americas, RWE, SCLU@equinor.com

Presenter or Panelist 3: Jeremy Stefek | National Renewable Energy Laboratory, Jeremy.Stefek@nrel.gov

Presenter or Panelist 4: Jacqueline Richard | Nunez Community College, jrichard@nunez.edu

Managing our Rivers for Multiple Uses

Standard, Session #34

Lower Mississippi River Physical Model: Operations, Calibration and Cross-Calibration

The Lower Mississippi River Physical Model (LMRPM) is one tool being used by the Louisiana Coastal Protection and Restoration Authority to study the hydraulics and sediment (sand) transport in the lower ~190 miles of the river. This session is aimed at presenting how the LMRPM was designed and is operated; some of the latest experimental research; and how the model results are being used in conjunction with numerical modeling.

Session Organizer: Clint Willson | LSU Center for River Studies, Email: cwillson@lsu.edu

Moderator: Clint Willson | LSU Center for River Studies, cwillson@lsu.edu

Presenter or Panelist 1: Emily Fertitta | LSU Center for River Studies, eferti4@lsu.edu

Incorporation of Hydraulic Structures in the Lower Mississippi River Physical Model

The Lower Mississippi River Physical Model (LMRPM) was designed study the hydraulics and sand transport in the lower ~190 miles of the actual (prototype) river. To study how natural processes and man-made structures impact the river stages and in-channel sand transport, LMRPM spillways and diversions need to closely replicate how the prototype structures do or are expected to perform. However, the LMRPM scales, 1:6000 (horizontal) and 1:400 (vertical), make it very challenging to incorporate the scaled structures and to reproduce the complex hydrodynamics and sediment transport from the river and through the structures. This presentation will begin with some of the issues and constraints of replicating prototype structures in the LMRPM. Next, the steps for designing and testing the model structures will be presented along with some of the experimental and theoretical approaches that are required to make accurate measurements, incorporate complex hydraulic processes, and determine the operating procedures necessary to replicate prototype conditions. Finally, validation of a couple LMRPM structures will be shown, demonstrating the ability to reproduce the prototype conditions. This last part is critical to ensuring that the hydraulics and sand transport in the main channel, what the LMRPM is designed to replicate, can be studied under different scenarios.

Presenter or Panelist 2: Thomas McLain | Louisiana Coastal Protection and Restoration Authority, thomas.mclain@la.gov

Design, Calibration and Operation of the Lower Mississippi River Physical Model

The Lower Mississippi River Physical Model (LMRPM) is a 1:6000 horizontal, 1:400 vertical scaled movable bed physical model of the lower ~190 miles of the actual (prototype) Mississippi River. The LMRPM was designed to replicate the hydraulics and bedload (sand) transport in the river under prototype conditions and is being used to study how natural and anthropogenic processes and features impact the transport and availability of sand for coastal restoration projects. The LMRPM is made up of 216 high-density foam panels, each routed to reproduce the scaled topography and bathymetry of the river and surrounding areas. The model hydraulics were scaled using the Froude number and Reynolds number independence, and the model sediment density and size were scaled using particle Reynolds number and Shields parameter. Two pumps are used to inject water and model sediment into the model

at a time scale of 65 seconds, which is ~5 days prototype. This time scale allows for both the replication of intra-annual river discharge dynamics, critical to sand transport, and multi-year and -decade long experiments that are necessary for studying medium- and long-term processes and phenomena. Water level sensors are located along the model river at the same location as prototype river gages. This presentation will provide an overview of the design, construction and operation of the LMRPM and how the model was calibrated and validated using prototype river stage and dredging data.

Presenter or Panelist 3: Francesca Messina | The Water Institute, fmessina@thewaterinstitute.org

Cross-comparison of physical and numerical models of the Lowermost Mississippi River

The Louisiana Coastal Protection and Restoration Authority has been using various tools to support coastal restoration projects. Among these tools the Lower Mississippi River Physical Model (LMRPM) and the numerical Basin Wide Model have been used as part of the Lowermost Mississippi River Management Program to identify management strategies for the river.

The LMRPM is a physical model of the lower 195 miles of the Mississippi River in scale 1:6000. It extends from Donaldsonville, LA, to the Gulf of Mexico. It simulates hydraulics and bedload sand transport in the Mississippi River and is used to study the impacts of flood events, diversion openings, and the effect of relative sea level rise on the river hydraulics and bedload sand transport.

The Basin Wide model is a Delft3D numerical model that extends from River Mile 137 to the Gulf of Mexico. It simulates the morphological evolution processes that occur during the creation of a new delta, including sediment transport, morphology, hydrodynamics, and water quality.

Similar simulations have been performed with both models, providing the opportunity for cross-calibration. The comparison focused on future without project simulations with the same sea level rise, identical hydrographs and similar sediment. River discharge and stage, bed elevation, and dredging volumes were compared between the two models and with empirical data at several locations along the river. Preliminary results show a good comparison for stage and flow, especially in earlier decades, and similar results for bed level. LMRPM predicts higher dredged volume compared to the numerical model. Further analysis is being conducted to better understand the differences. Numerical and physical models have their own strengths and challenges and should be treated as complementary. The goal is to develop a cross-calibration methodology, and to provide guidance on model capabilities, and limitations.

Presenter or Panelist 4: Julia Mudd | LSU Center for River Studies, mjulia1@lsu.edu

Testing of a magnetic, fluorescent lightweight tracer sediment for use in the Lower Mississippi

The Lower Mississippi River Physical Model (LMRPM) at Louisiana State University utilizes a lightweight, unexpanded polystyrene sediment with a specific gravity of 1.05 and a d10, d50 and d90 of 0.250 mm, 0.425mm, and 0.800 mm, respectively, to mimic the sand transport of the Lower Mississippi River. While the black model sediment is easily visible against the stark white of the LMRPM, the relative homogeneity of the sediment particles and the opaqueness of the model channel make it difficult to closely study sediment dynamics during an experiment, in particular the punctuated sand transport along the river and the evolution of sand bars around spillways and diversions.

A tracer sediment, with fluorescence and magnetic properties, was purchased to hopefully allow for more quantitative tracking of particles, and therefore an enhanced understanding of sediment transport and dynamics in the LMRPM. While these tracer particles have similar density and grain sizes to LMRPM model sediment, parameters such as their angularity, settling velocities, and threshold for incipient motion are unknown. Angle of repose, settling velocity, and incipient motion tests were conducted to calculate these parameters and compare the tracer sediment behavior to that of the model sediment to determine if the tracer sediment can eventually be employed in the LMRPM. Results from these experiments will be presented and plans for incorporating the tracer sediment into future LMRPM experiments will be outlined.

Ecosystem Restoration

Panel, Session #35

Opportunities and Challenges of Dredging Mississippi River Sediment for Large Scale Restoration

Dredging of the lowermost Mississippi River occurs frequently to ensure safe passage of deep draft vessels from the Gulf of Mexico to Baton Rouge, Louisiana. Since the authorization of the Mississippi River Ship Channel, the vast majority of dredging has occurred at Southwest Pass, the river's only deep draft inlet in the shipping channel. In 2009, the Coastal Protection and Restoration Authority (CPRA) began constructing the first ecosystem restoration project to sustainably dredge renewable sources of Mississippi River sediment – the Bayou Dupont Marsh Creation Project. This project involved dredging 3 million cubic yards of sediment from a lateral sand bar at Alliance and ultimately would create 568 acres of wetlands. Since the completion of that project, CPRA and its private and public sector agency partners have designed ten marsh creation, ridge restoration and barrier island restoration projects utilizing Mississippi River sediment (seven have been constructed and three are currently under construction). This work has resulted in thousands of acres of created or restored habitat, involving dredging tens of millions of cubic yards of sediment from Mississippi River sand bars located as far as 20 miles away from the fill sites.

This Panel Session will present perspectives from professionals who have worked on several of these projects. Experiences from previously constructed projects will be referenced, but the discussions will focus on challenges, design methodology, innovative approaches, and lessons learns associated with the three most recent Mississippi River dredging projects – Large Scale Barataria Marsh Creation Project: Upper Barataria Component Creation Project, the Bayou Grande Cheniere Ridge Marsh Creation Project, and the Barataria Basin Ridge and Marsh Creation Project – Spanish Pass Increment. Panelists will also discuss current and past modeling efforts that focus on how we can utilize sediment in the river for future projects.

Session Organizer: Rudolph Simoneaux | Louisiana Coastal Protection and Restoration Authority, Email: rudy.simoneaux@la.gov

Moderator: Rudolph Simoneaux | Louisiana Coastal Protection and Restoration Authority, rudy.simoneaux@la.gov

Presenter or Panelist 1: Brad Miller | Louisiana Coastal Protection and Restoration Authority, brad.miller@la.gov

Presenter or Panelist 2: Gordon Thomson | Baird, gthomson@baird.com

Presenter or Panelist 3: Jonathan Hird | Moffatt & Nichol, jhird@moffattnichol.com

Presenter or Panelist 4: Adam Linson | Louisiana Coastal Protection and Restoration Authority, adam.linson@la.gov

NOAA Fisheries

Human Dimensions

Standard, Session #36

Exploring Place: Our History and Our Future

"This session explores how ties to place and landscape in Louisiana influence how we response to land loss and flooding. It includes presentations that explore:

how the decisions of people who have recently relocated were influenced by human capital and financial capital. Understanding how different coastal residents experience the pushes and pulls of place can inform compensating policies for sending communities to build and maintain resilience to future hazards

How tribal ancestors of the Grand Caillou/Dulac band of Biloxi Chitimacha Choctaw (GCDBCC), who are spread across several small towns in the southernmost parts of Louisiana several miles from lands granted to 19th C ancestors, have been formced to migrate inland by coastal land loss.

How combined remote sensing methodology that included gradiometer, ground penetrating radar, and the deployment of specially trained HHRD cadaver dogs have been used to identify human burials. This technique could be applicable to other areas of coastal Louisiana as lands previously settled by indigenous and other peoples continue to convert to wetlands. "

Session Organizer: | , Email:

Moderator: Michelle Beauregard | CDM Smith, beauregardmm@cdmsmith.com

Presenter or Panelist 1: Amber Robinson | HDR Engineering, Inc, amber.robinson@hdrinc.com

Welcome to the Dog Show: Using GPR and Cadaver Dogs to Locate an Unmarked Burial Ground in Coastal Louisiana

Coastal Louisiana, with her lush marsh, murky swamps, and complex estuary systems, is commonly referred to as a sportsman's paradise. A lesser-known fact is the predominance of indigenous and historic-age unmarked burial sites once inhabited by diverse communities in the coastal zone. With federal laws demanding a closer look at these protected historic resources during environmental permitting processes, more projects will need to take the potential presence of these sensitive resources into account.

During a railroad bridge replacement project that crosses the Bonnet Carré Spillway near Norco, Louisiana, HDR was informed by the USACE that an unmarked Civil War-era cemetery may be located within the project's Area of Potential Effect (APE). Following consultation with the U. S. Army Corps of Engineers (USACE) and Louisiana Division of Archaeology (LDOA) and detailed archival research, it appeared that HDR's client would be required to mechanically excavate the full extent of the archeological APE to determine presence/absence of human remains. However, through professional networking and creative problem solving, HDR identified a cutting-edge solution that met the regulatory requirements of the USACE and LDOA without the use of traditional, expensive, and time-consuming excavation – historical human remains detection (HHRD) dogs.

In January 2022, the HDR team employed a combined remote sensing methodology that included gradiometer, ground penetrating radar, and the deployment of specially trained HHRD cadaver dogs to

identify human burials. Through the application of this innovative biotechnology, HDR was able to help its client successfully obtain critical data to navigate the requirements of Section 106 of the NHPA and the Louisiana Unmarked Human Burial Sites Preservation Act in record time. This technique could be applicable to other areas of coastal Louisiana as lands previously settled by indigenous and other peoples continue to convert to wetlands.

Presenter or Panelist 2: Zachary Overfield | HDR Engineering, Inc, Zachary.Overfield@hdrinc.com

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Presenter or Panelist 3: Devon Parfait | Restore the Mississippi River Delta, dparfait@edf.org

GIS ANALYSIS OF HISTORICAL TRIBAL LAND RECORDS AND MIGRATION RESPONSE TO COASTAL LAND LOSS

Coastal Louisiana has the highest wetland loss rates in North America, with multiple causes including delta subsidence, effects of human infrastructure, oil and gas extraction activities, sea level rise, and increasing storm impacts. Native American tribes including the Grand Caillou/Dulac band of Biloxi Chitimacha Choctaw (GCDBCC), are concentrated in the southernmost parts of Louisiana, where land loss-rates are double the regional average.

The GCDBCC is preparing to petition the Bureau of Indian Affairs (BIA) for federal acknowledgment. A key BIA criterion is documentation that "a substantial portion of the group inhabits a specific area or lives in

a community viewed as American Indian". GCDBCC members are spread across several small towns, several miles from lands granted to 19th C ancestors (via the 1830 treaty of Dancing Rabbit Creek), and might appear to the BIA to have lost community identity. GIS analysis of satellite imagery, historical maps, and land records provides a means to examine this history, and to investigate the hypothesis that progressive land loss drove tribal ancestors to migrate inland.

Using a genealogical database constructed by tribal elders, we researched the Bureau of Land Management database for 19th C land patents and survey plats showing the sections granted to GCDBCC ancestors. We converted the township/range/section locations to lat/long, and overlaid them on the 1894 USGS topographic map. In combination with the original survey plats, this shows that the GDBCC were granted lands that, while marshy in places, were distant from bodies of open water. Viewing the sections on recent orthoimagery show the extent of the change: many of the land grants are now largely or wholly open water. Tribal ancestors living on those sections would have had no option but to move away as their lands became inundated, having little ability to consolidate.This geoscience-based analysis will strengthen the GCDBCC petition for federal recognition.

Presenter or Panelist 4: Abbey Hotard | Texas A&M University at Galveston, ahotard@tamu.edu

Rethinking Relocation and Resilience: How pushes and pulls of place shape relocation decisions

Among the suite of flood risk reducing strategies used for adaptation, relocation or managed retreat is one of the most extreme. Altogether moving from one's home is not an equivalent action to adaptation strategies in place, such as investing in one's home (e.g., elevation) or supporting the construction of community-wide mitigation infrastructure (e.g., levee). Research has established that household relocation decisions depend on the complex interplay of "push" (e.g., crime) and "pull" (e.g., employment, amenities) factors that affect quality of life. This study extends resilience theory to the conceptualization of relocation decisions by framing these push and pull factors as tradeoffs between 'capitals' or resources and assets. It presents a conceptual framework outlining the web of interacting household and community capitals involved in relocation decisions to answer: What are the key capitals of place that affect the likelihood of relocation consideration? And, how do household capitals moderate the effect of place-based assets in relocation considerations? To explore these questions, this study examines data from an original survey collected in 2022 from residents of the Greater Houston and Greater New Orleans regions. The findings of this research will illuminate which capital assets are most important for decisions to relocate and identify those individuals most likely to remain in place. By conceptualizing relocation as tradeoffs between capitals, this research sheds light on how household level decisions can affect community level assets by adding to (e.g., human capital – gains in educated, working households) or detracting from (e.g., financial capital – loss of tax revenue) collective capital. Understanding how different coastal residents experience the pushes and pulls of place can inform compensating policies for sending communities to build and maintain resilience to future hazards.

Presenter or Panelist 5: Ronald McPherson | HDR Engineering, Inc, ronald.mcpherson@hdrinc.com

Coastal Erosion from an Alaskan Perspective

Alaska is roughly 2,600 miles from Louisiana but is dealing with very similar issues…devastating erosion in rural coastal communities. This presentation will provide an opportunity to look up from the commonly

discussed coastal erosion issues of Louisiana and see how another state with unique attributes is dealing with the similar issues.

Communities within Western Alaska are experiencing ever growing coastal erosion issues. Historically, shore-fast ice (ice that is connected directly to the shoreline) has provided the erosion protection needed during the severe late fall and winter storm waves. However, this natural form of protection can no longer be relied upon and has been absent in many communities for several years. This has led to devastating erosion that have taken homes, schools, and other key infrastructure. Most Western Alaska communities have extremely small populations and limited accessibility. This makes construction costs exorbitant and cost to benefit ratios dismal such that finding solutions for these communities is extremely challenging.

Generally, Alaskans have approached the coastal erosion in these communities in three different ways: 1) Protect in place, 2) smart community planning, and 3) complete community relocation. Each of these options have their advantages and disadvantages. This presentation will provide some additional details about the advantages and disadvantages of these methods and provide some recent examples of each and how they were implemented.

Coastal Law, Policy & Funding

Panel, Session #37

BLUE CARBON IN LOUISIANA: WHO WILL GET THE CREDITS AND WHEN?

In addition to providing important ecosystem services and serving a critical role in buffering against rising sea levels and severe storms, Louisiana's coastal wetlands sequester significant amounts of carbon. As the Louisiana Coastal Protection and Restoration Authority (CPRA) continues to implement the state's Coastal Master Plan, it will maintain and restore hundreds of square miles of coastal wetlands that otherwise would be lost to a variety of causes including sea level rise, subsidence, and erosion. These coastal restoration activities should make CPRA eligible for earning verifiable carbon offsets, known as "blue" carbon credits.

The magnitude of the state's coastal restoration and conservation program is unparalleled not only nationally but around the world, and it gives Louisiana an opportunity to become a leader in the emerging blue carbon market – both as a generator of credits but also in the development of effective crediting methodologies, monitoring approaches, and markets that have largely eluded policymakers and practitioners to date. If successful, carbon credits could become a new funding source for CPRA to finance coastal restoration projects. The development of an active blue carbon market in south Louisiana may also serve as a financial incentive for the private sector to implement more coastal restoration projects and at greater scale.

While the opportunity is significant in Louisiana, a myriad of challenges and uncertainties must be overcome to turn opportunity into reality. These challenges and uncertainties span scientific data gaps, ambiguities in law and policy, uncertain capital markets, and the underlying ongoing complexity of property ownership in Louisiana when privately owned coastal wetlands erode. The proposed panel will discuss the opportunities and challenges in developing a blue carbon market capable of crediting coastal restoration projects in south Louisiana and beyond.

Session Organizer: Harry Vorhoff | Louisiana Governor's Office, Email: harry.vorhoff@la.gov

Moderator: Megan Terrell | Plauche & Carr, LLP, megan@plauchecarr.com

Presenter or Panelist 1: David Peterson | Louisiana Coastal Protection & Restoration Authority, david.peterson@la.gov

Presenter or Panelist 2: Beaux Jones | The Water Institute of the Gulf, bjones@thewaterinstitute.org

Presenter or Panelist 3: Harry Vorhoff | Louisiana Governor's Office, harry.vorhoff@la.gov

Presenter or Panelist 4: Jim Bergon | Delta Lands LLC,

Presenter or Panelist 5: Ryan Vivian | Louisiana Coastal Protection & Restoration Authority, ryan.vivian@la.gov

Hydrology, Geomorphology and Ecology of the Coast

Standard, Session #38

Rockefeller Refuge: Funding Strategies, H&H Modeling, Coastal Protection, and Public Use

This session is a continuation and expansion of the Rockefeller Refuge session held at the 2018 State of the Coast. This session's intent is to highlight the recent public access work, hydraulic research, and coastal engineering in Southwest Louisiana at Rockefeller Refuge. The Refuge experiences multiple coastal challenges including 40+ ft/yr of erosion, saltwater intrusion, and direct exposure to Gulf conditions. Through the diverse projects discussed here, Refuge management has maintained the property while providing public and commercial access and opportunities for pioneering wildlife, fisheries, and wetlands research. This session highlights important coastal needs in Southwest Louisiana and provides discussion topics for protecting and restoring our coastal resources.

Scooter Trosclair (LDWF), the Refuge Manager, will give an overview of the Refuge and will discuss the many stakeholders and funding sources being brought together to preserve the Refuge. Sina Amini (HDR) will discuss the history of the Refuge's Gulf shoreline including erosion patterns, shoreline protection projects, and post-hurricane survey results of portions of the protected and unprotected shoreline after the direct impacts of Hurricanes Laura and Delta. Kazungu Maitaria (Fenstermaker) will discuss hydrodynamic modeling conducted to identify healthy marsh ecosystem management strategies. Lance Ardoin (LDWF) will discuss improvements to facilities for public use and monitoring data of how the Refuge is accessed and used by the public.

Session Organizer: Erin Rooney | HDR Engineering, Inc., Email: erin.rooney@hdrinc.com

Moderator: Erin Rooney | HDR Engineering, Inc., erin.rooney@hdrinc.com

Presenter or Panelist 1: Phillip Trosclair | Louisiana Dept. of Wildlife & Fisheries, ptrosclair@wlf.la.gov

Overview and funding sources for Rockefeller Wildlife Refuge Projects

Rockefeller Wildlife Refuge (RWR) was donated to the State of Louisiana in 1920. A coastal marsh that at the time of the donation consisted of 86,000 acres, has now been reduced to approximate 70,000 acres mainly due to coastal erosion. Obligations within the Deed on Donation are stated to protect and maintain the coastal property. RWR is self-funded from the royalties generated from oil and gas activities. The cost to maintain the property is a major funding challenge to meet the needs to fully protect and maintain the property. The self-generated funds can maintain staff, typical road and bridge repair for public access, levee and water control maintenance, and research, but additional funding is needed to combat coastal issues pertaining to inundation, saltwater intrusion, and internal and coastal erosion. Working with engineering firms, organizations, local government and State and Federal agencies, applying for other funding sources has been critical in order to achieve the obligation of this property.

This presentation will discuss RWR's history and will highlight how funding partnerships have been established with non-profits, surrounding parishes, and other entities that understand the importance of RWR to protecting Louisiana's coastal communities.

Presenter or Panelist 2: Sina Amini | HDR Engineering, Inc., sina.amini@hdrinc.com

Overview of Shoreline Stabilization Measures at Rockefeller Refuge

The Rockefeller Wildlife Refuge is located in southwest Louisiana and originally encompassed about 86,000 acres of land with nearly 26.5 miles of shoreline along the Gulf of Mexico. Due to wave action, sea level rise, and subsidence, the shoreline at the Rockefeller Refuge experiences an average erosion rate of over 40 feet per year. This loss of land along the shoreline has reduced the area of the Rockefeller Refuge to around 70,000 acres.

Efforts to address erosion have been limited due to soft soils along the shoreline with low bearing capacities that don't support traditional coastal structures. A pilot project that included a lightweight aggregate core breakwater showed that this structure would be effective at reducing erosions ad remain stable in the difficult site conditions. Since the pilot project, additional projects have been implemented that include over 4 miles of lightweight aggregate core breakwaters and a jetty. Subsequent aerial imagery and elevation surveys indicate that these projects have slowed down shoreline erosion. However, more than 20 miles of the shoreline along the Rockefeller Wildlife Refuge remains exposed. Therefore, as future sources of funding are secured, projects are planned to be implemented at the remainder of the shoreline.

In 2020, the area was impacted by Hurricanes Laura and Delta. Post-storm monitoring showed that projects that had been completed before the 2020 hurricane season did not experience any structural damage. Further analysis of the 2020 hurricane season showed the projects have been effective in reducing shoreline erosion compared to areas where no projects were implemented.

A 2018 State of the Coast presentation on Rockefeller Refuge focused on the engineering and design of breakwater lightweight aggregate core cross-sections. This presentation will instead focus on overall shoreline change patterns at the Refuge, a history of the shoreline projects, post-hurricane monitoring results, and upcoming projects.

Presenter or Panelist 3: Jeanne Hornsby | C. H. Fenstermaker & Associates, L.L.C., jeanne@fenstermaker.com

H&H Modeling of the Mermentau Watershed

The Mermentau watershed is characterized by flat topography and complex hydrologic and hydraulic conditions. Its wetlands experience negative effects from coastal surge and pluvial/fluvial flooding. Hwy 82 segments its two wetlands, disrupting natural water flow. Wholistic representation of known-unknown behaviors of the system required a multidisciplinary approach in questioning how this natural system works and how we influence it. Cameron Parish was awarded a LWI grant to reduce flood inundation in the Mermentau Basin, north of Hwy 82. We relied on local knowledge of a Biologist of the pulse of system, skillset of Spatial Scientist to develop an accurate terrain model, and a Scientist who created a 2D hydrodynamic model (HEC-RAS) in support of healthy marsh ecosystem management strategies. Major decisions, assumptions and best science practices were integrated into the model. A subset of winter storm events and historical observations were used for model calibration. The absence of winds in HEC-RAS caused significant overpredictions in flood elevations and the model could not be calibrated. Hence, we incorporated NOAA HRRR wind stresses over the water surface as an extra meteorological forcing. With no universal scientific methodology on selection, model parameters were selected based on local knowledge and judgement. Wind induced hydrodynamics in HEC-RAS provided

model calibration and validation. A new wind-forced simulation incorporating 3 extra water control structures and drainage improvements shows that water elevations drop 1 ft below the no-action scenario within Rockefeller Refuge. The model shows that expanding water control capacity at Rollover control structure will efficiently direct these floodwaters to the sea.

This presentation will be a technical-focused review of water flow in and around Rockefeller Refuge. This modeling shows how the Refuge interacts with surrounding locations and how healthy marsh ecosystem management strategies can be used.

Presenter or Panelist 4: Lance Ardoin | LDWF-Rockefeller Wildlife Refuge, lardoin@wlf.la.gov

Rockefeller Wildlife Refuge Recreational Usage, Enhancement Projects, and Affiliated Assets

Rockefeller Wildlife Refuge (RWR) saw approximately 465,000 visitors over the last three years. Public recreational users visiting the refuge have the opportunity to partake in various activities such as fishing, crabbing, shrimping, and birding. While the primary goal of RWR is to provide a refuge and preserve for all wildlife and fisheries species, a secondary goal is to enhance the experience for the public to utilize many of the resources RWR has to offer. Refuge staff actively monitors public usage using various methods at strategic locations. By use of traffic and trail counters, an approximate number can be derived on the daily, weekly, monthly, and yearly usage of roads, launches, and fishing piers. These numbers can then demonstrate a correlation to the success of management practices focusing on estuarine organisms, upkeep of infrastructure, and recreational enhancement projects. LDWF and its partners who share similar goals have recognized the importance of implementing recreational enhancement projects in locations like RWR. Oftentimes enhancement projects can reveal secondary benefits that were not the original focus of the project. For example, the construction of walkways and fishing piers for the "Rockefeller Wildlife Refuge Piers and Signage" project displayed a decrease in disturbance on the levee-banks of high public-use areas resulting in less erosion and a stable levee system, as well as a significant reduction in litter observed at these locations. It seemed that by providing easier access to and from a person's boat or vehicle, that person was more likely to dispose of his or her trash properly.

This presentation will describe how in increasing the publics use and involvement with RWR, the refuge can more easily implement outreach and better educate the public on the importance of protecting the coast to preserve all that it has to offer.

Ecosystem Restoration

Standard, Session #39

Project Performance - Marsh Creation, Terraces, Living Shorelines

This session consists of 5 presentations related to restoration project performannce, covering a variety of project types, sizes, and locations from diverse perspectivies.

Session Organizer: | , Email:

Moderator: Ashley Booth | Louisiana State University, bootharb@gmail.com

Presenter or Panelist 1: Eva Hillmann | Pontchartrain Conservancy, eva@scienceforourcoast.org

Bayou St. John Urban Marsh 2013 - 2023

Bayou St. John (BSJ) historically drained from the Mississippi River to Lake Pontchartrain. Today, the bayou sits several feet below the lake and exists mostly within a flood protection levee system. A dredging project at the mouth of the bayou (2013) to improve water flow and the bayou's ecological function was an opportunity to use sediment beneficially for marsh creation. About 2,800 yd3 of dredge were used to build two marsh platforms, creating a 0.44-acre marsh (2014). The Pontchartrain Conservancy (PC) designed a monitoring plan to study marsh development, including changes in vegetation, elevation, and soil properties. Study sites were set up in June 2014. All sites were located inside the marsh retaining walls, though some marsh developed naturally outside the retaining walls. After ten years, the BSJ Urban Marsh is a young, resilient tidal wetland in a dynamic environment. The marsh is home to a number of plants occurring in low abundances. The species planted during marsh construction (Spartina patens, Spartina alterniflora, Schoenoplectus californicus) still dominate, though a shift in community membership occurred. S. patens and S. alterniflora decreased in abundance, as S. californicus and Panicum repens increased. Other marsh properties were slow to change, which is not uncommon compared to other constructed marshes. Yet, the discovery of a robust submerged aquatic vegetation bed (Vallisneria americana, 2022) was an exciting addition to the development of the BSJ Urban Marsh. This marsh exemplifies wetland creation that can be implemented along the armored south shore of Lake Pontchartrain. Creating fringing marsh, even in small patches, provides habitat for fish, invertebrates, birds, and other animals. Increasing the amount of fringing marsh along the south shore is one of the ten Pontchartrain Coastal Lines of Defense outlined by the PC as a priority for both increasing storm surge protection and establishing critical habitat for priority species.

Presenter or Panelist 2: Michelle Lignieres | Nicholls State University, mfolse28@nicholls.edu

Using small-bodied fish assemblage to compare constructed terraces and original marsh

In 2019 a system of terraces was constructed across a 20-hectare portion of a wetland previously damaged by saltwater intrusion in Terrebonne Parish for a restoration project. To assess changes over time, we are surveying fauna at several different levels, including invertebrates, small-bodied fish, large-bodied fish, frogs, reptiles, and birds. For the brevity of this presentation, we are comparing the assemblage of small-bodied fish at terraces to that of the original marsh from 2019 to the present. We made monthly sampling trips conducting surveys with Gee minnow traps. We have calculated mean (±SE) small-bodied fish abundance at six terrace stations and three marsh stations. Using Gee minnow traps, we have collected 12 small-bodied fish species, including Sheepshead Minnow, Sailfin Molly,

Mosquitofish, Gulf Killifish, and Rainwater Killifish, as the top 5 most abundant species. The most prevalent small-bodied fish species collected was Sheepshead Minnow, Cyprinodon variegatus, representing 57.23% of total fish caught at the terraces and the marsh. The average Sheepshead Minnow catch per unit effort of the terraces (21.30 ± 2.63) and of the marsh (24.45 ± 3.26) was not found to be significantly different. Strong seasonal patterns observed in small-bodied fish assemblage collected suggests a seasonal preference over a preference to terrace or marsh habitat. Though there are some physical differences between the constructed terraces and the natural marsh, we conclude that the terraces appear to be providing suitable edge habitat to support small-bodied fishes and has a similar function as the natural marsh habitat. This project was supported through funding by Resource Environmental Solutions.

Presenter or Panelist 3: Gary LaFleur | Center for Bayou Studies at the Coastal Center, gary.lafleur@nicholls.edu

Enhancing a Terrace Restoration Project by Combining Hyperspectral and LiDAR Data for High Value

To reverse and repair the effects of coastal land loss in Terrebonne Parish a marsh terrace restoration project was constructed on a 20-hectare site that had transitioned from a cypress swamp to open water. Sixteen terraces were constructed by excavating adjacent borrow canals to a depth of 3.7 m, and building linear mounds, followed by planting with Seaside Paspalum on the crown, Saltmedow Cordgrass on the shoulder, and Smooth Cordgrass on the toe. One large terrace on the northeast aspect of the site was built to a post-settlement height of 1.3 m, and planted with Bald Cypress trees at 3.0 m intervals along the crown. Fourteen internal terraces were constructed to a post-settlement height of 0.9 m, and a sacrificial terrace facing the south was built to a larger standard with a 3:1 slope facing the open water, and a 5:1 slope facing the inside of the site. After construction, a systematic monitoring program by the Coastal Center at Nicholls was established to document the abundance of fauna that may contribute to a newly established food web. Within three years, a rich set of species were documented at the terraces including aquatic invertebrates, small fishes, large-bodied fishes, amphibians, reptiles, birds, and mammals. In this presentation we report the physical status of the plot as well as the floral colonization of the terraces by combining data from hyperspectral and LiDAR sensors flown over the site using un-crewed aerial system technology after four years of habitat development since construction. Preliminary surveys allowed us to document that the physical structure of the terraces has changed only slightly through settling, while substantial trapping of sediment has occurred in the borrow canals between terraces. In contrast the plant profile within the site has been highly modified through the recruitment of Roseau Cane and Cattail and the loss of the Smooth Cordgrass. This project received support from Resource Environmental Solutions.

Presenter or Panelist 4: Wendell Mears | Anchor QEA LLC, wmears@anchorqea.com

DESIGN, CONSTRUCTION AND MONITORING OF A LIVING SHORELINE PROJECT ALONG THE GULF COAST

The Hancock County Marsh Living Shoreline Project (project) was developed as an Early Restoration (RESTORE) project. The Mississippi Department of Environmental Quality and National Oceanic and Atmospheric Administration (the federal and co implementing trustee) worked cooperatively to develop a project along the Hancock County, Mississippi, shoreline. This project offsets injuries by preserving and protecting existing marsh and providing for increased secondary productivity. It is the first Mississippi RESTORE project to be designed, constructed and monitored.

The project consists of three restoration components:

•6 miles of living shoreline to protect the coastal preserve.

•46 acres of restored marsh with dredged material.

•46 acres of subtidal shellfish reef in Heron Bay.

The selected alternative was a result of geotechnical, wind-wave, and current analyses to locate and design the segmented breakwater, subtidal reef, and marsh components. This project used traditional coastal engineering analyses of wave conditions and erosive forces. The analysis was used to design natural features, as well as a low-relief stone breakwater, to reduce shoreline erosion and optimize circulation.

This presentation will focus on the engineering analyses, permitting hurdles, the five phases of construction and the long-term monitoring results. Challenges and how they were overcome will be presented

Predicting and Planning for the Future of the Coast

Standard, Session #40

Coastal Flood Risk Assessment in Louisiana's 2023 Coastal Master Plan

This session provides an overview of the coastal flood risk assessment methodology and risk analysis results used to inform the development of Louisiana's 2023 Comprehensive Master Plan for a Sustainable Coast. Specifically, the presenters will describe the hydrodynamic modeling of storm surge and waves, flood depth and damage estimation, and evaluation of potential community-scale nonstructural risk reduction investments. The session also includes an investigation of how modeled risk over time might have disparate impacts on communities with differing demographics, and the distribution of potential risk reduction benefits across these communities.

Each presenter will describe key updates to the modeling and analysis approach for the 2023 plan, provide selected results to illustrate potential outcomes in a future without action or with proposed master plan projects in place over the next 50 years, and summarize key insights and implications from the updated and state-of-the-art analysis.

Session Organizer: Jordan Fischbach | The Water Institute, Email: jfischbach@thewaterinstitute.org

Moderator: Jordan Fischbach | The Water Institute, jfischbach@thewaterinstitute.org

Presenter or Panelist 1: Zachary Cobell | The Water Institute, zcobell@thewaterinstitute.org

Storm Surge and Wave Analysis to Inform Louisiana's 2023 Coastal Master Plan

Louisiana's 2023 Comprehensive Master Plan for a Sustainable Coast utilizes ADCIRC+SWAN model simulations to evaluate the effectiveness of different risk reduction projects on reducing storm surge and wave impacts. The ADCIRC+SWAN model utilized during the Coastal Master Plan process was originally developed for Louisiana's 2012 Coastal Master Plan and has received incremental updates over time for both increased accuracy and to include the most recent available data collected over time. The model mesh currently serves as the backbone for many ADCIRC studies throughout the state, including analyses conducted by USACE for levee recertification and storm surge and wave forecasting operations conducted by multiple forecast groups.

Prior to the 2023 Coastal Master Plan, the model was updated to include the latest CONED topography and bathymetry as well as newly constructed and surveyed levees throughout the state. A model calibration for updated wind drag and bottom friction coefficients was conducted using a suite of historic hurricanes. The model was refined to be applicable to both tropical and non-tropical systems within the state such that a single configuration was suitable for various efforts, including compound flooding. The modeling team demonstrated that the model is well calibrated and efficient for a study such as the Louisiana Coastal Master Plan.

Finally, the model was applied to both synthetic and historic storms to demonstrate how the surge and wave response differs with and without the proposed Master Plan projects in place in multiple future years. These analyses are used by the CLARA model to predict changes in damage over time or with and without projects, discussed later in this session.

Presenter or Panelist 2: David R. Johnson | Purdue University, davidjohnson@purdue.edu

Flood Risk and Damage Assessment in Louisiana's 2023 Coastal Master Plan

Louisiana's 2023 Comprehensive Master Plan for a Sustainable Coast consists of an approximately $50 billion portfolio of projects intended to reduce flood risk and restore ecosystems across the coastal zone over the next 50 years. The plan allocates half of that budget to a combination of structural flood protection projects and nonstructural measures such as home elevations, floodproofing, and voluntary acquisitions.

A series of systems models was used to evaluate flood risk with and without projects, under present day conditions and each decade from 10 to 50 years into the future. Specifically, the Coastal Louisiana Risk Assessment model (CLARA) was used to estimate flood risk in a future without action and risk reduction with proposed projects in place. Future time periods were evaluated in multiple scenarios with varying assumptions about factors such as sea level rise, future storm characteristics, and system fragility.

In this talk, we present overall results regarding future flood risk in coastal Louisiana and the risk reduction benefits from the 2023 Coastal Master Plan. In addition to the expected annual damage in dollars used in previous editions of the plan, this includes a new metric, expected annual structural damage, that treats all structures as if they have the same value. This represents an important step in providing a more equitable and balanced risk reduction project portfolio.

Presenter or Panelist 3: Michael T. Wilson | RAND Corporation, miwilson@rand.org

Exploring the 2023 Coastal Master Plan Nonstructural Protection Evaluation Results

Louisiana's 2023 Comprehensive Master Plan for a Sustainable Coast took a new, programmatic approach to nonstructural protection. Using results from the Coastal Louisiana Risk Assessment (CLARA) model, the master plan development team identified several approaches to assessing the benefits of floodproofing, elevation, and acquisition to shape a cost competitive budget for selection by the Planning Tool (PT).

This presentation will compare expected annual damage in dollars and expected annual structural damage benefits over time for elevation threshold- and participation rate-based variants, including a methodological discussion of setting targets for Implementation Period 2 (IP2). It will also offer exploratory analysis of a sample of community-level results. To conclude, the team will show how the increased nonstructural budget included in the draft 2023 Coastal Master Plan interfaces with structural projects to reduce risk substantially and equitably across the coast.

The results may be informative to other state agencies, nongovernmental organizations, community advocates, and coastal stakeholders who are interested in developing coastal hazard mitigation plans, comprehensive plans, or other nonstructural mitigation projects.

Presenter or Panelist 4: Brett McMann | The Water Institute of the Gulf, bmcmann@thewaterinstitute.org

Hydrologic Modeling & Drainage Analysis of the Cameron Creole Watershed

Recent study of the Calcasieu-Sabine Basin has generated new questions regarding the relative contributions of salinity and water level (stage) to wetland health. To further investigate the hydrologic impacts of natural forcings and the impacts of human interventions, physics-based and machine-learning

based analysis have been undertaken. This presentation will summarize the complementary physics-based MIKE model analysis by the Water Institute of the Gulf and machine learning efforts by Mott MacDonald.

The Cameron Creole watershed (CCW) is bounded by LA State Highway 27 (east) and Calcasieu Lake (west), the Gulf Intracoastal Waterway (north), and natural chenier ridges (south). It is entirely impounded by berms, highway embankments, and natural features. The causes of wetland loss within the basin are two-fold – high salinities during summer months and flood stress post a cold front passage. These causes will be further discussed by Leigh Anne Sharpe in an accompanying session presentation.

The Water Institute examined stage and drainage patterns by analyzing CRMS locations within the basin, and through running the MIKE hydrodynamic model to test the magnitude of impact that the limited CCW gate opening area and opening frequency play on internal stage. Other external factors, such as Mermentau Basin structure operations and internal marsh hydrology, were also assessed as potential limiting factors to ideal marsh drainage.

On a parallel path, Mott MacDonald developed a neural network and used machine learning techniques to further illuminate the key influences on marsh stage (e.g. short-term or long-term precipitation averages, tidal ranges, and other phenomena). Both teams then used their complementary tools to analyze whether addition to or modification of existing hydraulic connection between the CCW marshes and Calcasieu Lake could benefit marsh hydrology.

Disaster Impacts, Mitigation and Recovery

Standard, Session #41

Coastal Communities and Climate Change

This session explores various aspects of how stress and trauma influence local populations and how they response. It includes a variety of different data collection strategies from repeated surveys following stressful events to oral histories and Traditional Ecological Knowledge. The Survey of Trauma, Opportunity, and Resilience in the Gulf (STRONG) provides insights on mental health response to Deepwater Horizon Oil Spill, Hurricanes Harvey and Michael, and the COVID-19-pandemic and how Gulf Coast residents' mental health symptoms have been affected by different disaster experiences, after accounting for other potentially traumatic event exposure (e.g., physical assault, car crash). Hurricane Ida's impact on tribal communities is explored in the context of historical marginalization, compounding disruptions, and existential threats to their cultural identity as they draw upon their Traditional Ecological Knowledge to stay connected to each other, the land, and the water and fight to preserve their social and cultural resilience. In August of 2016, widespread flooding occurred across south Louisiana a decade after Hurricanes Katrina and Rita devastated the US Gulf Coast. Come hear what it feels like to have a flood run through your living room, or what the shell-shocked person being evacuated on television is thinking at that moment. What does it feel like to be beholden to charity and FEMA? How long and how much effort does it take to rebuild a home? Another presentation explores how proximity to water and improved overall health has been intuitively known by the residents of coastal Louisiana for generations. Climate change and land loss profoundly threaten this relationship. Vulnerable populations which may rely on the benefits of water proximity to mental health may be particularly impacted.

Session Organizer: | , Email:

Moderator: Rajeev Ramchand | RAND Corporation, ramchand@rand.org

Presenter or Panelist 1: Melissa Awbrey | Tulane University, mawbrey@tulane.edu

Hurricane Ida's impact on Indigenous Tribes in Louisiana: Resilience, Justice, Maybe Even Love?

What we do in Louisiana matters on a national and even global scale. With some of the worst coastal land loss in the world, our coastal region will be looked to as a case study for climate migration. I will discuss the impacts that Hurricane Ida has had on the bayou regions of southeastern Louisiana in particular on Native American tribes. Some with roots dating back 1,000 years, the Native American tribes of this region have experienced significant devastation and loss from Hurricane Ida and deserve special attention when discussing the most significant impacts of the storm. Pushed to the outer edges of land that has been disappearing from under their feet since the 1930s, these tribes are uniquely vulnerable to the impacts of storms like Ida and are some of the earliest coastal communities in the world to be displaced by climate change and its effects. I will discuss Hurricane Ida's impact on these tribal communities in the context of historical marginalization, compounding disruptions, and existential threats to their cultural identity as they draw upon their Traditional Ecological Knowledge to stay connected to each other, the land, and the water and fight to preserve their social and cultural resilience. I will reflect on such questions as: Do we really understand what is lost when people with deep knowledge about living sustainably on our planet are displaced and dispersed from their homelands, can

we fully conceive of the consequences of this loss across society in the face of climate change? Should we just keep proceeding with a cost-benefit approach, focusing on the numbers of people and financial impact because coastal communities will be underwater later this century anyway? Or, could we try a different way? What if the intangible interconnections with everything around us were the true source of our resilience and sustainable possibilities. What if it is ultimately love that will lead to our long-term resilience and survival?

Presenter or Panelist 2: Kevin Conrad | Ochsner Health, kconrad@ochsner.org

Losing Our Blue Mind: The Impact of Climate Change and Land Loss on our Mental Health

The term" Blue Mind" was coined by neuroscientists and marine researchers to identify a personality trait that experiences a full awareness of water and its beneficial impact on mental health. Several studies have have shown a direct correlation between proximity to water and improved overall health The residents of coastal Louisiana have intuitively know this for generations and have been drawn to the water for peace, pleasure and relaxation. Climate change and land loss profoundly threaten this relationship. Vulnerable populations which may rely on the benefits of water proximity to mental health may be particularly impacted. This presentation will review the current research in this area, its implications to the mental health of residents of coastal Louisiana and possible efforts to remediate the problem.

Presenter or Panelist 3: Marlene Friis | Tulane University, mfriis@tulane.edu

"A river ran through my living room": LSU study audio on Great Flood of 2016

Louisiana is no stranger to devastating hydrologic events. In August of 2016, widespread flooding occurred across south Louisiana a decade after Hurricanes Katrina and Rita devastated the US Gulf Coast. This presentation will showcase primary source audio material from an LSU study that examined associations among disaster stressors and mental health outcomes in the wake of the Great Flood of 2016 (Cherry et al., 2021). A total of 186 persons ages 19-89 participated in this study. They were divided into three flood exposure groups and responses were compared amongst (1) non-flooded controls; (2) single disaster adults with 2016 flood damage to homes and property, and (3) double disaster adults who permanently relocated inland because of catastrophic losses in the 2005 Hurricanes Katrina and Rita and who flooded in 2016. This presentation focuses on salient representative answers to the following question: "What were the most stressful things during the flood and its aftermath?" Three major themes emerged regarding immediate impact and flood-related destruction, how communities worked together, and the lingering consequences of flood-related damage. The major themes, along with supportive quotes taken from the primary data, will be presented. Come hear what it feels like to have a flood run through your living room, or what the shell-shocked person being evacuated on television is thinking at that moment. What does it feel like to be beholden to charity and FEMA? How long and how much effort does it take to rebuild a home? Eyewitness accounts provide unique and time-sensitive primary resource materials to understand human vulnerabilities. They form part of the historical record and may serve as primary data points for researchers invested in disaster preparation, recovery, and mitigation.

Authors: Marlene Friis, Katie E. Cherry, Matthew R. Calamia, Emily M. Elliott

Presenter or Panelist 4: Vanessa Parks | RAND Corporation, vparks@rand.org

The Survey of Trauma, Opportunity, and Resilience in the Gulf (STRONG)

The two primary objectives of this presentation are (1) to provide an overview of the longitudinal Survey of Trauma, Opportunity, and Resilience in the Gulf (STRONG), and (2) to describe findings on the associations between three different types of disasters (Deepwater Horizon Oil Spill, Hurricanes Harvey and Michael, the COVID-19-pandemic) and mental health (depression, anxiety, and alcohol use). The STRONG survey began in 2016 as an effort to understand the impact of the Deepwater Horizon Oil Spill on a representative sample of 2,520 individuals living in Gulf Coast communities from Texas to the Florida panhandle. A second wave of the survey was administered in 2018-2019 to examine the impact of recent hurricanes on this same sample. The third wave of STRONG data collection, completed in 2022, then examined how Gulf Coast residents have fared during the COVID-19 pandemic. We will describe the overall study and data collection methods at each wave, and report on our findings related to how Gulf Coast residents' mental health symptoms have been affected by different disaster experiences, after accounting for other potentially traumatic event exposure (e.g., physical assault, car crash).

Flood Risk Management: Coastal and Inland

Standard, Session #42

River Management and Flood Mitigation

The increasing frequency of destructive riverine floods along the U.S. Gulf Coastal region coupled with urbanization, drought, and some of the highest rates of relative sea level rise in the U.S. has intensified the demand for innovative flood mitigation and river management activities in vulnerable coastal regions. A major challenge is the need to implement sustainable and practical solutions which minimize adverse impacts and benefit both people and the coastal watersheds and ecosystems. This epic task will require multi-generational planning and perspective supported by creative frameworks and tools capable of describing the benefits while also quantifying unintended consequences as well as opportunities. This session presents recent modeling and management-relevant applications supportive of balanced and sustainable riverine flood mitigation activities in coastal Louisiana and beyond.

Session Organizer: Robert Miller | University of Louisiana at Lafayette, Email: robert.miller@louisiana.edu

Moderator: Robert Miller | University of Louisiana at Lafayette, robert.miller@louisiana.edu

Presenter or Panelist 1: Darrel Broussard | USACE New Orleans District, darrel.m.broussard@usace.army.mil

Southwest Coastal, LA - Nonstructural Solutions for Calcasieu, Cameron, and Vermilion Parishes

The US Army Corps of Engineers' Southwest Coastal Louisiana Non-structural Project developed coastal storm risk management measures for Calcasieu, Cameron, and Vermilion Parishes. The study area has approximately 250,000 people at risk from hurricane, storm surge flooding, and wave action. The recommended plan is a 100% voluntary project that would implement nonstructural elevation and floodproofing measures across the 4,700 square miles of the 25-year floodplain of the study area. This project was authorized for construction in WRDA 2016 at a total cost of $3.1B. Funded for construction inFY22, this project will reduce coastal storm damages for up to 3,462 residential structures, 342 non-residential, and 157 warehouses. Initial efforts included community outreach and education on the project and process for homeowners and business owners to apply. This presentation will focus on the importance of the project, details of the plan, and vision for implementation.

Presenter or Panelist 2: Austin Doucet | Fenstermaker, austind@fenstermaker.com

Louisiana Watershed Initiative Region 4 H&H Modeling Status

In August 2018, Governor Edwards launched the Louisiana Watershed Initiative (LWI), a continuation of the planning, coordination, and collaboration across various federal, state, and local agencies in direct response to the historic flooding events in March and August of 2016, events that forced us to rethink how our state approaches floodplain management.

In regard to the collection of information for the development of relevant, living models of each watershed that can then be leveraged with regard to land use, policy decision-making, and project evaluation, C.H. Fenstermaker & Associates, L.L.C. (Fenstermaker) has been tasked by LADOTD with performing HUC8 Hydrologic and Hydraulic (H&H) Modeling as well as Topographic and Bathymetric

Surveying relative to Region 4 which contains 6 HUC8 watersheds including Toledo Bend, Whisky Chitto, Lower Sabine, Lower Calcasieu, Upper Calcasieu, and West Fork Calcasieu which encompasses the Sabine and Calcasieu River as well as nine parishes.

Fenstermaker has been working towards the overarching goal of developing the HUC8 H&H models since mid-2021. The 6 HUC8 models are being developed to accommodate regional-scale flood mitigation and watershed management activities, but also support the analysis of cumulative impacts from development, drainage improvement projects, and evaluation of drainage ordinances. The watershed models are being decomposed using a tiered modeling approach making use of differing resolutions as necessary depending on key h&h drivers within the watershed such as population, NFIP flood claims, social vulnerability, and availability to leverage existing h&h studies within the watershed. Region 4 incorporates various modeling standards and techniques including coupled unsteady 1D/2D, full unsteady 1D, and full 2D with rain-on-mesh. Nearing the completion of Model Setup and progressing towards the Calibration & Validation phase, there is abundance of information to share regarding LWI Region 4 H&H Modeling

Presenter or Panelist 3: Muhammad Izhar Shah | University of Louisiana at Lafayette, muhammad-izhar.shah1@louisiana.edu

Modeling the Effects of Hydrologic Forcing Uncertainty on Mitigation-
Induced Water Quality Impacts on a Tidal Freshwater River:

Relative sea level rise and other forms of hydrologic intensification will increase flood risks in coastal communities worldwide in the future. South Louisiana faces some of the highest rates of sea level rise in the United States and the hydrology of its inland waterways has been significantly altered due to a variety of factors. Increasing demand for flood mitigation and drainage improvements necessitates the need to assess the long-term implications of large-scale countermeasures on the water ecosystems of coastal Louisiana. This study presents the development a coupled Soil & Water Assessment Tool (SWAT) with a calibrated hydrodynamic model for the Vermilion River in the Acadiana Region of coastal Louisiana. The novel approach features the calibration of a regional SWAT water quality model with hourly simulation capabilities. The SWAT model was calibrated and used to provide input forcing for a HEC-RAS model which has been used to study the effects of river dredging on water temperature and salinity regimes in the Vermilion River and swamp wetland system. Numerous simulation trials utilizing a range of hydrological forcings are used to investigate the effect of changes in the watershed runoff parameters on key ecohydraulic variables (e.g., water temperature and salinity) in the river and surrounding wetlands. The framework is also used to test the effects of flood mitigation (e.g., dredging) on the river and to establish the robustness of the findings to hydrologic uncertainty. The approach provides an efficient framework upon which similar modeling efforts can be leveraged to help quantify the environmental impacts and opportunities associated with regional flood mitigation activities in the future.

Presenter or Panelist 4: Garland Pennison | HDR Engineering, Inc, garland.pennison@hdrinc.com

The Changing Paradigm of Modeling the Bayous

Louisiana Watershed Initiative (LWI) Region 5 is located primarily in Acadiana and encompasses 16 parishes and five Hydrologic Unit Code (HUC) 8 watersheds covering approximately 10,190 square miles. Region 5 requires modeling structure-controlled navigable rivers and diversion systems within a landscape experiencing multifaceted ecological and environmental challenges. Successfully modeling the continent's largest freshwater diversion system through the Atchafalaya River is critical. The proposed presentation is part of the River Management and Flood Mitigation session and focuses on changing priorities associated with the Atchafalaya River HUC, creating an evolving paradigm in surface water modeling. The book Designing the Bayous: The Control of Water in the Atchafalaya Basin (1800-1995) (Reuss, 2004) provides a historical context of competing priorities associated with managing water resources in the Atchafalaya Basin. This presentation provides a brief overview of changing paradigms that prioritize diverse and competing objectives for the expansive flood control and conveyance system that extends from the Old River Control Complex to the Gulf of Mexico. This includes an ongoing plan to create a National Estuarine Reserve System (NERRS) within the Atchafalaya Basin and Governor Edward's creation of the Atchafalaya River Basin Restoration & Enhancement (ARBRE) Task Force. The presentation summarily describes the LWI model development and ongoing modeling strategy to couple hydrology and coastal hydraulics for modeling compound flood risk within the Atchafalaya River basin. ADCIRC+SWAN coastal models developed by the Coastal Protection and Restoration Authority (CPRA) and The Water Institute (TWI) are coupled with the LWI Region 5 HEC-RAS 2D model. Highlighting these challenges and complexities will be informative for conference attendees.

Renewable Energy

Panel, Session #43

Louisiana Renewable Energy Forecast

Renewable energy growth in Louisiana is anticipated to expand significantly over the next decade. In 2022, 21 GW of solar, 230 MW of wind, 4 GW of batteries, and 5 GW of hybrid resources entered into the MISO generation interconnection queue in Louisiana, the 3rd highest amount of megawatts out of any state in the Midcontinent Independent System Operator. Multiple electric utilities have net zero carbon emission goals and released thousands of megawatts worth of renewable energy procurement plans, just last year including Entergy Louisiana, Southwest Electric Power Company, and the 1803 Cooperatives.

The New Orleans City Council has a legally-binding net zero mandate in place which will drive hundreds of megawatts of power procurement over the next decade. Governor John Bel Edward's Climate Initiatives Task Force called for a goal of adding 5,000 megawatts of offshore wind by 2035. The Bureau of Ocean Energy Management recently announced new Wind Energy Areas for offshore wind near Lake Charles, representing approximately 3,000 megawatts worth of potential development opportunity.

With the significant opportunities for renewable energy growth in Louisiana, there are still market barriers to the industry. This panel will discuss market opportunities, trends, and barriers for the renewable energy industry in Louisiana.

Session Organizer: Simon Mahan | Southern Renewable Energy Association, Email: simon@southernwind.org

Moderator: Simon Mahan | Southern Renewable Energy Association, simon@southernwind.org

Presenter or Panelist 1: Tommy Greer | Arevon Energy, tgreer@arevonenergy.com

Presenter or Panelist 2: Gizelle Wray | Savion Energy, gwray@savionenergy.com

Presenter or Panelist 3: Jessica Hendricks | Alliance for Affordable Energy,

jessica@all4energy.org

Managing our Rivers for Multiple Uses

Panel, Session #45

Challenges facing Navigation in Louisiana Rivers

The objective of this session is to stimulate discussion on past, present, and future challenges to LMR navigation. Future challenges will include optimizing the balance between future navigation demands in face of increasing traffic, climate change and better managing the river for coastal sustainability including the operation of large sediment diversions.

Session Organizer: Brendan Yuill | U.S. Army Corps of Engineers, Email: brendan.yuill@usace.army.mil

Moderator: David Ramirez | U.S. Army Corps of Engineers, david.a.ramirez@usace.army.mil

Presenter or Panelist 1: Sean Duffy | Big River Coalition, sean.duffy@bigrivercoalition.org

Presenter or Panelist 2: Michelle Kornick | U.S. Army Corps of Engineers, michelle.s.kornick@usace.army.mil

Presenter or Panelist 3: Jeff Corbino | U.S. Army Corps of Engineers, jeffery.m.corbino@usace.army.mil

Presenter or Panelist 4: Alex Kolker | LUMCON, akolker@lumcon.edu

Presenter or Panelist 5: Rudy Simoneaux | Louisiana CPRA, rudy.simoneaux@la.gov

Presenter or Panelist 6: Mac Wade | Port of Morgan City, mac@portofmc.com

Human Dimensions

Standard, Session #46

Applied Science for Non-structural Adaptation Planning, a Case Study in Mandeville, LA

This session explores how applied science can be used to support community level adaptation planning with a focus on nonstructural flood risk management. Government agencies often require environmental risk mitigation strategies to pass a cost-benefit test. However, these can favor protection of valuable assets, which can produce inequitable outcomes. Distributional equity in efficient risk mitigation is influenced by how efficiency is operationalized, and alternative efficiency measures have been developed which can better satisfies egalitarian and prioritarian equity notions. Homeowner decisions to elevate the foundations of single-family residences are often related to flood insurance that encourages protection from the 100-year flood event. However, it may be more cost-effective in some areas to elevate beyond that standard. Actual decisions were analyzed to show how policies for risk mitigation could be improved. In addition to the direct impact of flooding on houses, indirect impacts such as out-migration due to severe storm and flood events from rural communities can result in reduced access to services which creates a fragile situation. Drive time differences before and after the closest essential facility to each individual shuts down; can be used to assess resilience, as it indicates the degree to which residents would have access to alternative options for meeting essential needs. Quantifying a measure of vulnerability based on alternatives and marginal time can help understand how "fragile" the community's long-term well-being is. The final presentation in the session will discuss how these various challenges and opportunities can be used to consider adaptation options for the City of Mandeville.

Session Organizer: David Lessinger | CSRS, LLC, Email: david.lessinger@csrsinc.com

Moderator: David Johnson | Purdue University, davidjohnson@purdue.edu

Presenter or Panelist 1: Nathan Geldner | Purdue University, ngeldner@purdue.edu

Efficient Nonstructural Flood Risk Mitigation and Intersectional Equity Implications

Government agencies often require environmental risk mitigation strategies to pass a cost-benefit test. All else equal, these favor protection of valuable assets, which can produce inequitable outcomes. We demonstrate that distributional equity in efficient risk mitigation is influenced by how efficiency is operationalized and propose an alternative efficiency measure which better satisfies egalitarian and prioritarian equity notions. We compare optimal allocations of $100 million to home elevation projects in New Orleans, that minimize flood risk measured in (i) dollars or (ii) as a proportion of a structure's replacement cost. Minimizing the latter metric allocates more resources to impoverished neighborhoods. It reduces proportional damage to residences by an additional 11% at the expense of 2% of economic damages. Composite strategies show even more favorable tradeoffs (4% proportional damage for 0.04% economic damage). An analysis of coastwide nonstructural policies based on Louisiana's 2023 Coastal Master Plan budget highlights the generality of our findings and demonstrates the power of equity-aware efficiency measures in improving distributional outcomes.

Presenter or Panelist 2: Utkuhan Genc | Purdue University, ugenc@purdue.edu

Using Travel-time to Essential Services to Identify Vulnerable and Fragile Communities

Hurricanes and associated coastal flooding are the costliest and deadliest natural hazards in the United States between 1980 and 2021. In addition to the direct impact indirect impacts such as out-migration due to severe storm and flood events from rural communities can result in reduced access to services which creates a fragile situation. For example, Cameron Parish, faced a steady population decline after Hurricane Laura and Delta in 2020 that caused a lot of businesses to shut down operations temporarily or in some cases permanently. As the population declines over time, there will be fewer incentives for these businesses to stay in operation, which creates a fragile and uninhabitable situation for the remaining community members. In this study, we looked at travel-time changes under what-if scenarios representing closures of essential services such as grocery stores, gas stations, or medical emergency services. We measure the drive time differences before and after the closest facility to each individual shuts down; this measure relates to resilience, as it indicates the degree to which residents would have access to alternative options for meeting essential needs. The main empirical results of this study will be based on Cameron Parish, where first-hand observations and interviews with residents implied that the population decline-induced business closures are threatening the quality of life of community members. Additionally, a similar analysis will be done on Morgan City and Slidell, Louisiana, communities experiencing different migration trends. Quantifying a measure of vulnerability based on alternatives and marginal time will help us understand how "fragile" the community's long-term well-being is. Preliminary analysis has shown that Cameron Parish is quite fragile with respect to access to grocery stores, where even one store closure would substantially increase the percentage of the population that has to drive over 30 minutes to access groceries.

Presenter or Panelist 3: Erin Groll-Barrash | Purdue University, egroll@purdue.edu

Comparing Optimal Home Elevations to Reconstruction Decisions and Insurance Standards

This study explores the decisions that Louisiana homeowners made to elevate the foundations of single-family residences during recovery after Hurricane Katrina. The relevant policy standard, related to flood insurance, encourages protection from the 100-year flood event. However, it may be more cost-effective in some areas to elevate beyond that standard, as the estimates are infrequently updated. Homeowner decisions may also be influenced by policy design for funding home elevations, risk perception, and demographic factors. Leveraging data on home reconstruction and retrofits funded by federal programs, with detailed estimates of flood depth probability distributions, we are able to compare the actual housing elevation decision to the 100-year flood standard and "optimal elevation heights" calculated by minimizing the sum of mitigation costs, flood insurance premiums, and expected damage over a multi-decadal planning horizon. The optimal elevations are estimated using detailed flood depth probability distributions from Louisiana's Coastal Master Plan. Leveraging data on home reconstructions and retrofits funded by federal programs, we then compare the economically optimal elevations to actual elevation decisions and the 100-year flood depths in the area. This study gives insight into the extent to which homeowners anchor decisions on minimum standards promoted by policy, and thus it has potential implications on policy design to incentivize more cost-effective risk mitigation programs. Analyzing the effectiveness of actual decisions provides insight into how policies for risk mitigation could be improved.

Presenter or Panelist 4: David Lessinger | CSRS, LLC, david.lessinger@csrsinc.com

Mandeville Flood Risk Resilience Strategy

The City of Mandeville and CPRA recently partnered to develop a non-structural flood risk mitigation strategy specific to the Mandeville community. The City and their consultant, CSRS, will present a summary of the strategy and discuss next steps in implementing and securing funding for non-structural adaptation projects and initiatives.

Presenter or Panelist 5: Lauren Brinkman | City of Mandeville, lbrinkman@cityofmandeville.com

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Preparing for Climate Change

Panel, Session #47

Environmental, Social and Governance Aspects of Decarbonization

This session will begin with a presentation to provide an introduction to carbon capture and storage including an overview of technologies used for capture, transportation and injection.

The presentation will be followed by a moderated panel discussion. Topics will include:

- *An update on developments at the Louisiana legislative level over the 2022 session and ongoing 2023 session;*
- *Discussion of a risk-based approach for energy companies in coastal Louisiana to address CCS/CCUS as part of a comprehensive approach toward decarbonization.*
- *Risks of insufficiently substantiating ESG commitments, including climate and decarbonization goals.*
- *Communication challenges and approaches for a variety of audiences.*

Session Organizer: Bessie Daschbach | Hinshaw & Culbertson LLP, Email: bdaschbach@hinshawlaw.com

Moderator: Harry Vorhoff | Governor's Office of Coastal Activities, Harry.Vorhoff@la.gov

Presenter or Panelist 1: Mark Zappi | University of Louisiana at Lafayette,

Presenter or Panelist 2: Colleen Jarrott | Hinshaw & Culbertson LLP, cjarrott@hinshawlaw.com

Presenter or Panelist 3: Ash Shepherd | Talos Energy, Ash.Shepherd@talosenergy.com

Presenter or Panelist 4: Bessie Daschbach | Hinshaw & Culbertson LLP, bdaschbach@hinshawlaw.com

Coastal Law, Policy & Funding

Panel, Session #48

Transforming Environmental Review: Getting restoration projects on the ground faster

Permitting processes for restoration projects can add significant costs and time to those projects. This panel will explore strategies to increase the efficiency of regulatory review for restoration projects.

First, an overview discussion will include identification of some of the legal regimes that have slowed projects or significantly increased project costs, building in perspectives from other experts that have published materials on the issue.

The first panelist will address "What speeds and slows restoration: Insights from research on mitigation bank timelines and Pay for Success policies." Mitigation banks are an example of restoration projects burdened with delays and permitting costs that can burn up to a third of a project's budget. This panelist will review research results from a quantitative analysis of US Army Corps of Engineers data on timelines of mitigation bank approvals and will also provide a summary of insights from a series of interviews with project developers and Corps Districts on what slows and speeds restoration.

The next panelist will provide an overview of Title 41 of the Fixing America's Surface Transportation Act (FAST-41), with particular focus on the role of the Federal Permitting Improvement Steering Council (Permitting Council) in tracking environmental review processes for large or complex infrastructure projects, including large scale ecosystem restoration projects. The Permitting Council's work in implementing FAST-41 is part of a government-wide effort to improve coordination, transparency, and accountability in permitting of these critical projects.

The final panelist will legislation adopted in California in September of 2021 that created an exemption from review under the California Environmental Quality Act (CEQA) for fish and wildlife projects that meet certain requirements. The final panelist will explore lessons learned during the first two years of experience under this new program.

Session Organizer: Samuel Plauche | Plauche & Carr LLP, Email: billy@plauchecarr.com

Moderator: Samuel Plauche | Plauche & Carr LLP, billy@plauchecarr.com

Presenter or Panelist 1: Becca Madsen | Environmental Policy Innovation Center, becca@policyinnovation.org

Presenter or Panelist 2: Danny Weigand | Federal Permitting Improvement Steering Committee, danny.wiegand@fpisc.gov

Presenter or Panelist 3: Megan Terrell | Plauche & Carr LLP, megan@plauchecarr.com

Presenter or Panelist 4: Michael Hare | RES, mhare@res.us

Hydrology, Geomorphology and Ecology of the Coast

Standard, Session #49

Using modeling to understand processes, inform restoration efforts, and river management

Models can be useful in tools to help understand natural processes and exploring options to inform management actions. In this session speakers will present and discuss models that have been developed to examine sediment dynamics across multiple spatiotemporal scales, impacts of in-bay sediment borrow, strategies to optimize operation of planned restoration projects, and impacts of river flood management structure to the coastal environment and a key commercial fishery.

Session Organizer: | , Email:

Moderator: Alisha Renfro | National Wildlife Federation, RenfroA@nwf.org

Presenter or Panelist 1: Martijn Bregman | The Water Institute, martijnbregman@gmail.com

EFFECTS OF IN-BAY SEDIMENT MINING IN BARATARIA BAY, LOUISIANA

Coastal restoration projects implemented by the Louisiana Coastal Protection and Restoration Authority (CPRA) usually rely on compatible sediment resources from offshore borrow areas or the Mississippi River. However, modern interdistributary bays in the Mississippi River Delta Plain (MRDP) feature several buried paleochannels that form a potential resource of restoration-compatible sediment, providing realistic potential use cases to test the impacts of in-bay sediment extraction to the regional sediment budget.

This study investigates (1) the effect of in-bay borrow pits on the tidal prism, (2) the potential of borrow pits to capture sediment that would otherwise be deposited elsewhere or exported to the Gulf of Mexico, and (3) the influence of pit orientation on local to regional sediment dynamics. A process-based numerical model (Delft3D Flexible Mesh) was developed for the Barataria Basin, Louisiana, to simulate hydrodynamics, sediment transport, and morphology with mixed meteorological forcing comprising of quiescent conditions, cold fronts, and tropical cyclones. The evaluated borrow areas have similar excavation areas (~1.6 km2) and volumes (~10 million m3) but different orientations and locations.

Model results indicate that the studied borrow pits do not affect the tidal prism; however, local hydrodynamics are noticeably different, with larger significant wave heights and higher flow velocities at the pit during high-energy events. The evaluated borrow pits each infill at a rate of ~125,000 m3/y regardless of orientation or location. Infilled sediment is mainly (>90%) sourced from the bay floor of Barataria Bay. Borrow pits effect minimal change in sediment export volumes from the Barataria Basin. The observed difference (<0.3%) in sediment export corresponds to up to 10% of the borrow pit infilled volume, suggesting that borrow pits do not significantly change the loss of sediment from the system.

Presenter or Panelist 2: Mallory Dyson | University of Southern Mississippi, mallory.dyson@usm.edu

The influence of the Bonnet Carré Spillway on the success of the brown shrimp (F. aztecus)

In 2019, significant inland precipitation led to an unprecedented "double opening" of the Bonnet Carré

Spillway (BCS) first in the spring (February 27 to April 11) and later in the summer (May 10 to July 27) discharging high volumes of freshwater into the northern Gulf of Mexico (nGOM). The commercially important brown shrimp (F. aztecus) resides in waters along the Gulf Coast with diadromous migration patterns and are particularly sensitive to salinity gradients outside of their preferences. The unusually high freshwater sources caused by BCS are hypothesized to significantly affect habitat suitability for brown shrimp, particularly affecting the juveniles. The Habitat Suitability Index (HSI) model can be used to visualize habitat preferences for environmental variables and is applied to this research for juvenile estuarine preferences via temperature and salinity parameters. To investigate the environmental impacts of BCS freshwater releases into nGOM waters, the Mississippi Sound and Bight Coupled Ocean-Atmosphere-Wave-Sediment Transport (msbCOAWST) hydrodynamic model was used to estimate temperature and salinity dynamics in nGOM waters using "with BCS" and "without BCS" scenarios, specifically during the period from March to August. The difference between these two scenarios was used to isolate the impact(s) to brown shrimp habitat suitability specifically as a result of BCS contributions. The goal of this research is to provide resource managers along the Gulf Coast with the best available science as a means for decision support and to create a modeling framework to explore reduced-effect strategies for future BCS operation. In the future, this research will be expanded to include additional age classes of brown shrimp (i.e., larvae and adults) and blue crab (Callinectes sapidus) (i.e., larvae, postlarvae, juvenile, and adult).

Presenter or Panelist 3: Ahmed Khalifa | PhD Candidate, Department of River-Coastal Science and Engineering , Tulane University, akhalifa1@tulane.edu

Development and Application of a Simplified Biophysical Model

The Mississippi River Delta is subjected to high relative sea level rise (RSLR). To evaluate possible restoration strategies, we developed a computationally efficient Simplified Biophysical Model (SBM). The SBM includes hydrodynamic, accretionary, and morphodynamic components. For accretion and land loss it incorporates several approaches from the Integrated Compartment Model used for the 2023 Coastal Master Plan. Within the SBM, a hydrodynamic model calculates salinity, which is used to estimate the inundation depth threshold of vegetated land. Salinity is also used to determine the annual rate of organic accretion for vegetated areas, which is added annually to the morphodynamic calculations of mineral sediment. The SBM completes a full-decade calculations in approximately 20 hours. The hydrodynamic component was validated against USGS and CRMS measurements for the year 2018 in both Barataria and Breton Sound. The SBM model also showed good agreement with the land change estimated by USGS for the period 1994-2020. Once validated, the SBM model was used to evaluate various operation plans for the Mid-Barataria Sediment Diversion (MBSD). The objective of the analysis was to identify a balance between inundation reduction and sediment volume delivery, and to investigate sediment dynamics in the outfall area. As expected, the resulting amount of land area created and sustained from various operation plans is proportional to the amount of diverted water and mineral sediment. Aside from the subaerial land creation, the MBSD creates significant shallow-water areas that might be of important ecological value. The effect of the diversion on water levels and coastal communities' flooding is more noticeable in the first two decades of operations, after which the diversion signal is masked by RSLR. Overall, this analysis presents the opportunities to optimize diversion operations to achieve land building while limiting the potential ecological impacts in the receiving basin

Presenter or Panelist 4: Zhengchen(John) Zang | LSU, zzang@lsu.edu

Gulf-COAWST: The Development of Sediment Transport Modelling Framework in the Gulf of Mexico

Sediment transport in coastal seas is critical in landforms evolution, regional material cycling, and marine ecology. A comprehensive understanding of sediment dynamics across multiple spatiotemporal scales is critical in developing adaptive coastal protection and restoration plans in the northern Gulf of Mexico. Over the past decade and built on the community-based ocean modeling system, we developed a state-of-the-art sediment transport modeling framework that can provide us with an advanced understanding of the coupling of physical-geochemical-biological processes involved in sediment transport events on different spatiotemporal scales. Here we present several advanced developments, including a four-way coupled (atmosphere-ocean-wave-biogeochemical) sediment and ecosystem simulation for hurricane events, a novel bottom boundary layer model for fluid mud development during cold fronts, and 20-yr coupled wave-ocean simulation that captured the high- and low- Mississippi River discharge scenarios. Time scales of these events range from days to weeks, months and decadal, and the spatial scale ranges from estuaries to continental shelves and the entire Gulf of Mexico. Our future efforts include the continuous development of a source-to-sink sediment modeling system built on a new coupled ocean-river modeling system and hyper-resolution (30 m) sediment transport models for bays and estuarine environments in connection with benthic ecology and aquacultural activity.

Ecosystem Restoration

Standard, Session #50

Marsh Creation Design and Assessment

This session consists of 5 presentations related to marsh creation project design and assessment, covering topics such as the effects of design choices on ecosystem dynamics and resistance to hurricane impacts.

Session Organizer: Elizabeth Jarrell | US Army Corps of Engineers, Email: elizabeth.Jarrell@usace.army.mil

Moderator: Elizabeth Jarrell | US Army Corps of Engineers, elizabeth.Jarrell@usace.army.mil

Presenter or Panelist 1: Daniel Dehon | C. H. Fenstermaker and Associates, danield@fenstermaker.com

Targeted Small Scale Marsh Restoration

This project proposed the restoration of the marsh platform along a recently installed pipeline alignment located between Lake Lery and Lake Borgne in St. Bernard Parish, Louisiana. This project posed several challenges compared to a traditional marsh creation job due to its narrow footprint, landowner requirements, COVID-related cost increases during construction, and previously disturbed soils. The narrow footprint was overcome by using imported sand as fill material. While more expensive, it eliminated the need for earthen containment, resulting in an overall reduction in project cost and risk. This project would likely not have been constructed if not for the landowners due to the relatively small area of impact (less than 10 acres). The impacts would have simply been offset through mitigation. However, the landowners exercised their right to require on-site mitigation. There were several lessons learned during the construction that would be useful for future similar projects. These small-scale restoration projects will likely become more common given my recent experiences with the permitting agencies on similar projects, where on-site restoration was recommended and preferred. The project was recently completed in December 2022 and monitoring will continue into 2026.

Presenter or Panelist 2: Gerald Songy | Moffatt & Nichol, gsongy@moffattnichol.com

Having The Edge on Marsh Creation

Marsh creation projects often use area (in the form of acreage) as a metric for success. If land reclamation and storm surge buffering are the main objectives of the project, this may be the most appropriate metric for success. However, if improvement of fisheries and colonial nesting habitat is desired, other metrics may be equally important to consider for coastal restoration projects. Using metrics such as fractals (Bertassello et al. 2018) or length of marsh edge (Rozas et al. 2005) are alternative methods to measure success and inform innovative design protocols of intertidal marsh habitat restoration. Implementing circular marsh mounds with sloped edges encompassing all elevations within the entire tidal range can provide over 3 times more edge habitat than a conventional marsh platform. If construction funding is limited, entities can consider these alternative coastal restoration features if borrow material properties can support uncontained dredged fill placement. One example of successful implementation of marsh mounds for marsh restoration can be witnessed in Graveline Bay, situated on the north side of Dauphin Island, Alabama. Currently near completion of construction, this project will ultimately restore approximately 60 total acres (40 acres of subaerial acreage (above MSL)

and 20 acres of intertidal acreage between MLW and MHW) to compensate for over 75 acres of land loss in the bay over the last several decades. Implementing a conventional marsh platform was considered, but due to limited construction funding, marsh mounds were considered as a more cost-effective implementation strategy, while simultaneously increasing marsh edge threefold (32,438 linear feet (marsh mound approach) vs. 9,900 linear feet (conventional marsh platform)), and leverage intertidal restoration acreage to optimize project benefits. This presentation will focus on the opportunities and constraints of this alternative marsh creation habitat of this newly constructed project.

Presenter or Panelist 3: Kevin Stoner | LSU Graduate Student, kston25@lsu.edu

Impacts of Containment and Elevation on Created Marsh Plant Community and Ecosystem Dynamics

In Louisiana, much of the coastal restoration funding is going to marsh creation, which uses dredged sediment to increase the elevation of an area to elevations suitable for marsh plants. Approximately, 95% of marsh creation projects involve higher-elevation containment dykes that prevent the loss of dredge sediment prior to settlement. The long-term effects of containment dykes on tidal exchange, plant dispersal, sediment delivery, accretion, and ultimately the ability to keep up with sea-level rise are unknown. To test the hypothesis that elevations, flooding dynamics, plant species, and accretion differs between confined, unconfined, and natural marshes, we established a comparative field study in marshes on the northeast shore of Lake Pontchartrain in Big Branch National Wildlife Refuge, Louisiana. Here, an unconfined marsh creation site was formed when dredge sediment overflowed a containment dyke and spilled into an open water area in 2018, where a marsh has since established. A nearby contained marsh with a few gaps in the dyke, also created in 2018, and a natural marsh are studied. In each marsh, a continuous water level and salinity probe was placed 60 cm below the marsh surface. Elevation surveys are being conducted, and accretion is being measured using feldspar marker horizon plots. Long-term accretion measured in the natural marsh using 137Cs dating averaged 4.23 ± 0.24 mm/y. Preliminary surveys indicate differences in the plant community of the marsh, with a predominance of high marsh species and shrubs in the confined marsh and lower marsh herbaceous species in the unconfined and natural marsh. Water level data has shown a lower water depth of the confined marsh than the natural marsh of up to 6 cm, which combined with the high elevation in the confined marsh, is likely to result in lower accretion than the natural marsh and ecosystem dynamics. The findings from this research will inform marsh restoration and management.

Presenter or Panelist 4: Kristen Ramsey | FWS, kristen_ramsey@fws.gov

The Resistance of Created Marsh to Hurricane Impacts: Implications for a Sustainable Coast

With a warming climate, coastal Louisiana is facing increasing hurricane frequency and intensity. Wetlands reduce risks from storms surge and flooding on coastal communities, and act as a natural line of defense against the effects of storms. However, coastal wetlands are also vulnerable to the impacts of such storms, and storm-driven erosion from major hurricanes contributes to wetland loss rates and localized sedimentation from overwash. The effects of hurricanes on natural coastal wetlands, though complex, are well studied. Yet, little is known about the impacts of hurricanes on constructed marsh.

Presenter or Panelist 5: Michelle Fischer | U.S. Geological Survey (USGS), fischerm@usgs.gov

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Predicting and Planning for the Future of the Coast

Panel, Session #51

Using Models to Support the Coastal Master Plan: Looking Ahead to 2029

Since the 2012 Coastal Master Plan, modeling of project effects has been an integral part of plan development. For the 2023 Coastal Master Plan a number of major changes were made in the models to incorporate new data, improve process representation and increase resolution. These changes are documented in the appendices to the 2023 Coastal Master Plan and have been discussed in many forums. As the 2023 Coastal Master Plan moves through the legislative process, it is time to think about how to adjust, and apply models for analysis to support the 2029 Coastal Master Plan.

This panel session includes discussion of potential adjustments on models or their application that the master plan team is already considering. These include using the models to refine projects prior to their evaluation for selection, to explore the future of the coast under a wider array of potential future conditions and consider how project interactions can be used to maximize benefit for the system. The session also provides an opportunity for the broader technical audience at State of the Coast to provide ideas on what they would like to see going forward for the use of the models, and to contribute new developments that could be useful. The expectation is that following some opening remarks, the focus would be on interaction with the audience to explain models and the explication, and how they can be modified and applied for the next Coastal Master Plan.

Session Organizer: Stuart Brown | CPRA, Email:

Moderator: Denise Reed | University of New Orleans,

Presenter or Panelist 1: Eric White | CPRA,

Presenter or Panelist 2: Jordan Fischbach | The Water Institute of the Gulf,

Presenter or Panelist 3: Krista Jankowski | CPRA,

Presenter or Panelist 4: Stuart Brown | CPRA, stuart.brown@la.gov

Ecosystem Restoration

Standard, Session #52

Diverse Benefits of Coastal Restoration

This session consists of 4 presentations related to the ecologicial benefits of coastal restoration projects, including studies of impacts to communities of various species as well as opportunitiesfor communities to support project benefits.

Session Organizer: | , Email:

Moderator: Kristin DeMarco | Louisiana State University, KDeMarco@agcenter.lsu.edu

Presenter or Panelist 1: Thomas Cancienne | Stantec, thomas.cancienne@stantec.com

DESIGN OF A BREAKWATER FOR SAV HABITAT RESTORATION AT JEAN LAFITTE

Activities associated with Deepwater Horizon Oil Spill (DWH) resulted in a loss of a significant portion of the submerged aquatic vegetation (SAV) population in Lakes Salvador and Cataouatche.

Funding resulting from DWH has allowed for the process of designing a solution to restoring SAV population by providing suitable habitat.

Through literature review & workshops with leading experts in aquatic ecosystems in Louisiana, it was determined that the key factor to restoring SAV populations at this location was the reduction of bed shear stresses.

Previously low, these stresses have increased with loss of previously existing SAV and shoreline retreat. The resulting key design criterion was that bed shear stresses should be below 1 pa.

It was determined that wave energies should be reduced in the habitat restoration area through wave energy attenuation structures.

Rubble mound breakwaters were selected from product cost-value analyses combined with phase resolving wave modeling, as they best achieve the shear stress reductions while maximizing the amount of area protected.

Presenter or Panelist 2: Quenton Fontenot | Nicholls State University, quenton.fontenot@nicholls.edu

Comparison of Finfish and Crustacean Assemblages Among Brackish Marsh Terraces and Open Water

Louisiana has lost approximately a quarter of coastal lands that were present in 1932 from a variety of natural and anthropogenic factors, thus necessitating restoration activities. One technique is creating marsh terraces in areas where marsh has been degraded to open water. Terraces provide edge habitat and slow land loss by reducing wave energy in surrounding marsh. This study evaluated the influence of marsh terraces on finfish and crustacean assemblages in a brackish marsh east of Golden Meadow, Louisiana. The habitats evaluated included new terraces built in 2022, established terraces built in 2017, and an open water area. Gee's® minnow traps, gill nets and a shrimp trawl were used to sample along terrace edges, terraces channels and in open water. Sampling occurred twice a month May through October 2022. Finfish and crustaceans were identified to species, counted and measured (mm). Catch per unit effort (CPUE) was calculated as number of individuals collected per unit of effort for each gear type.

Fundulus grandis (Gulf Killifish) collected in minnow traps had a higher mean CPUE (± SE) in established terraces (0.26 ± 0.08) than new terraces (0.01 ± 0.01; F1,22 = 13.43, P = 0.001), but no differences were detected for other species. Differences between established and new terraces may indicate changes in edge habitat quality for some species whereas trawl data suggests finfish assemblages are not different among habitats. Examining finfish and crustacean assemblages provided insight into possible ecological effects of terraces and how those effects may change over time.

Presenter or Panelist 3: Skylar Liner | School of Renewable Natural Resources, Louisiana State University, sliner4@lsu.edu

Can Gulf Ribbed Mussels Augment Coastal Restoration Projects in a World of Climate Change?

As climate models predict increasing effects of rising sea levels along our coasts, managers seek to improve multi-dimensional restoration project designs. Gulf ribbed mussels (Geukensia granosissima) exist within brackish and salt marsh habitats along the Gulf of Mexico yet are not considered when designing coastal restoration projects. Previous research shows that the presence of mussels along shorelines increases nutrient availability, shoreline stability, and marsh edge vegetation (biomass, productivity). However, we know little of the impacts changing inundation levels have on gulf ribbed mussels directly, or how combined changes in mussel density and inundation levels impact marsh vegetation productivity. A marsh organ experiment was designed to examine how mussel density impacts vegetative responses to inundation levels of predicted sea level rise (four organs x 5 inundation levels (+5, 0, -5, -10, -15 cm from current marsh platform) x 4 mussel densities (0, 254, 509, and 1018 m-2)). Each individual microcosm was filled with sieved marsh sediment, three S. alterniflora stems (height = 40 ± 5cm), and mussels representing the target density. Vegetation characteristics were monitored bi-weekly from June to October 2022. Plant productivity was measured at the peak of growing season and at the conclusion of the experiment via CO2 and CH4 gas fluxes. The experiment concluded with a destructive sampling that quantified plant (above- and below-ground) and mussel biomass. Initial results indicate vegetation stem height, live leaves, reproductive features, productivity rates, and total biomass increased with increasing densities of mussels. However, the effect of increased mussel density appears to be dampened with increasing inundation. These data will help clarify the potential for gulf ribbed mussels to enhance marsh productivity under current and future inundation levels and help understand their potential use in advancing restoration project design.

Presenter or Panelist 4: Erin Rooney | HDR Engineering, Inc., erin.rooney@hdrinc.com

Designing Shoreline Projects for Unexpected Nature-Based Benefits: Lake Pontchartrain Case Study

The southern portion of Tangipahoa Parish historically contained cypress swamp next to Lake Pontchartrain before being deforested in the mid-20th century. The remaining wetlands in this area have sustained significant land loss from daily wind-generated waves, coastal storms, subsidence, sea level rise, and increased salinity in the lake. To protect these areas, HDR Engineering, Inc. (HDR) designed the Lake Pontchartrain Shoreline Protection Project under contract with the Tangipahoa Parish Government (TPG). Design was completed in 2011 and construction was completed in 2013.

Soon after construction, aerial imagery showed that land began accreting and growing vegetation behind the new breakwaters. Several years after construction and through coordination between USACE and TPG, USACE placed additional dredged material from the nearby Tangipahoa River shoreward of the new breakwaters to assist the land building process. Based on recent aerial imagery, over 45 acres of

land and vegetation have been created between the breakwaters and the pre-existing shoreline since the breakwater construction.

In addition to publicly available aerial imagery, elevation survey data from pre-construction (2010), immediately post-construction (2013), and six years post-construction (2019) will be compared and analyzed. The sediment deposition patterns vary relative to proximity to the Tangipahoa River and at the breakwater gaps. These deposition patterns will be discussed including a qualitative analysis of how future designs may benefit from this knowledge.

While this project was designed during the early years of the natural and nature-based features (NNBF) movement, it has many lessons learned that can apply to new designs. This presentation will focus on the unexpected benefits to the area that occurred post-construction. It will explore lessons learned to better design future shoreline protection projects and potentially use nearby natural features to enhance project performance.

Flood Risk Management: Coastal and Inland

Standard, Session #53

Flood Risk Management through Actionable Information for Gulf Coast Homeowners

Flood is one of the most costly and devastating natural hazards in the US. causing over a billion dollars in damage to property and crops in 2020. Ninety-nine percent of all counties in the US were affected by flooding between 1996 and 2019. This session focuses on flood risk quantification and management and the decision-making process of homeowners and the resulting policy implications. This session examines the costs and benefits of elevation of new and existing homes, resulting policy implications, tools to inform homeowner decision making, and risk mitigation through natural and nature-based features. The interdisciplinary team presents multiple perspectives including natural and social science and engineering.

Session Organizer: Carol Friedland | Louisiana State University Agricultural Center, Email: cfriedland@agcenter.lsu.edu

Moderator: Robert Rohli | Louisiana State University, rohli@lsu.edu

Presenter or Panelist 1: Carol Friedland | Louisiana State University AgCenter, cfriedland@agcenter.lsu.edu

Benefits and Costs of Freeboard for Louisiana Homes

This presentation introduces a new and unique webtool that helps individuals identify an optimal level of freeboard – elevation of the first floor above the base flood elevation: "FloodSafeHome" (floodsafehome.lsu.edu). This tool enhances flood resilience decision-making by evaluating expected incentives and future savings based on user-specified property information. The user inputs the location of interest (by parcel or address), building square footage, and number of building stories, along with other optional information, including current and targeted community rating system and occupancy timeline, insurance coverage and deductible scenarios, and interest rate. FloodSafeHome calculates monthly savings from installing freeboard by evaluating flood risk parameters such as freeboard construction cost, insurance premium savings, avoided average annual loss, and total benefit with and without insurance, for multiple freeboard heights. A beta version of FloodSafeHome has been developed for three parishes (i.e., counties) in Louisiana and is being expanded to 20 coastal parishes. The FloodSafeHome web-based decision-making portal is expected to enhance extension and outreach on disaster education by helping potential homeowners make risk-informed decisions based on various economic analysis and benefit information. Future work will assess its impact on enhancing the protection of life and property, and therefore long-term resilience, to the ever-present flood hazard in one of the most flood-prone U.S. states. This project is funded by Louisiana Sea Grant.

Presenter or Panelist 2: Pamela Jenkins | University of New Orleans, pjenkins@uno.edu

Policy Implications of Residential Freeboard Acceptance

As with the other presentations on the panel, this work reflects several years of building interdisciplinary knowledge. This presentation describes how this interdisciplinary approach to the barriers and incentives of the use of freeboard as a mitigation strategy could be successful. The study shows how the

diversity of stakeholders (including homeowners, developers, state and parish officials, assessors, and realtors) involved in the decision-making process for freeboard and elevation creates barriers for its implementation. This presentation integrates the output of the FloodSafeHome webtool described in the previous presentation to explore human dimensions of implementation. Combining both social scientists and engineers provides a much broader range of data and analysis. The presentation outlines the policy implications for greater acceptance of freeboard in both new and existing construction.

Presenter or Panelist 3: Monica Farris | University of New Orleans, mateets@uno.edu

Actionable Risk Information for Gulf Coast Homeowner Decisions

Understanding natural hazard risk is an important component of facilitating resilient residential community development. Current Web-based tools centered around property information make it easy to find a suite of information about a home in general (cost, taxes, insurance cost, # beds, # baths, square footage) and more specific community information such as school grades, crime stats, walkability, and flood potential. Furthermore, the ease with which most people use such tools in the process of critical decision making (i.e., buying a home, investing in property) invites the development of an address-based risk assessment tool for natural hazards – a set of information not currently available beyond specific hazards (e.g., First Street Foundation's Flood Factor), not provided in a meaningful way for use in decision making, or not aggregated beyond a parcel to support regional situational awareness and decision support. This research, funded by NAS, fills that need by developing "HazardAware," a Web tool to assess flood risk and decision-making regarding mitigation options. Among the many features of HazardAware are toolsets showing the economic costs and benefits of flood mitigation and facilitating the development of resilient residential communities. The goal of this study is to implement current property level flood risk analysis methodologies and translate risk findings to the general public through an informative and accessible Web-based application (HazardAware) that explains hazard risks in an understandable manner for those with little scientific knowledge about the mechanism of flood loss assessment and flood modeling. The information presented here contributes to the current efforts for providing educational and informative tools for current residents, potential homebuyers and renters, and community decision-makers to enhance flood risk resilience.

Presenter or Panelist 4: Md Adilur Rahim | Louisiana State University AgCenter, mrahim@agcenter.lsu.edu

Quantifiable Flood Risk Reduction for Homeowners through Natural and Nature-Based Features

Flood risk is generally represented as the average annual loss (AAL), which is the expected amount of damage or loss that is expected to occur in buildings annually due to flooding. Recently, natural and nature-based features (NNBFs) have been gaining much attention as a means of protection against tropical storms. Mangroves are an important NNBF that are considered effective in reducing flood risk by reducing waves and surges, thus providing coastal protection from natural hazards. However, it is unclear how reduced waves and surges can be translated into actual reductions in AAL. This study presents a methodology to assess the expected flood risk mitigation effect of mangroves using the Gumbel extreme value distribution and AAL metric. Monte Carlo simulation is used to calculate AAL at the individual building level for a hypothetical building near Mexico Beach, Florida. The results of the case study show that mangrove wave and surge reduction can reduce the flood hazard intensity at the building location, which in turn reduces the AAL. AAL can be reduced by 9.5% for a 10% wave and 5 cm surge reduction scenario and 72% for a 60% wave and 50 cm surge reduction scenario, compared to the

“no wave and surge reduction” scenario. This study will help decision-makers, including government and community officials, to assess the role of mangroves and their design for coastal protection. Future work will explore the level of mangrove development necessary to achieve this level of flood risk reduction to buildings in coastal areas.

Renewable Energy

Panel, Session #54

What's all the BUZZ About? Creating Pollinator Habitat to Reduce O&M Costs

The solar industry has an opportunity to restore and enhance ecosystem services at their facilities that also reduce operation and maintenance costs at utility-scale solar installations. SWCA will facilitate a roundtable discussion with panelists representing industry leaders, including solar developers and vegetation managers, EPC and reclamation contractors, and conservation-minded habitat managers. This panel of industry leaders will explore how to generate the economic, ecological, and visual benefits of promoting enhanced habitats on solar facilities. SWCA's restoration ecologists have developed a toolbox of innovative methods for soil and vegetation management at solar facilities that create beneficial habitat and ultimately reduce long-term operation and maintenance costs. But these beneficial practices can inadvertently create regulatory risks when protected species are potentially attracted to newly created habitats.

Importance – The rapid growth of utility-scale solar throughout the United States has led to growing pollinator regulation at the local level. These regulatory changes present an opportunity for restored habitats on solar installations to provide ecosystem services that benefit operations management and maintenance, including site stabilization, water quality, air quality, pollinator resources, and visual impacts. There are a variety of regulatory compliance tools available to help landowners undertake beneficial actions for federally protected species without creating a regulatory liability. We review these tools and how they may be applied to operational programs, including typical timelines, opportunities for streamlining, and ongoing expectations and management.

Session Organizer: Nathan Wojcik | SWCA Environmental Consultants, Email: nwojcik@swca.com

Moderator: Will Norman | SOTC/SWCA, Will.Norman@swca.com

Presenter or Panelist 1: Nathan Wojcik | SWCA Environmental Consultants, nwojcik@swca.com

Presenter or Panelist 2: Rob Schultz | Senior Associate/Vegetation Management – Invenergy), rschultz@invenergy.com

Presenter or Panelist 3: Brian Early | (Habitat Ecologist - LDFW), bearly@wlf.la.gov

Presenter or Panelist 4: Jayme Stotka | Williams, Jayme.Stotka@williams.com]

Managing Rivers for Multiple Uses

Standard, Session #56

Mississippi River: navigation operation, flooding, and land use management

The Lower Mississippi River is a key deep draft navigation channel and an active deltaic lobe. Natural crevasses and engineered diversions (current and proposed) from the Lower Mississippi River into adjacent receiving basins has provided freshwater and sediment for wetland restoration in the face of rising relative sea level and supported a broad spectrum of estuarine-coastal species. The Lower Mississippi River is home to five major ports with a combined ~ 500 million tons of cargo, thereby considered a major economic corridor for Louisiana and the entire US. Further, flood risk and restoration activities have been the focus of much research and analysis from agencies and academic institutions. This session is comprised of four presentations discussing detailed modeling of gated structures used in engineered diversions; numerical modeling of the influence of tides on the water level, discharge and velocities of the Lower Mississippi River; lessons learned from European large navigation flood gates and their potential implementation in South Louisiana; and numerical modeling of compound flooding in the eastern side of the Lower Mississippi River including the Amite-Comite, Maurepas and Breton Sound.

Session Organizer: | , Email:

Moderator: Mitch Andrus | Royal Engineers & Consultants, mandrus@royalengineering.net

Presenter or Panelist 1: Gongqiang He | FTN Associates, ggh@ftn-assoc.com

FLOW-3D Modeling of Tainter Gate Discharge and Head Losses

The tainter gate is a type of radial arm floodgate used in dams, canal locks, irrigation head works and freshwater diversions. It is one of the most common types of flow-control structures in water conservancy projects. The precise control of tainter gates and the ease of design and operations under a wide range of head differences, make tainter gates an attractive choice for installation in flow control structures in Louisiana rivers.

In this study, a Large Eddy Simulation (LES) based FLOW-3D, a fully non-hydrostatic, three-dimensional (3D) Computational Fluid Dynamics (CFD) model, is calibrated, validated and then applied to model the complex 3D flow field around a partially open tainter gate placed in an open rectangular long channel. The model was calibrated with results from US Army Corps of Engineers (USACE) physical model experiments for discharge and head loss. Grid sensitivity study was performed to find the most optimum grid size suitable for LES modeling. Once calibrated, the model was applied to simulate a range of experimental conditions for different gate openings under a range of realistic head differences typically expected in Louisiana flow control structures. An empirical equation requiring just two calibration coefficient was then developed through a multi-linear regression analysis to develop a gate discharge rating curve which can be readily used by hydraulic engineers to calculate discharge and headloss for a given geometry of the gate, opening size and head difference. The developed equation can also be used as an independent internal boundary condition in large scale two-dimensional shallow water equation-based basin wide models. This study is expected to aid hydraulic modelers, designers and operation managers make appropriate decision regarding the choice of tainter gate, optimum sizing and the operational range.

Presenter or Panelist 2: Robert Miller | University of Louisiana at Lafayette, robert.miller@louisiana.edu

Evaluation of climate induced repetitive flood loss potential on a municipal scale

As of 2019, the state of Louisiana had the highest number of unmitigated repetitive flood loss properties in the United States. A reduction in the number of repetitive loss properties could significantly improve quality of life for Louisiana residents, and reduce the fiscal exposure of the National Flood Insurance Program (NFIP). However, continental-scale flood models suggest that future flood hazards – particularly in Louisiana - will intensify as a result of climate change. Local-scale community engineering flood hazard models were employed in this study to assess the future repetitive loss potential for the Ile Des Cannes watershed located in the Acadiana region of southern Louisiana, USA. Trends in observed 10-year daily maximum rainfall and river tailwater intensities were combined with varying levels of distributed regional detention to develop mean estimates of future repetitive loss potential in the watershed. The results suggested that linear increases in storm intensities and peak flow rates produced an exponential increase in the potential repetitive flood loss for slab foundation structures. Although the most optimistic regional detention alternatives were outpaced by climate change-induced flood intensification, the results demonstrated such countermeasures reduce future repetitive loss potential by 30%. The findings revealed a significant bias in cost benefit evaluations which fail to factor in future climate variability. The findings also highlight practical limitations of regional flood mitigation measures relevant to municipal risk managers in climate-vulnerable coastal environments.

Presenter or Panelist 3: Soroush Sorourian | FTN Associates, Ltd., s.sorourian@gmail.com

Numerical Modeling of Tidal Influence on Lower Mississippi River Water Level, Discharge and Velo

The Lower Mississippi River (LMR) is a backwater dominated reach of the river and extends from Head of Passes (River Mile 0) to Baton Rouge (RM 230). Tidal influence propagates along the river from downstream to upstream with decreasing amplitude and widely influences water level, discharge, and velocity. Stage data from in-river gages indicates tidal effect on water level extends as far as Donaldsonville (RM 173.6) at low river and shows strong seasonality with river discharge and Gulf of Mexico tides. These tidal variations on water level and discharge in the river, extending hundreds of miles inland, have wide ranging implications affecting river engineering including but not limited to river navigation, port operations, channel morphology, wetland restoration efforts and saltwater intrusion into upstream fresh aquifers. In this study, the modulation of river water level, discharge and velocity by tides and their interaction with the seasonality of discharge variation in the LMR will be investigated using a numerical modeling tool.

A 2D Delft3D model, extending from Head of Passes to Baton Rouge was fully calibrated and validated for water levels, discharge and velocities against long term gage data at USACE and USGS stations as well as event based ADCP observations over multiple years within the last decade (2009-2020). This model will be applied to simulate a recent annual river hydrograph (2018-2019). Model results will be classified to quantify reach scale variability of typical tidal amplitude for water level, velocity and discharge variation along the LMR. The influence of varying channel cross-section, bed friction and seasonality of the river discharge and Gulf of Mexico water levels on this tidal influence will be quantified. In addition, the variation of the tidal wave speed along the different reaches will be illustrated. This study is expected to provide practicing engineers a ready resource of tidal amplitudes at different locations within the LMR.

Human Dimensions

Standard, Session #57

Encounters with Place-Based Coastal Management

State-sponsored efforts to restore the coast invoke Louisiana's "rich histories, culture, and ecosystems, and natural resources" as attributes worthy of preservation (CMP 2023: 2). Yet the very richness of coastal histories and cultures is largely absent from the broad-scale planning documents and metrics that establish and benchmark visions of coastal restoration. Likewise, coastal communities' ecological knowledge is often omitted from these plans despite generations of practice adapting to coastal change and living with water.

This panel brings together Louisiana-based practitioners and scholars to consider place- and culture-centered efforts to preserve the coast. We highlight these local efforts to advance three propositions for coastal planning. First, coastal residents, especially those who have historically been marginalized from the benefits of water management infrastructures, are adaptation experts. Second, this expertise is the product of ecological relationships that are themselves worthy of protection. Third, state-sponsored efforts to protect coastal cultures and histories are made much stronger through including coastal communities from the beginning and by paying close attention to place. We will dedicate the second half of this presentation to an open discussion of these propositions.

Session Organizer: Simone Domingue | University of Oklahoma, Email: simone.domingue@ou.edu

Moderator: David Cheramie | Independent Scholar, david.cheramie@gmail.com

Presenter or Panelist 1: Patty Ferguson-Bohnee | Arizona State University, pattyfergusonbohnee@asu.edu

Reclaiming Native Ground: The Pointe-au-Chien Indian Tribe's Fight to Maintain Cultural Heritage

The Pointe-au-Chien Indian Tribe has called the Terrebonne Basin home since time immemorial. Coastal erosion, salt water intrusion, increased storm intensity, and flooding have resulted in resettlement of Tribal homes to the current village and beyond. The Pointe-au-Chien people were never consulted for their views on the appropriate balance between environmental harm and economic gain. No funding program exists to directly assist communities such as Pointe-au-Chien with the challenges brought by sea level rise and coastal erosion and many funding programs ignore the unique nature of this historical Tribal community. As a result, the Tribe has faced the loss of sacred ancestral homelands, destruction to sacred burial sites and the endangerment of cultural traditions, heritage, health, life, and livelihoods. This presentation will discuss the adaptation and advocacy efforts undertaken by the Pointe-au-Chien Indian Tribe to maintain their cultural heritage and community despite these barriers, and the need to reform programs to value loss of culture, language and heritage.

Presenter or Panelist 2: Simone Domingue | University of Oklahoma, simone.domingue@ou.edu

Culture, Power, and Inequality in Coastal Planning

Climate adaptation in Louisiana coastal communities is fraught with politics, and community attitudes toward adaptation-- and actual adaptation practices or plans-- are infused with social values, albeit

these values may not be explicitly expressed. Despite the social underpinnings of climate adaptation, much research assumes that more technical information, better data, and community "capacity building" will resolve or ameliorate key tensions in setting adaptation priorities and making progress toward equitable risk reduction and resilience. In this talk, I problematize this assumption by highlighting the continued role of culture, power, and inequality in shaping adaptation planning in Louisiana's coastal zone. I highlight the continued need for research, practice, and advocacy that addresses the root causes and structural drivers of Louisiana's environmental crises, warranting scrutiny to the role of industry in shaping climate adaptation options, discussing resource disparities between coastal communities, and evaluating the cultural values and institutional logics that influence decision making in the coastal zone.

Presenter or Panelist 3: Will McGrew | Télé-Louisiane, will@telelouisiane.org

Language as a Form of Resilience and a Means of Maintaining Cultural Heritage

Founded in 2018, Télé-Louisiane is the multi-lingual media platform by and for the people of Louisiana. Télé-Louisiane works with private and public sector partners to produce and distribute media focused on breathing new life into Louisiana's languages, cultures, and people. In particular, Télé-Louisiane works with Louisiana Public Broadcasting to produce a weekly news show La Veillée and an animated show Boudini–in Louisiana's heritage French language dialects. This presentation will address ways in which language functions as a form of community-based resilience, collective action, and economic development across Louisiana's coastal frontline communities.

Presenter or Panelist 4: Michael Saunders | Nicholls State University, saundersbcc@gmail.com

Culture, Ecological Knowledge, and Landscape Management

In areas where communities depend heavily on the environment for their livelihood, especially when those communities have inhabited the same landscape for generations, cultural and ecological knowledge are deeply intertwined, and cultural loss is accompanied by the loss of vital experiential understanding of local ecosystems. Maintaining robust cultural ties is thus critical to environmental resilience, as local ecological knowledge is a key asset related to landscape management and ecological sustainability. This is particularly so in common property resource contexts such as the fisheries and marshes of Louisiana. Failing to incorporate such knowledge into environmental planning – whether at the planning, implementation, or monitoring phases – not only diminishes the crucial nature of this ecological understanding, but also overlooks the important database local cultural and ecological knowledge represents. This paper explores the role Traditional Ecological Knowledge (TEK) can, and should, play in planning and restoration initiatives in coastal Louisiana.

Human Dimensions

Standard, Session #58

Building Capacity for the Future of the Coast

During this session, audience will hear from different programs working across the coastal communities in Gulf of Mexico region to build capacity of the future generations and creating caring stewards to foster, restore and revitalize our coastal communities. In this panel, audience will hear about:

CSED Environmental Research Internship – CSED Environmental Research Internship is a year-around education and community beyond the school day initiative to encourage high school students to gain hands-on in STEM and environmental research related experiments and activities. COVID-19 has wreaked havoc in the lives of students and families, as many are pondering next steps. This program provides an exciting line-up of activities and explorations planned that excite and stimulate curiosity to science and expose our "youth scientist and researchers of tomorrow" to experiments in various fields of engineering, biology, chemistry, physics, optics and optical illusion, earth sciences and mathematics. This initiative provides lessons and experiences about the illustrious minority men and women in science and interact with present day professionals, educators and public officials who support the development and restoration of our coastal communities throughout Louisiana.

Brother Martin High School on Raising Coastal Issue Awareness through High School Education - We have created an interdisciplinary unit with our 8th grade honors students in World Geography and English I that is built around the anchor text Bayou Farewell (Mike Tidwell), which is read in the summer before the start of school. Students participate in two field experiences, one near the start of the unit and one as the culminating activity. Initially, we travel to the Caernarvon diversion, bag oyster shells with the Coalition to Restore Coastal Louisiana in Violet, Louisiana, visit a Catholic church in Lake Catherine destroyed by Hurricane Katrina and now rebuilt, and do rudimentary water testing in Lake Pontchartrain. Students read a variety of articles on coastal challenges and proposed solutions and participate in a Q and A with an expert panel that features environmental scientists, wildlife and fisheries experts, and coastal reporters. In groups students research the pros and cons of a variety of coastal restoration strategies and present their findings to their peers. Finally, students tour the Center for River Studies display and the Department of Coast and Environment at LSU, both in Baton Rouge.

University of New Orleans course at the Bay Denesse Living Laboratory - We have designed a place-based course for Earth and Environmental Science undergraduates at the University of New Orleans that focuses on Bay Denesse, as part of the Bay Denesse Living Laboratory. The area exemplifies the confluence of stakeholders and forces that shapes the Louisiana coast. In the last year of their undergraduate education, students come ready to apply their previous coursework in a real-world context. The first iteration in fall 2022 culminated in designing and building a structure to enhance sediment retention, which remains in place today. The course runs every semester, and students build off the previous cohort's work. This presentation will review course activities and lessons learned, as well as solicit feedback from educators and residents alike.

Two fellowship programs from The National Academies of Sciences, Engineering and Medicine's Gulf Research Program (GRP). Two alumni from GRP's Science Policy Fellowship and Early-Career Research Fellowship will highlight their experiences on how these opportunities helped shape their career paths.

Early-Career Research Fellowship alumni will speak to the importance of funding early-career researchers and providing flexible funding to support innovative research. Science Policy Fellowship alumni will shed light on the importance of working at the intersection of science and policy, gaining that first-hand experience in science policy space, learning about the region, and the value of mentorship. They will are excited to share about their career trajectory, their current work, the importance of building and retaining capacity in the region, and how their fellowship experience supported them in their careers.

Session Organizer: Maeesha Saeed | Gulf Research Program - National Academies of Sciences, Engineering, and Medicine, Email: msaeed@nas.edu

Moderator: Arthur Johnson | Center for Sustainable Engagment and Development, (CSED), ajohnson@sustainthenine.org

Presenter or Panelist 1: Brittany Bernik | Gulf Coast Ecosystem Restoration Council, brie.bernik@restorethegulf.gov

Presenter or Panelist 2: Bryce Black | CSED Student Intern, directorcsed@gmail.com

What We Learned During this Environmental Research Internship
Introduced to the waterways surrounding us:

Mississippi River Channels, the Wetlands, Pollution and Threats to wildlife and our community

Field trips:

the levee where the industrial canal meets the Mississippi River, Bienvenue Wetland Triangle, Bayou Sauvage,

and a boat trip on the Port of NOLA

Presenter or Panelist 3: Madeline Foster-Martinez | University of New Orleans, mrfoster@uno.edu

Place-based education for the future of Our Coast: Bay Denesse Living Laboratory
Place-based education is an established pedagogical approach that can increase students' connections to the environment. By focusing on one geographic location, one can more easily examine the forces that have shaped it – both past changes and future projections – addressing inherent interdisciplinarity of natural-human systems. We have designed a course for Earth and Environmental Science undergraduates at the University of New Orleans that focuses on Bay Denesse. Bay Denesse exemplifies the confluence of stakeholders and forces that shapes the Louisiana coast. The area contains built and natural infrastructure, restoration activities (e.g., dredged-material placement), land cover change, natural recruitment of vegetation, and multiple land use practices. It is influenced by, as well as influences, the Mississippi River via Neptune Pass, bringing up issues of navigation and commerce, and media attention in the area provides the opportunity to analyze different writing styles and purposes.

The Bay Denesse Living Laboratory provides a platform to facilitate greater interaction between the students and practitioners in the area. This collaborative environment allows them to gain insights from multiple perspectives of the landscape, provide additional professional development opportunities, more easily access existing data, streamline needed permitting, and interact with elementary and high school students, providing those students with additional role models.

In the last year of their undergraduate education, students come to this course ready to apply their previous coursework in a real-world context. The first iteration in fall 2022 culminated in designing and building a structure to enhance sediment retention, which remains in place today. The course runs every semester, and students build off the previous cohort's work. This presentation will review course activities and lessons learned, as well as solicit feedback from educators and residents alike.

Presenter or Panelist 4: Jayden Lewis | The Scientific Method, As researchers, we need to follow a procedure of

collecting data and evidence called the Scientific

Method:

make an observation (in our case, the water

smelled unusual)

ask a question (why does it smell?)

form a hypothesis (a testable explanation)

Presenter or Panelist 5: Bernard Singleton | CSED, Creating the Environmental Research Internship Initiative

jbsbless@yahoo.com
CSED Environmental Research Internship is a year-around

education and community beyond the school day initiative to encourage high school students to gain hands-on in STEM and environmental research related experiments and activities. COVID-19 has wreaked havoc in

the lives of students and families, as many are pondering next steps.

This program provides an exciting line-up of activities and explorations planned that excite and stimulate curiosity to science and expose our "youth scientist."

Presenter or Panelist 6: Jonathan Smith | CSED Student Intern, directorcsed@gmail.com

Ongoing Research
This internship introduced us to the multiple

waterways surrounding New Orleans and their

importance to our community and economy

We learned about the connection of the

Mississippi and the wetlands and how important

it is to take care of these resources

We observed the importance of wildlife and

plantlife and how much we need to preserve their

habitats (the wetlands)

We learned that as members of this community,

we need to do our part to preserve and protect

our natural waterways

Presenter or Panelist 7: Phoebe Zito | Assistant Professor in the Department of Chemistry at the University of New Orleans, pazito@uno.edu

Presenter or Panelist 8: Thomas Mavor | Brother Martin High School, tmavor@brothermartin.com

Raising Coastal Issue Awareness through High School Education

8th grade English I Honors and World Geography Honors students at Brother Martin High School experience a multi-step interdisciplinary unit that includes geography and writing content as well as map reading and writing/researching skills while exposing s

Coastal Law, Policy & Funding

Standard, Session #59

Disaster Recovery and Planning for Social Resilience

In 2022 the City of New Orleans developed its first ever local disaster recovery framework. The recovery framework addresses a major gap in disaster management practice, in which long-term recovery occurs across sectors and outside of the traditional purview of emergency managers. The Hazard Mitigation Office worked with a community advisory committee to develop a flexible, scalable operational framework to guide future recovery efforts. This session will cover the planning process, key framework elements, and how the city has begun using the framework during the Hurricane Ida recovery process. This panel will also discuss home elevation policies across coastal Southeast Louisiana and present the results of preliminary ethnographic research conducted in Lower Plaquemines Parish investigating why coastal community resident hold such antipathy towards home elevation requirements, including the perception that FEMA home elevation policies are a broader government strategy to depopulate the coast and drive out coastal community residents. This panel will present a strategy for a more flexible and locally informed approach building on existing cultural practices, social systems, and inherited knowledge. The panel will also discuss FEMA's Risk Rating 2.0 and discuss a review study using exploratory data analysis and visualization of the rating factors released by FEMA to better understand the risk premium. The information provided in this study can help homeowners, community developers, and government agencies make more informed decisions about their flood insurance policies by understanding the effect of different attributes on risk premiums.

Session Organizer: | , Email:

Moderator: Beaux Jones | The Water Institute, bjones@thewaterinstitute.org

Presenter or Panelist 1: Austin Feldbaum | City of New Orleans, afeldbaum@nola.gov

NEW ORLEANS COMPREHENSIVE DISASTER RECOVERY FRAMEWORK

In 2022 the City of New Orleans developed its first ever local disaster recovery framework. The recovery framework addresses a major gap in disaster management practice, in which long-term recovery occurs across sectors and outside of the traditional purview of emergency managers. Disaster recovery can be a pivotal moment to reduce future risk, increase resilience and sustainability, and take steps to address pre-disaster inequities. The Recovery Framework establishes recovery as a distinct phase in the disaster management cycle and will support coordinated disaster recovery processes to achieve better recovery outcomes.

The Hazard Mitigation Office worked with a community advisory committee to develop a flexible, scalable operational framework to guide future recovery efforts. The framework integrates external partners with city recovery management teams to formalize sharing of information and resources. The framework also identifies desired recovery outcomes and metrics that can be used to track recovery progress, as well as continuous improvement processes to institutionalize lessons learned through recovery from successive disasters.

This session will cover the planning process, key framework elements, and how the city has begun using the framework during the Hurricane Ida recovery process.

Presenter or Panelist 2: Grant McCall | Center for Human-Environmental Research, mccall@cherscience.org

Left High and Dry: Social Impacts of FEMA Home Elevation Policies in Lower Plaquemines Parish

Since Hurricane Ida in 2021, the Federal Emergency Management Agency (FEMA) has sought to more strictly enforce existing home elevation policies across coastal Southeast Louisiana. These policies are meant to protect homes from flooding resulting from tropical storms. However, such policies are widely reviled by coastal community residents, who perceive them as imperious, ineffective, unaffordable, and unfair. This paper presents the results of preliminary ethnographic research conducted in Lower Plaquemines Parish investigating why coastal community resident hold such antipathy towards home elevation requirements. Above all, we find that there is enormous fear concerning access to funding and services for home elevation, as well as deep resentment about inequalities in terms of those who have the resources to elevate their homes and those who do not. There are also anxieties concerning the imposition of barriers to individuals buying, selling, and insuring homes. Finally, there are issues such as climbing stairs for the elderly and disabled, the risk of falling for families with children, and the fact most local tropical storm damage has been caused by wind rather than water. In the end, most Lower Plaquemines Parish residents do not believe that they will be able to elevate their homes. Furthermore, many perceive FEMA home elevation policies as a broader government strategy to depopulate the coast and drive out coastal community residents. We argue that the FEMA policies would be better informed and more effective based on a more thorough ethnographic consideration of both the socioeconomic context of coastal communities and vernacular architectural strategies as they relate to issues of risk reduction and disaster recovery. Rather than forcing coastal communities into a one-size-fits-all risk reduction policy, we argue for a more flexible and locally informed approach building on existing cultural practices, social systems, and inherited knowledge.

Presenter or Panelist 3: Md Adilur Rahim | Louisiana State University, mrahim@agcenter.lsu.edu

Communicating Flood Risk Information through Risk Rating 2.0

The Federal Emergency Management Agency (FEMA) has introduced a new risk-based premium approach called Risk Rating 2.0 which considers geographic attributes (e.g. distance to the lake, river, coast), building attributes (e.g. foundation type, first-floor height), and policy attributes (e.g. coverage and deductible limit) by coverage (i.e., building and contents) and perils (i.e., pluvial and fluvial flooding, storm surge, tsunami, great lake, and coastal erosion) to estimate risk premiums. In this review study, we conduct exploratory data analysis and visualization of the rating factors released by FEMA to better understand the risk premium. The associated rating factors are multiplied and summed by coverage to get the initial premium without fees for each structure. As the rating factors are multiplicative, lower factors contribute to lower risk premiums. The rating factors decrease with increasing distance from flood sources.

Individual and community level flood mitigation play a significant role in reducing the Risk Rating 2 insurance premium. The elevation of a structure is an important indicator where the higher elevation of the structure relative to flood sources lowers the risk factors. Similarly, the first-floor height, type of foundation (slab foundations having lower factors than crawlspace foundations), the occupancy of the property (single-family home masonry having a lower rating factor than frame structure), floor of interest, and whether machinery and equipment is elevated above the first floor affect the risk factors

and therefore the premium. Additionally, the Community Rating System (CRS) can also provide discounts on the initial premium, with discounts ranging from 5% to 45% based on the CRS class. Overall, the information provided in this study can help homeowners, community developers, and government agencies make more informed decisions about their flood insurance policies by understanding the effect of different attributes on risk premiums.

Hydrology, Geomorphology, and Ecology of the Coast

Standard, Session #60

Factors that influence the abundance and resilience of wildlife and fisheries

Louisiana's and surrounding coastal system supports abundant and diversion wildlife and fisheries. In this session, speakers will explore factors that influence densities of nekton and distribution of invasive species, the breeding success of bird colonies on barrier islands, cutting edge research to support oyster population resilience under changing environmental conditions, and an effort to facilitate interstate collaboration on restoration and management of commercially important fisheries.

Session Organizer: | , Email:

Moderator: David Muth | Restore the Mississippi River Delta, muthdp@gmail.com

Presenter or Panelist 1: Quenton Fontenot | Nicholls State University, quenton.fontenot@nicholls.edu

Dynamics of the Annual Flood Pulse May Affect Larval Invasive Carp in the Atchafalaya River

To evaluate the extent of invasive carp spawning areas, Louisiana Department of Wildlife and Fisheries (LDWF) personnel sampled waterways monthly in 2013 (May – July), 2014 (April – June), 2019 (May – June), 2021 (April – June), and 2022 (April – June) with ichthyoplankton nets (500 µm mesh) towed just below the water surface for a target duration of 600 s. Samples were transferred to one-liter plastic containers, fixed with 70% ethanol, and then transferred to Nicholls State University. All larvae were identified to family and cyprinids were designated as invasive carp or not invasive carp. Invasive carp larvae were collected in the Atchafalaya, Mississippi, Ouachita, and Red Rivers and were not collected in SW LA or north of Lake Ponchartrain. Invasive carp abundance was similar for 2013 and 2014, relatively low for 2019, and extremely high for 2021 and 2022 (Figure 1) and extremely prevalent in the Atchafalaya River system. It appears that invasive carp reproduction is much higher in normal flood pulse years (2021 and 2022) than years that have an altered flood pulse (2013, 2014, and 2019). The Atchafalaya River Basin also has prime juvenile habitat and is likely a main source of invasive carp in Louisiana.

Presenter or Panelist 2: Ann Fairly Pandelides | University of Louisiana at Lafayette, ann.pandelides@louisiana.edu

From lab bench to hatchery: operationalizing a genomic approach for oyster selective breeding

Louisiana oysters support one of the largest fisheries in the U.S. Gulf of Mexico, adding significant economic value and providing key ecosystem services and estuarine habitat to coastal communities. In recent decades, oyster populations have declined dramatically. A primary cause of this decline is fluctuating salinity in oyster reef areas caused by increased precipitation, flooding, and freshwater diversions. Freshwater inputs are predicted to continue to affect water quality and oyster habitat. Bringing together expertise in oyster ecology, genomics, environmental monitoring and oyster production, the LO-SPAT project aims to build and apply our understanding of oyster tolerance to low salinity to advance restoration goals in Louisiana. To this end, a genomic selection (GS) approach for selective breeding of low salinity tolerant oysters is being developed and operationalized for large-scale

production. Development and construction of the predictive GS model requires a high-throughput genotyping tool for oysters to facilitate accurate prediction of the trait or phenotype of interest on a large number of individuals. A 66K SNP array is now available and has been tested in Louisiana oyster populations. Operationalizing the use of a GS model in a production-focused context requires an efficient process for collection, culture, and non-lethal genotyping of candidate oysters, which will be selected for spawning based on their predicted phenotype. We are optimizing a non-lethal method for sampling candidate broodstock oysters collected from populations across the Louisiana coast. Within this workflow, advances in broodstock culture and husbandry permit selective breeding on a large scale. This talk will focus on these important considerations in operationalizing cutting edge research for oyster production. Using this approach, production of oysters in Louisiana can better support population resilience to changing coastal environments and goals for coastal restoration.

Presenter or Panelist 3: Andrea Santariello | University of Louisiana at Lafayette, aksant92@gmail.com

Caught on Camera: the summer lives of island breeding Royal Terns and Black Skimmers

The rapidly disappearing coastal marshes and islands of Louisiana are important breeding habitat for many seabird species. This study investigated the factors that influence the breeding success of Royal Terns and Black Skimmers on a number of Louisiana's coastal islands. Motion-detection game cameras were used to observe colonies 24/7 throughout each breeding season from 2018-2021. Breeding success and causes of nest failure were recorded for a sample of nests detected by each camera. We used generalized linear models, with binomial structure, and covariates that include island/colony habitat characteristics and predator activity to investigate how they influence breeding success. We found that the most common cause of nest failure was due to flooding, followed by opportunistic predation from colony disturbance. The results of this study provide important information on the conservation of Royal Tern and Black Skimmer breeding colonies in Louisiana, specifically as it relates to the restoration of its coastal islands.

Presenter or Panelist 4: Tom Sevick | The Water Institute, tsevick@thewaterinstitute.org

The Effects of Habitat Type and Complexity on Nekton Assemblages in the Oligohaline Marshes

Coastal Louisiana has extensive communities of Submerge aquatic vegetation (SAV) which provide a variety of ecosystem services to both nekton and coastal communities (food and shelter for nekton, sediment stabilization, storm protection and fisheries production). In addition to SAV, the estuaries of coastal Louisiana contain several species of introduced floating aquatic vegetation (FAV), which have the potential to significantly impact aquatic ecosystems. Nekton were sampled in submerged aquatic vegetation (SAV), in floating aquatic vegetation (FAV) and over non-vegetated bottom within the oligohaline marshes in three basins in coastal Louisiana (Atchafalaya, Barataria and Pontchartrain). In addition, the mean fractal complexity of these major habitats was assessed.

While the correlation between nekton abundance and diversity and the abundance of SAV has been documented, the mechanistic drivers behind this relationship are relatively unknown. The purpose of this study was to quantify nekton densities in key habitat types and to assess the relative role of fractal complexity in nekton habitat usage. Nekton were collected using 1-m2 throw traps taken in May 2015. Results from this study confirmed that nekton density is directly related to SAV and FAV percent cover, with higher densities of nekton being sampled in vegetated habitats. In addition, our results showed a strong connection between fractal complexity and the density and assemblage structure of nekton. Our results suggest that invasive species of FAV provide fractally complex habitats which nekton can

effectively utilize for cover. Procambarus sp., in particular, made use of species of FAV and were significant indicators of high levels of fractal complexity. There appear to be species-specific patterns of habitat use by certain nekton groups. Moreover, within vegetated habitats fractal complexity appears to be an important factor influencing nekton.

Presenter or Panelist 5: George Ramseur | Moffatt & Nichol, gramseur@moffattnichol.com

Evaluating the Impacts of Management Action and Natural Drivers on Water Quality in the LMACS

The Louisiana, Mississippi, Alabama Coastal System (LMACS) is a science planning domain that redefines the Mississippi Sound to help facilitate interstate collaboration on complex restoration and management issues. This domain includes jurisdictions of the Mississippi Department of Marine Resources, Louisiana Coastal Protection and Restoration Authority, Alabama Department of Conservation and Natural Resources and their state and federal partners. These agencies have similar goals for water quality and estuarine/marine resources which have functional linkages across the three states. For example: Mississippi has lost oyster production over the last two decades amid indications that factors in adjoining states may be key to potential management solutions. However, funding and support for multi-state actions are limited, and regulatory and scientific consensus are needed. The 2021 NOAA RESTORE Science Program funded our Team to develop research and application Plans to pursue this regulatory and scientific consensus.

We are seeking to implement these Plans beginning with how hydrologic flow, salinity, temperature, and extent of viable oyster habitat in the LMACS varies in response to climate change as well as factors potentially controlled through management action, such as restoration of barrier islands & marshes or manipulations of freshwater inflows. Specific actions to be investigated include potentially increasing the longshore extent and mass/volume of the island & marsh barrier system from Chandeleur & Biloxi Marsh to Mobile Bay. Other actions could include historic structural oyster reef restoration, navigation channel modifications and manipulations of natural and human induced variability in freshwater inflows from the Mississippi River through Mobile Bay. Natural drivers to be investigated will include relative sea level rise; variability in quiescent and storm conditions; and changes to inflows and storm patterns associated with climate change.

Presenter or Panelist 6: Soupy Dalyander

| The Water Institute, sdalyander@thewaterinstitute.org

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Human Dimensions

Standard, Session #61

Research on Sediment Diversions

This session consists of 5 presentations related to the Mid Barataria Sediment diversion, covering topics from historical context to data collection to anticipated environmental impacts.

Session Organizer: | , Email:

Moderator: Ann Hijuelos | USACE, <Ann.Hijuelos@usace.army.mil>

Presenter or Panelist 1: Jason Chauvin | T. Baker Smith, jason.chauvin@tbsmith.com

Mid-Barataria Sediment Diversion - River Sampling

The Mid-Barataria Sediment Diversion (MBSD) project, located on the west bank of the Mississippi River at River Mile 60.8, will reconnect the Mississippi River to the Barataria Basin by delivering sediment, fresh water, and nutrients to rebuild the delta marshes with the goal of improving coastal protection against the effects of sea level rise, subsidence, and storm events.

Extensive data collection efforts were made to support the engineering and design of the diversion. Included in this effort were data collection in the Mississippi River to support numerical and physical modeling of the diversion with the goal of understanding the sediment load in the river over a range of flows and hydrograph trends. Results of the data collection and modeling efforts will also support the development of an operation plan for the diversion. Mississippi River sampling included water discharge and current profiling, suspended sediment concentration, bed sediment grain size, bed load transport, and batture sediment sampling. Sampling equipment, processes, and results will be presented.

Presenter or Panelist 2: Robert Feder | Louisiana State University, rfeder2@lsu.edu

Impact of river diversions on salinity and nutrient availability in brackish marsh soils

Louisiana plans to restore eroded coastal marshes by diverting sediments, nutrients, and fresh water from the Mississippi River to the Barataria Basin estuary. Models predict that surface water salinity in lower Barataria Basin may decrease by as much as 13 ppt once the Mid-Barataria Sediment Diversion is in operation. Changes in surface water salinity can alter soil porewater chemistry, plant productivity, and carbon- and nitrogen-cycling in wetland soils. This study investigated the impact of a freshwater pulse associated with river diversions on porewater salinity and nutrient availability in brackish marsh soils of lower Barataria Basin.

Replicate soil cores were continuously flooded with a fresh or control salinity treatment for 0, 7, or 28 days, mimicking the continuous operation of the Mid-Barataria Sediment Diversion for upwards of one month. At the end of each incubation period, the intact soil cores were destructively sampled to characterize porewater salinity and ammonium (NH_4^+) availability every 2 cm for the top 10 cm of soil.

Porewater salinity decreased by 5.3 ppt at 0-2 cm in brackish marsh soil after 7 days of a continuous freshwater pulse. The NH_4^+ partition coefficient, a ratio of the NH_4^+ bound to soil versus NH_4^+ mobile in porewater, also increased in the top 2 cm of soil after 7 days of freshwater pulsing. Porewater salinity

and the NH4+ partition coefficient in the top 10 cm did not experience any additional change between 7 to 28 days of freshwater pulsing. A decrease in the surface water salinity of lower Barataria Basin may ultimately decrease porewater salinity in brackish marsh soils and increase the concentration of NH4+ bound to soil particles. This change could potentially conserve additional nitrogen for plants and microbes in marsh soils, whereas a decrease in NH4+ sorption might release excess nitrogen into Barataria Basin where it can support harmful algal blooms that threaten coastal communities.

Presenter or Panelist 3: Marlene Friis | Tulane University, mfriis@tulane.edu

Understanding the Historical Context of the Mid-Barataria Sediment Diversion Project

The Mid-Barataria Sediment Diversion (MBSD) will be Louisiana's largest land loss mitigation project. It seeks to sustainably reconnect the Mississippi River to its deltaic plain at a cost of $2.2 billion. This presentation will lend historical context to engineering projects designed to control the natural course of the Mississippi River and prevent annual floods, which, however, are necessary for delta-building. The MBSD is essentially an attempt to reverse some of the consequences of the levee system built and maintained by the US Army Corps of Engineers, which, in turn, have been compounded by oil and gas navigation canals as well as natural forces. The presentation will contextualize the foregrounding of sediment diversions in the very first attempts to address the issue of land loss in Louisiana. As such, it will chronicle the various iterations of the MBSD from its genesis in CRCL's original 1987 civic document to save the coast, through to Coast 2050, and CPRA's 2006, 2013, 2017, and 2023 Master Plans. It will also include how CPRA's recommendations dovetailed with the Louisiana Trustee Implementation Group's BP Oil Spill funding mandate, which is the MBSD's major source of funding. The presentation will review the decision drivers and constraints embedded in CPRA's Planning Tool and highlight how the increase in scale and broadening of beneficiaries may contribute to a mismatch between perceived local needs and those of the state. The purpose of this presentation is to supply historical context to the MBSD to facilitate understanding of how such projects come into being and nurture a more nuanced appreciation for both proponents and opponents of an engineering project of this size in Plaquemines Parish.

Presenter or Panelist 4: Mercedes Pinzon Delgado | Louisiana State University, mpinzo1@lsu.edu

Impact of River Reconnection on Water Quality in Brackish Marsh in Coastal Louisiana, USA

Wetlands provide important ecosystem services including improving surface water quality through nutrients removal. Louisiana has experienced ~4800 km2 of coastal wetland loss between 1932 and 2016 due to high relative sea level rise, and reduced sediment from Mississippi River (MR) due to levees. The 2017 LA Coastal Master Plan aims to restore Louisiana's degraded coastline through restoration projects, including sediment diversions.

The Mid-Barataria Sediment Diversion Project is intended to reconnect MR sediment-laden water with the wetlands of Barataria Basin to nourish degrading marshes. However, the diversion will also deliver substantial nitrate (NO3-) to the basin, potentially negatively impacting water quality. We sought to quantify NO3- reduction rates for marsh and submerged sediments in Barataria Basin using soil cores receiving 2 mg N-NO3 L−1. In addition, 2 cm of mineral river sediment from a MR crevasse splay was placed over the organic marsh soil as an additional treatment to replicate sediment deposition on the marsh once the MR is reconnected. We hypothesized that NO3- reduction rates would decrease once mineral sediment is deposited on the organic marsh soil. For an aerobic water column, nitrate reduction rates for vegetated marsh, post-diversion marsh, submerged eroded marsh (fringe) and estuarine mud zones were 71.1 ± 2.7, 27.8 ± 4.5, 19.7 ± 1.2, and 13.0 ± 0.75 mg N m−2 d−1, respectively. Thus, the post-

diversion marsh NO3- reduction rate decreased by ~60% compared to current vegetated marsh. However, we predict the newly deposited sediment will increase NO3- removal by 1.17x in the fringe and mud zones, which are always flooded. The marsh is only flooded 31-48% of the time, lessening the impact of the reduction. These findings can improve parameterization of water quality models used to project nutrient loading and fate more accurately across the basin under a scenario of an operating large river reconnection project.

Presenter or Panelist 5: Melissa Awbrey | Tulane University, mawbrey@tulane.edu

Designing and Engaging for Resilience: The Mid-Barataria Sediment Diversion

As we face the existential crisis of climate change and other ecological crises in coastal Louisiana, we must find ways to preserve and increase the social and cultural resilience of people and communities impacted by these crises as well as by the decisions made and actions taken to mitigate and adapt to them. This is a moral issue, but it is also a practical one as ultimately our ecological and socio-ecological resilience in the face of these crises will come from people, from our individual and collective capacities to create sustainable and just solutions and future pathways together. In this presentation, I will discuss opportunities for the CPRA and coastal protection and restoration organizations to shape a more robust plan going forward to address the social and cultural impacts of the Mid-Barataria Sediment Diversion (MBSD) project currently underway in southeast Louisiana as well as other current and future projects. Deep and authentic partnership with impacted communities is essential to sufficiently integrate social and cultural considerations into coastal protection and restoration processes like the MBSD. Despite CPRA and partner organizations' significant efforts to engage impacted communities, some still feel forgotten and sacrificed, frustrated that decisions that impact them are made without sufficiently involving them, and deeply disappointed that their valuable, place-based knowledge is not legitimately being considered when it is so desperately needed. I will discuss underlying factors contributing to this disconnect and will offer suggestions for how CPRA and other coastal protection and restoration organizations can better partner with the community going forward. I will also reflect on the broader implications of the questions and opportunities raised by this exploration for global resilience in the face of climate change and other environmental crises.

Predicting and Planning for the Future of the Coast

Panel, Session #62

Developing Integrated Engineering and Design Solutions (DEEDS) for Coastal Louisiana

Ecosystem restoration is defined as "the action of repairing sites in nature to their former function or condition." Coastal land loss and sea level rise are negatively impacting coastal ecosystem functionality, communities and infrastructures. As a result, ecosystem restoration efforts are proposed that harness natural and nature-based features (NNBF) to build land and protect key assets. However, these restored landscapes will scarcely resemble what previously existed. Arguably, the approaches proposed within restoration frameworks are more design-oriented processes, though designers such as landscape architects and planners are rarely involved in their development and implementation. The LSU Coastal Sustainability (CSS), with support from the USACE Engineer Research and Development Center (ERDC) through the Developing Integrated Engineering and Design Solutions (DEEDS) project, proposes a Collaborative Ecosystem Design (CED) technical approach to the development of NNBF projects in coastal landscapes. The CED framework focuses on how environmental co-benefits are associated with NNBF in the Gulf, and strives to develop 'design-criteria' that quantifies the relationships among ecosystem structure & processes with specific values of goods & services to reduce uncertainty in evaluating social benefits. LSU CSS was developed in 2009 to span the divides between disciplines such as coastal science, engineering, architecture, planning, and economics to 1) conduct research that incorporates ecosystem services into performance measures, and 2) educate the next generation of multidisciplinary coastal professionals. This panel discussion engages faculty and students from across disciplines to 1) highlight working partnerships between LSU CSS, USACE, CPRA and other state and local agencies to develop CED and risk reduction measures; and 2) present site-specific ecosystem designs developed by multidisciplinary student teams during the 2022 CSS Summer Internship Program.

Session Organizer: Traci Birch | Louisiana State University, Email: tbirch@lsu.edu

Moderator: Traci Birch | Louisiana State University, tbirch@lsu.edu

Presenter or Panelist 1: Jacob Gautreaux | Louisiana State University, jgaut53@lsu.edu

Presenter or Panelist 2: Ulsia Urrea Marino | Texas A&M University - Corpus Christi, uurreamarino@islander.tamucc.edu

Presenter or Panelist 3: Tabassum Islam | University of South Alabama, ti2121@jagmail.southalabama.edu

Presenter or Panelist 4: Grayson Loudon | Louisiana State University, gloudo1@lsu.edu

Hydrology, Geomorphology, and Ecology of the Coast

Panel, Session #63

Industrial Impacts on the Safety of Coastal Communities

This panel discusses various impacts of coastal industries on communities. It includes environmental analysis of abandoned oil wells in Louisiana, the water demands of petrochemical and liquefied natural gas (LNG) exports, underreporting of pollution fallout from Hurricane Ida, environmental concerns related to the expansion of carbon capture and sequestration (CCS), and how growth of CCS is in competition with the growth of renewables in the medium term.. While abandoned wells, LNG, hurricane-related pollution, and CCS are disparate topics, the topics are intricately related by their connections to the current dangers faced by marginalized communities along the Gulf Coast. It is impossible to analyze underreported pollution thoroughly without discussing which communities have historically received less attention, or to invite new CCS technologies into the state without examining the racially and economically disadvantaged communities that would be most affected by a possible CO2 leak or drinking water infiltration. Energy, economy, and ecology are impossible to separate in Louisiana and Texas, and the presentations in this session collectively show that a holistic view of Gulf Coast's current moment demands an intersectional, diverse approach.

Session Organizer: Jade Woods | Center for International Environmental Law, Email: jwoods@ciel.org

Moderator: Chris Dalbom | Tulane University, cdalbom@tulane.edu

Presenter or Panelist 1: Naomi Yoder | Healthy Gulf, naomi@healthygulf.org

Hurricane Ida Pollution and Data Justice

In the months following the August 29, 2021 landfall of Hurricane Ida, we examined reports of pollutant releases due to the storm by aggregating and analyzing otherwise unorganized data from federal and state reporting agencies. In total, the assessment of Hurricane Ida-related release data shows that there were 2,230 pollution events that occurred directly or indirectly because of the hurricane. Notably, this included a minimum of 171 oil spills involving a cumulative 5,436 barrels, as well as an additional 257 reports of sheens covering over 65 million square meters. There were 48 instances of air pollution reported, accounting for approximately 730 tons of pollutants emitted. Despite the alarmingly high numbers, these totals are almost guaranteed to be an undercount of what was actually released due to severely lacking data protocols by the response agencies involved: the vast majority of pollution incident records indicate a simple occurrence, without specifying the type or amount of pollutant. In this presentation, we discuss these and other challenges to adequate pollution reporting and data transparency in Louisiana. Storm-related pollution events are not mere "acts of God," but rather reflect systemic neglect of coastal communities by industry and their supposed regulators. The distribution of fossil fuel infrastructure in the state—and thus the distribution of impacts when that infrastructure fails—makes this a pressing environmental justice issue. We conclude with proposals for increasing access to standardized pollution data, as one of many tools needed in the fight for clean air and water on the coast.

Presenter or Panelist 2: Sheehan Moore | Healthy Gulf / CUNY Graduate Center, sheehan@healthygulf.org

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Presenter or Panelist 3: Jade Woods | Center for International Environmental Law, jwoods@ciel.org

Presenter or Panelist 4: Scott Eustis | Healthy Gulf, scotteustis@healthygulf.org; scott@healthygulf.org

The Geography of Leasing Conflicts between Oil and Gas and Wind Power in the Gulf of Mexico

Offshore Wind power is a key element to the industrial electrification that Louisiana cites as vital to the state's future (Governor's Climate Task Force, 2022)

We have already witnessed that the labor skill sets and materiel can be largely transferable from the oil services sector to servicing methane leaks and building offshore structures. Previously, labor moratoriums from oil services have resulted in higher wages than when oil was actively drilling (Aldy, 2016). However, economists (Iverson, 2015) have stated that the growth of Carbon Capture and Sequestration is in competition with the growth of renewables in the medium term.

This is made obvious when we examine the limited geography of the plan to lease the Gulf of Mexico for Wind Power, against the geography for oil and gas leasing, including leases for Carbon Capture offshore (BOEM 257, Tier 1 Depleted Reserviors, 2022). Wind leases are limited by 16 factors (Celada for BOEM, 2022), including oil and gas pipelines and current oil and gas leases. Wind leases are also geographically restricted by the Endangered Species Act, and avoid impacts to the Rice's Whale, in a manner that oil and gas leases are not. Wind leasing must also avoid coastal areas, as well as fishing areas.

These conflicts have environmental justice implications, especially in regards to the geography of native american populations on the Louisiana coast (Hemmerling, DeMeyer, Parfait, 2021, Department of Energy, Energy Justice Dashboard, 2021).

In this presentation, we will review GIS layers presented by BOEM to describe potential geographical conflicts including as well as challenges to Louisiana ports that may wish to service wind power leases.

Presenter or Panelist 5: John Allaire | Retired Environmental Engineer, johncallaire@yahoo.com

25 Years of Coastal Changes in South West Louisiana from Resident's Perspective

A discussion of major changes in the coastal Chenier Plain related to coastal erosion and industrial development. Mr. Allaire, a retired environmental business manager, has lived on the coast of Cameron Parish since 1998. Discussion will include a photo essay of the changes and challenges of coastal erosion and industrial expansion in south west Louisiana.

Flood Risk Management: Coastal and Inland

Standard, Session #64

Compound Flooding

This session explores the challenge of compound flooding by considering analytical approaches that enable representative simulations to capture uncertainties around the joint effects of inland and coastal flooding. Aa novel probabilistic framework for compound coastal flood risk modeling developed for the Louisiana Watershed Initiative Pilot Study in the Amite River Basin titled the Extended Joint Probability Method with Optimal Sampling (EJPM-OS) will be described. This extends existing work on Joint JPM-OS previously used for purely surge and wave driven flooding. The complex and nonlinear physical interactions between inland and coastal flood drivers increase the uncertainty and bias in numerical modeling approaches for quantifying compound flood hazards. The pilot study of the coastal Amite watershed uses over 300,000 HEC-RAS model runs across a spectrum of compound flooding conditions and showcases how we may more precisely quantify epistemic and aleatory uncertainty and bias, efficiently select boundary conditions, and leverage detailed modeling efforts to inform more precise probabilistic assessments of flooding. A fully-coupled version of the Adaptive Hydraulics Model was used to simulate multiple flood sources in a single model to fully encompasses the transition zone and mechanistically account for the interacting flood drivers. Model applications and results include simulations of Hurricane Barry in Louisiana and Hurricane Harvey in Texas.

Session Organizer: | , Email:

Moderator: Hugh Roberts | The Water Institute, hroberts@thewaterinstitute.org

Presenter or Panelist 1: Nathan Geldner | Purdue University, ngeldner@purdue.edu

Coastal Compound Flooding for the Louisiana Watershed Initiative – The Extended Joint Probabilit

While probabilistic modeling of coastal flooding resulting from a single hazard driver such as storm surge has seen significant advancement over recent decades, the more complex problem of modeling compound coastal flooding i.e. coastal flooding driven by storm surge, rainfall, and riverine dynamics together remains challenging. We present a novel probabilistic framework for compound coastal flood risk modeling developed for the Louisiana Watershed Initiative Pilot Study in the Amite River Basin titled the Extended Joint Probability Method with Optimal Sampling (EJPM-OS). This framework extends existing work on Joint Probability Modeling with Optimal Sampling (JPM-OS) previously used for purely surge and wave driven flooding. This framework leverages a stochastic rainfall field generator to produce an empirical distribution of compound surge-rainfall events with pre-computed surge and wave behavior modeled via ADCIRC + SWAN. This empirical distribution is characterized by too many events to tractably simulate with high-fidelity hydrodynamic modeling for coastwide applications. We therefore hydrodynamically simulate the empirical distribution with a lower-fidelity hydrodynamic model or instead only simulate hydrologic behavior via HEC-HMS and discretize the output distribution with k-means clustering, using Principal Component Analysis as needed for dimensionality reduction and visualization. The events nearest each cluster centroid is assigned the summed probability mass of its cluster. If we assume these events to be arbitrarily near the cluster centroids, this discretization approach minimizes the integrated L2 error induced by discretization while reducing the event set to a size which

can tractably simulated via high-fidelity HEC-RAS simulations. This approach carries a number of conceptual advantages of other more common approaches.

By Nathan B. Geldner (Purdue University), David R. Johnson (Purdue University), Shubhra Misra (The Water Institute of the Gulf)

Presenter or Panelist 2: Mark Bartlett | The Water Institute, mbartlett@thewaterinstitute.org

Quantifying and incorporating uncertainty and bias in coastal compound flooding

In low-lying coastal regions around the world, coastal compound flooding risk is projected to increase in the future under climate change. In so-called coastal transition zones—zones where fluvial, pluvial, and coastal flooding interact but neither is dominant— the complex and nonlinear physical interactions between inland and coastal flood drivers increase the uncertainty and bias in numerical modeling approaches for quantifying compound flood hazards. Broadly speaking, compound flood hazard assessments continue to evolve along two distinct yet overlapping methodologies: 1) Multi-variate statistical analyses and 2) physics based modeling. Despite rapid advancements in these methodologies, there has not been a fully probabilistic response-based assessment of compound flood hazard in low-lying coastal regions that combine tropical and non-tropical events. Consequently, significant gaps remain in a systematic and comprehensive exploration and quantification of epistemic and aleatory uncertainty and bias in physics-based hydrologic, hydraulic and coastal hazard numerical models, and the associated input data sources and boundary conditions and probabilistic frameworks for compound flooding. Our pilot study of the coastal Amite watershed addresses these knowledge gaps through over 300,000 HEC-RAS model runs across a spectrum of compound flooding conditions. The pilot study showcases how we may more precisely quantify epistemic and aleatory uncertainty and bias, efficiently select boundary conditions, and leverage detailed modeling efforts to inform more precise probabilistic assessments of flooding. This local study may be leveraged for compound flood risk assessment on a regional coast wide basis. We anticipate that this study and its derivative analyses may inform future compound flood risk assessment efforts worldwide.

Presenter or Panelist 3: Tim Stephens | Dynamic Solutions, LLC, tastephens@dsllc.com

Applications and Implications of Simulating Compound Flooding with a Fully-Coupled Model

The extensive damage caused by recent compound flood events underscores the value of accurately simulating, quantifying, and predicting their impacts. Further, compound flood events are projected to increase in magnitude and frequency. Compound flooding can be characterized by a transition zone where multiple flood sources interact in a nonlinear manner to amplify flood hazards. We present novel modeling applications for accurately simulating compound flood events, results that identify the compound flooding transition zone and quantify flood hazards, and examine how the transition zone propagates with different flood drivers and among watersheds. Previous efforts to simulate compound flooding have relied on coupling discrete models that simulate individual flood sources, which fail to mechanistically simulate the interacting effects of multiple flood processes. We employ a fully-coupled version of the Adaptive Hydraulics Model to simulate multiple flood sources in a single model that fully encompasses the transition zone and mechanistically accounts for the interacting flood drivers. Model applications and results include simulations of Hurricane Barry in Louisiana and Hurricane Harvey in Texas. For each simulation, we demonstrate the model's ability to simulate the impacts of compound flooding by comparing simulated water levels with a dense network of gage measurements. A comparison of compound flood results with simulations of individual flood drivers shows shifts in

compound flooding impacts among storms with varying characteristics and reveals the importance of accurately simulating their interaction. Identifying the transition zone among different watersheds reveals key characteristics that control extents of compound flooding. The methods, analyses, and results presented here can serve as a template for evaluating compound flooding, nature-based features, other mitigation techniques, and alternative scenarios at additional locations.

Presenter or Panelist 4: Ehab Meselhe | Department of River-Coastal Science and Engineering, Tulane University, emeselhe@tulane.edu

Lessons Learned from Large Navigable Flood Gates in Europe

Large navigable flood gates are being planned for Galveston and proposed for the East Coast (New York and New Jersey) at a scale and at costs previously not attempted in the US. These gates will cost tens of billions of dollars. With experience lacking in the US for design, construction, and operations & maintenance, it is imperative to learn from the challenges our colleagues in Europe have faced where such large-scale gates were built. This will allow the US to avoid potentially costly mishaps which otherwise could result in a sub-optimally operating multi-billion dollar navigable flood gate. Proposed navigable sector gates include channel widths of 650 ft in Galveston and 800 ft in New York. The Maeslant Barrier in the Netherlands has a navigation width of 1,180 ft and became operational in 1997. The St Petersburg Barrier in Russia has a navigation width of 670 ft and became operational in 2013. Key lessons learned from the design, construction, and operations & maintenance of these gates and others such as Thames River Barrier will be presented. Design lessons include structural design efficiency for sector gate radial arms, dynamic stability during gate submergence, the need for reduced navigation velocities at gates to prevent collision, dealing with sedimentation. Operations and maintenance lessons include the need for weather and tide conditions monitoring and modeling for a trigger event (closure), increased maintenance with aging gates and closure protocol.

Renewable Energy

Panel, Session #65

Community Energy Pilots

Following climate-related events like Texas freeze and Hurricane Ida, causing days to months of power outages, the vulnerability of the electric grid as is has become clear. In response, community leaders are implementing alternative solutions. Currently, Together New Orleans is working with partners and funders to build a network of 85-100 "Community Lighthouses" throughout the state. Upon completion, congregations and community institutions will be equipped with commercial-scale solar power and back-up battery capacity. Then, they will be able to serve as resiliency hubs during power outages and natural disasters. After successful fundraising, including a gift from the Greater New Orleans Foundation and a $3.8M congressional earmark, some sites should be ready for the 2023 hurricane season. Panelists will speak about the success of this project, and opportunities for involvement, or replication.

Meanwhile, the City of New Orleans has received a grant from the U.S. Department of Energy (DOE) Communities Local Energy Action Program (LEAP). Under the Communities LEAP Pilot, DOE will provide supportive services for community-driven clean energy transitions across the country. In New Orleans, Communities LEAP – via technical assistance from National Renewable Energy Laboratory – will help the City further develop distributed solar generation with battery storage and district-scale microgrids, with an eye on economic development. The City and NREL will speak about the pilot's implementation.

Session Organizer: Jenny Netherton | Southeastern Wind Coalition, Email: jennyn@sewind.org

Moderator: Jenny Netherton | Southeastern Wind Coalition, jennyn@sewind.org

Presenter or Panelist 1: John Ross | Posigen, jross@posigen.com

Presenter or Panelist 2: Greg Nichols | City of New Orleans, grnichols@nola.gov

Presenter or Panelist 3: Allison Smith | NREL, Allison.Smith@nrel.gov

Presenter or Panelist 4: Jeffrey Cantin | SolAlt, jdcantin@solalt.com

Presenter or Panelist 5: Jeffrey Schwartz | City of New Orleans, jeschwartz@nola.gov

Film, Session #66

Managing Rivers for Multiple Uses

Standard, Session #67

Atchafalaya River and Basin: hydrology, inland swamps, and coastal estuarine habitats

The Atchafalaya-Wax Lake is the most recent and currently active delta lobe of the Lower Mississippi River. It was initiated approximately 400 years ago as a result of the Mississippi River stream capture by the Atchafalaya River. It is the largest bottomland hardwood river-floodplain system in North America. In 2022, after a coast-wide site screening and selection process, the Atchafalaya was nominated by the Governor to NOAA to be a Louisiana National Estuarine Research Reserve (NERR). This session includes four presentations spanning across key topics for the Atchafalaya River Basin. The presentations include a discussion about the significance and implications of designating the Atchafalaya as National Estuarine Research Reserve; how the hydrologic alteration of the basin influence its ability to respond to climate change; the long-term response of the Atchafalaya system to the operation (current and modified) Old River Control Structure; and the impact of hypoxia on key species of the Atchafalaya Basin.

Session Organizer: | , Email:

Moderator: Michelle Felterman | CPRA,

Presenter or Panelist 1: Mitch Andrus | Royal Engineers & Consultants, mandrus@royalengineering.net

Projected Long-Term Atchafalaya Basin and Delta Responses to River Flow Modifications at ORCS

The most recent and currently active delta lobe of the Mississippi River (MR) is the Atchafalaya-Wax Lake lobe, which was initiated approximately 400 years ago as a result of MR stream capture by the Atchafalaya River (AR). This capture process accelerated in the early to mid-1900s but further progress was prevented by construction and operation of the Old River Control Structure (ORCS) Complex. Many recent studies indicate that MR system below the ORCS is on a retreating geologic trajectory due to contributing factors such as sea level rise, subsidence, faulting, and declining hydraulic stream power.

This study uses both 1D and 2D numerical modeling techniques to evaluate the long-term effects of current water and sediment regulation mandates and alternatively explore the long-term land-building potential of progressively continuing the avulsion at the MR-AR bifurcation in a controlled manner. Riverine hydraulic and sediment transport modelling was performed using Delft 3D coupled with a spreadsheet which used a 1D spatially averaged equation to calculate delta growth. A 150-year model duration was used to account for flow and system adjustments, implementation of current restoration plans, and to sufficiently analyze delta response trends into the future.

The 150-year resulting land areas built for the MR vs. the AR at discrete flow percentages demonstrate a clear land-building capacity advantage in the AR. For common flow percentages, the AR builds 1.7 times more land at 30% of the total river flow and 3.0 times more land at 70% of the total river flow. Reconnaissance-level cost impact analysis on river levees and navigational dredging to accommodate flow, stage, and sediment load alterations indicate that flow diversion of up to 60% of total river flow into the AR could result in a cost-effective flood alleviation and deltaic land-building strategy over the next 150 years.

Presenter or Panelist 2: Chris Bonvillain | Nicholls State University, chris.bonvillain@nicholls.edu

Effects of hypoxia on crayfish population characteristics and fecundity in the Atchafalaya Basin

The Atchafalaya River Basin (ARB) is the largest bottomland hardwood river-floodplain system in North America and produces approximately 90% of the wild crayfish harvest in Louisiana. However, anthropogenic modifications to the natural hydrology in the ARB have altered historic river-floodplain connectivity and reduced water circulation and flow patterns that facilitate extensive areas of hypoxia for several months throughout the annual flood pulse. Although Red Swamp Crayfish Procambarus clarkii can tolerate relatively low dissolved oxygen concentrations, chronic environmental hypoxia can negatively affect P. clarkii population characteristics. Here we compare P. clarkii population characteristics and fecundity between chronically hypoxic and normoxic areas in the ARB. From 2008-2009 and 2016-2022, crayfish were sampled semimonthly at multiple sample sites in the eastern ARB during the crayfish season. Water quality and catch per unit effort (CPUE) were recorded at all sites on every sample date and sex and carapace length were recorded for all captured crayfish. Additionally, P. clarkii hemolymph samples were collected from ten intermolt individuals at all sample locations on each sample date to determine hemolymph protein concentration. During the 2020 and 2021 sample years, P. clarkii oocyte number and maturation stage were compared between individuals from hypoxic and normoxic sites. Across sample years, mean P. clarkii CPUE, carapace length, and hemolymph protein concentration have been consistently lower at chronically hypoxic locations. Furthermore, female P. clarkii from hypoxic locations produced significantly fewer total oocytes and had a lower mean annual maturation index in both 2020 and 2021. The results of this study demonstrate that chronic environmental hypoxia in the ARB can adversely influence P. clarkii population and fecundity characteristics.

Presenter or Panelist 3: Michelle Felterman | CPRA, michelle.felterman@la.gov

Louisiana's Atchafalaya National Estuarine Research Reserve

The National Estuarine Research Reserve (NERR) System is a network of protected areas representative of the various biogeographic regions and estuarine types in the United States. Reserves are established for long-term research, education, and interpretation to promote informed management of the nation's estuaries and coastal habitats. The NERR system is currently a network of 30 reserves with partnerships between the National Oceanic Atmospheric Administration (NOAA) and coastal states. Louisiana is the only marine coastal state in the country lacking a reserve. In 2022, after a coast-wide site screening and selection process, the Atchafalaya was nominated by Governor John Bel Edwards to NOAA to be a Louisiana NERR.

The Atchafalaya River System is a unique addition to the NERR system as the Atchafalaya River is the fifth largest river in North America by discharge and serves as a distributary of the Mississippi River, which drains over 40% of the contiguous United States. Further, the Atchafalaya Delta and Wax Lake Delta complex is the largest prograding delta system in the United States, a feature not found in any other reserve. The resiliency of the Atchafalaya River System provides new and distinct place-based opportunities for research, monitoring, education, and resource protection. The understanding acquired through the Atchafalaya NERR will benefit estuarine management efforts on a local, regional, and global scale.

Presenter or Panelist 4: Daniel Kroes | USGS, dkroes@usgs.gov

Degradation of connectivity along the Atchafalaya River reduces ability to respond to sea level

The Atchafalaya River Basin is the largest remaining forested wetland in the lower United States. Many changes to the hydrology and hydrologic connectivity in the Basin have occurred since flow regulation in 1960. Dredging and channel erosion resulted in reduced hydrologic connectivity of the river to its floodplain that had not been quantified. Analyses were conducted to determine the hydraulic and geomorphic factors that changed since discharge became regulated. Stage records, discharge measurements, and surveys were examined to compare: 1) stage/discharge relationships from 1960–2014; 2) discharge distribution to the floodplain from 1959–68 to 2005–12; 3) hydroperiods across the floodplain; and 4) channel cross sections and floodplain elevations. The stage of a 1.5-yr flood was reduced by 3.5 m from 1960–2014. Discharge from the River to the floodplain was reduced by 54%. These changes were driven by dredging and erosion that increased the main channel cross section by 181%. Reduced connectivity has resulted in several changes. Much of the floodplain experiences backwater conditions (>200 km2) or receives too little discharge to alleviate stagnancy and hypoxia in the forested wetland. Repeated surveys of large portions of the floodplain indicate net subsidence. In these poorly connected areas sediment deficits ranged from 2–39 mm/yr. Large portions of the Basin (>500 km2) have low water levels controlled by the prograding channel into the Gulf of Mexico and sea-level rise that inundate the floodplain for more than 50% of the calendar year. This extended duration of inundation contributes to hypoxia and likely reduces nutrient retention. In contrast, well connected areas experience rapid accretion. The confinement of discharge to a large efficient channel contributes to a sediment deficit on the floodplain relative to sea level rise and subsidence. This study provides insight into the effects of flood management projects along Coastal Plain rivers and deltas.

Human Dimensions

Panel, Session #68

Restoration as an act of self-determination: reflections on nature in an engineered landscape

Coastal land loss in Louisiana is a multigenerational traumatic event that continually erodes coastal communities' habitability, livelihoods, social cohesion, and connections to place. Coastal communities are experiencing and grieving this loss on many levels. Since the trauma is ongoing, and may likely accelerate with climate change, finding acceptance and closure is nearly impossible. The cycle of trauma and grief repeats indefinitely. This cycle is fertile ground for nostalgia and fear to thrive. Collectively, we yearn for a past long gone and are afraid of what the future may bring.

Many of the decisions around coastal protection and restoration are driven in part by fear and nostalgia. If we are afraid of the future and seek to hold on to a snapshot version of the past, it's understandable to try to lock things in place, in time and space. This can be problematic in a delta where change is constant.

Coastal restoration in Louisiana is a microcosm of the larger ontological discussion around the Anthropocene. Foundational questions such as 'What is nature in an engineered landscape?' and 'What is restoration if the baseline condition is unattainable?' are important to discuss. Can restoration be reframed to achieve ecologically, socially, and economically just landscapes? Can restoration catalyze systemic transformations? Can restoration help communities grieve loss, overcome, adapt, and grow?

Grounding these questions in the diverse perspectives and experiences of the communities experiencing these changes is of paramount importance. This is especially true for marginalized communities who have historically been excluded from climate-related conversations and decision-making.

This panel brings together experts from the fields of anthropology, geography, and political ecology with Indigenous and faith-based community leaders to discuss ways of reconnecting to the landscape in a damaged and changing coastal Louisiana.

Session Organizer: Gabriela Lingren | The National Academies of Sciences, Engineering, and Medicine, Email: GLingren@nas.edu

Moderator: Michael Biros | Coalition to Restore Coastal Louisiana, michael.biros@crcl.org

Presenter or Panelist 1: Joshua Lewis | ByWater Institute for Coastal Studies, Tulane University, jlewis9@tulane.edu

Presenter or Panelist 2: Jessica Simms | The National Academies of Sciences, Engineering, and Medicine; Gulf Research Program, jess.simms@gmail.com>

Presenter or Panelist 3: Devon Parfait | Restore the Mississippi River Delta, dparfait@edf.org

Presenter or Panelist 4: Shirell Parfait-Dardar | Grand Caillou-Dulac Band of Biloxi-Chitimacha-Choctaw., shirellparfaitdardar@gmail.com

Presenter or Panelist 5: Michael Malcom | The Poeple's Justice Council,

Preparing for Climate Change

Standard, Session #69

Advancing Sea Level Rise Research to Improve Awareness and Coastal Decision-Making in the GoM

The 2018 NASEM report Understanding the Long-Term Evolution of the Coupled Natural-Human Coastal System: The Future of the U.S. Gulf Coast concluded that sea level rise will significantly affect Gulf coastal ecosystems and communities. The report highlighted that one key research gap relating to improving the future of the Gulf coast is to understand and project the future of coastal landforms and whether they can keep pace with relative sea level rise (RSLR); improving projections is a complicated, necessary process that can improve natural resource management, restoration activities, and the resilience of Gulf communities. Among the Gulf states, Louisiana is experiencing the greatest loss of shoreline and has the second largest population projected to be impacted by RSLR across a range of projections.

This session will feature presentations from the Gulf Research Program (GRP)'s Gulf Sea Level Variation and Rise (GSLVR) grantees and will focus on recent findings on the understanding of non-subsidence and vertical land movement (VLM) components of Gulf sea level variation and rise, while incorporating these factors into RSLR forecast models and century-scale projections. This session will highlight effects felt in the Gulf from changes in the volume of the global ocean due to the expansion of warming waters and the melting of glaciers and ice sheets; changes in the earth's gravitation, rotation, and deformation (GRD) caused by redistributions of land ice and water; and the dynamics of atmospheric and oceanic processes within the Gulf region (e.g., the Loop Current System). Presenters are part of a collaborative research group that works with the NASA Sea Level Change Team and NOAA's Center for Operational Oceanographic Products and Services. The goal of this collaborative research is to produce research with end-use applicability, increase public understanding of the complexity of sea level rise, and meaningfully engage with stakeholders.

Session Organizer: Noel Walters | Gulf Research Program, National Academy of Sciences, Email: NWalters@nas.edu

Moderator: Noel Walters | Gulf Research Program, National Academy of Sciences, NWalters@nas.edu

Presenter or Panelist 1: Ping Chang | Texas A&M University, ping@tamu.edu

Prediction and Projection of GoM Sea-Level Changes Using Eddy-Resolving Earth System Models

Ping Chang, Jaison Kurian, Gaopeng Xu, Qiuying Zhang (Texas A&M University);

Frederic Castruccio, Stephen Yeager, Gokhan Danabasoglu, Nan Rosenbloom, and Teagan King (National Center for Atmospheric Research);

Susan Bates and Christine Shepard (The Nature Conservancy);

Current predictions and projections of future sea-level changes are based on CMIP-class climate model simulations. Although this class of models is capable of simulating global sea-level rise and its basic spatial patterns, they are unable to robustly and accurately predict or project future regional and local sea-level changes because of their limitation in representing complex coastline and bathymetry features

and regional ocean circulations with their coarse (~100 km) resolutions. More specifically, sea-level changes within the Gulf of Mexico are closely linked to changes in the Loop Current and its eddies, which cannot be resolved by CMIP-class models. In this talk, we will present preliminary results of dynamic sea-level changes (DSLC) from an unprecedented set of future climate projection and prediction simulations using a global eddy-resolving (~10 km) version of the Community Earth System Model (CESM-HR). These high-resolution simulations encompass a broad range of climate projections up to the end of this century under different emission scenarios and an ensemble of initialized decadal prediction simulations designed to forecast short term (1-5 years) DSLC. By directly comparing these high-resolution simulations to a similar set of standard CMIP resolution (~100 km) CESM simulations (CESM-LR), we will show that CESM-HR is not only more realistic in simulating observed sea-level variability and changes during the historical period, but more importantly it projects a significantly large future DSLC within the Gulf of Mexico compared to CESM-LR. These findings highlight the needs and benefits of using high-resolution climate models to improve projections and predictions of future DSLC.

Presenter or Panelist 2: Andrew Delman | University of California Los Angeles, andrewdelman@ucla.edu

Gulf Coast Sea Level Prediction and Attribution Using an Ocean State Estimate

Andrew Delman (University of California Los Angeles);

Thomas Frederikse (Planet, Haarlem, The Netherlands);

Tong Lee, Ou Wang, and Ichiro Fukumori (Jet Propulsion Laboratory, California Institute of Technology);

Emily Becker, and Benjamin Kirtman (University of Miami);

Renee Collini (The Water Institute);

In recent decades, sea level along the U.S. Gulf Coast has risen at a rate exceeding the global mean. Sea level variations on the Gulf Coast are also very coherent from Florida to Texas at seasonal to multi-year timescales, but the causes of both the fast rise and coherent variability are not well understood. This study uses a novel "hybrid dynamical" approach to predict sea level variability and change. Specifically, adjoint sensitivities from the Estimating the Circulation and Climate of the Ocean (ECCO) state estimate relate Gulf Coast sea level changes to air-sea fluxes, both locally along the Gulf Coast and remotely in the Atlantic basin. With these observationally-informed adjoint sensitivities, atmospheric conditions from seasonal prediction models are converted to sea level impacts with minimal computational effort. This method is shown to be very accurate in reconstructions of sea level in ECCO, and hindcasts using fluxes from ECCO and North American Multi-Model Ensemble (NMME) prediction models have also shown encouraging skill in predicting sea level variations along the U.S. Atlantic coast. The presentation will discuss preliminary results of the application of the hybrid dynamical method to Gulf Coast sea level prediction, as well as the causes of Gulf Coast sea level changes as diagnosed based on ECCO adjoint sensitivities. An emphasis will be placed on the information that state and local agencies and other end users can incorporate into coastal hazard planning and assessments, such as how large-scale climate variability may impact sea level variability along the Louisiana coastline.

Presenter or Panelist 3: David Rounce | Department of Civil and Environmental Engineering, Carnegie Mellon University, drounce@cmu.edu

Facilitating Dynamic Adaptive Pathways for GoM Decision-Makers: Land Ice and Water Projections

David Rounce and Matthew Weathers (Carnegie Mellon University);

Eric Larour and Surendra Adhikari (NASA Jet Propulsion Laboratory);

Richard Lammers and Alex Prusevich (University of New Hampshire);

Jordan Fischbach, Ioannis Georgiou, and Renee Collini (The Water Institute);

Ali Rellinger and Qiyamah Williams (PLACE:SLR);

Regional sea-level rise in the Gulf of Mexico is projected to increase flood risks, exacerbate erosion and loss of land, and harm freshwater resources. Dynamic adaptive policy pathways is an approach that enables coastal planners to identify a series of possible adaptation strategies that address short-term needs while maintaining flexibility to address future impacts depending on how future conditions develop. Underlining the dynamic adaptive policy pathways are probabilistic projections for various climate scenarios as well as an observational system that can be used to support the generation of the adaptation strategies and the timing of when decisions need to be made. Our team is seeking to refine projections of global mean sea-level rise based on contributions from glaciers and changes in land water storage and use reverse sea-level fingerprinting to improve probabilistic projections of regional sea-level rise. These projections will be used to develop a tool that supports the use of dynamic adaptive policy pathways. Here we provide an update of the latest scientific findings and an overview of the path forward.

Presenter or Panelist 4: Renee Collini | The Water Institute, rcollini@thewaterinstitute.org

Understanding the Pathway from Sea-Level Rise Science to Coastal Decision-Making

Rising seas in the Gulf of Mexico are accelerating, making accurate information and clear guidance critical to future resilience. Unfortunately, the information available about how much, where, and why seas might rise is frequently found in multiple places from multiple sources, with little context provided about how it relates to other available information or how the data might be applied. Additionally, at times new data or information appears to conflict with previous research or other sources of data. In this presentation, we will review the pathway of research to local decision-making and how different types of sea-level rise research and information can be integrated into that pathway. The example that will be used to illustrate this pathway will be the recently updated interagency sea-level rise projections. We will explore the roles of new research, interagency collaboration, translation documents and materials, and locally focused extension and outreach programming to generate accurate and actionable information. There will be a specific focus on how the updated information was contextualized and delivered to reduce confusion and support accurate application. We will review lessons learned and recommended practices for identifying where your research can and should be integrated to best support coastal decision-making and to reduce confusion.

Presenter or Panelist 5: Grand Caillou-Dulac Band of Biloxi-Chitimacha-Choctaw. | ,

Coastal Law, Policy & Funding

Panel, Session #70

Public Trust Doctrine: An Evolving Legal Theory for an Evolving Coastline

Tad Bartlett will provide a primer on the public-trust doctrine, including its manifestation in the Louisiana Constitution as applied by cases over the years (including the "Oyster Trilogy") and its current status. Bartlett then will discuss a cutting-edge application of the doctrine: correlative property rights surrounding servitudes, focusing specifically on the arguments for and against applying the public-trust doctrine to private affairs.

Next, Assistant Attorney General Machelle Hall will discuss the state's perspective on the public-trust doctrine, including the limitations of its applications to agency action.

Kerry Miller then will turn to specific application of the public-trust doctrine to asset retirement and discuss ways in which that application impacts the coast and coastal resources. Included will be a discussion of recent cases, including a matter handled by Fishman Haygood and the Fieldwood bankruptcy proceeding.

Bessie Daschbach will address how environmental, social and governance (ESG) relates to the above. In particular, she will discuss how (1) continued infringement on the resources within the public trust by way of outstanding environmental liabilities could run afoul of ESG disclosures and representations, creating an additional layer of enforcement and litigation risk; and (2) how resolving those liabilities could align with ESG objectives.

Lastly, Bartlett will discuss a potential outline for an "Act 312 for the Coast." Act 312 is the Louisiana statutory section providing a framework for cases seeking remediation from contamination caused by oilfield operations. The panel will discuss the potential for legislative enactments on the issue of coastal restoration and the extrapolation of the public-trust doctrine into a workable and effective statutory remedy operating similarly to Act 312.

Moderator Mike Dodson has environmental and commercial law experience and has litigated cases for plaintiffs and defendants.

Session Organizer: Michael R. Dodson | Fishman Haygood, LLP, Email: mdodson@fishmanhaygood.com

Moderator: Michael R. Dodson | Fishman Haygood, LLP, mdodson@fishmanhaygood.com

Presenter or Panelist 1: Kerry J. Miller | Fishman Haygood, LLP, kmiller@fishmanhaygood.com

Presenter or Panelist 2: Tad Bartlett | Fishman Haygood, LLP, tbartlett@fishmanhaygood.com

Presenter or Panelist 3: Bessie Antin Daschbach | Hinshaw, bdaschbach@hinshawlaw.com

Presenter or Panelist 4: Machelle Hall | Assistant Attorney General, State of Louisiana, HallM@ag.louisiana.gov

Panel, Session #71

Understanding factors that influence vegetation survival

"""This session includes presentations that discuss various aspects of wetland vegetation dynamics and their response to management.

In the Chenier Plain active wetland management is often essential for maintaining productive waterfowl habitat and healthy marshes. To better understand mechanisms driving elevation change in managed Chenier Plain marshes, we assessed elevation change and accretion, in situ belowground productivity and decomposition for three common perennial plant species.

In the Pontchartrain Estuary of southeast Louisiana, swamp reforestation projects reclaimed > 400 acres of former swamp with long-term survival of planted saplings between 60 – 80% depending on location. Data indicate that newly planted saplings can survive hurricanes and that the reforestation of coastal swamps is a worthwhile investment for land and resource managers.

In the Birdsfoot delta, Phragmites is valued for its ability to stabilize the shoreline and facilitate high accretion rates but has recently suffered from a die-off and overall decline. A coastwide survey was conducted across four hydrologic basins of Louisiana to sample vegetation, elevation and soil and creek and porewater chemistry. The goal is to identify favorable environmental conditions for Phragmites growth to control its spread and the causes of its die-off in the Birdsfoot.

A notable loss of Spartina patens dominated marshes occurred during Hurricane Ida in 2021. Adjacent marshes dominated by Sagittaria lancifolia experienced less impact. A comparative field study and a greenhouse mesocosm study we used to test differences in above-and belowground biomass, elevation and flooding dynamics, and soil shear strength. The goal is to understand the widespread decline of S. patens and guide restoration strategies.

Die-off of vegetation was initially reported in the Birdsfoot Delta in late summer 2016. The presentation uses 15-years of coastwide reference monitoring data to examine conditions pre-, during, and post- die-off. Analysis indicated that the die-off actually began after the widespread drought in the Mississippi Watershed during the 2012 summer and Hurricane Issac in August 2012. The landscape-level consequences of the die-off of this species may include alternate states with less robust species or peat and ecosystem collapse. """

Session Organizer: | , Email:

Moderator: Julie Whitbeck | National Parks Service, julie_whitbeck@nps.gov

Presenter or Panelist 1: Ashley Booth | Louisiana State University, bootharb@gmail.com

Elevation change and mechanisms for sustainability in Chenier Plain marsh impoundments

Coastal wetland loss is prevalent in the Chenier Plain of Louisiana and Texas due, in part, to altered

hydrology and sedimentation regimes. Initially created via mineral sedimentation, marshes in the region now largely accrete via organic matter accumulation, a process driven by belowground productivity and inhibited by decomposition. The balance between these two processes is crucial for maintaining surface elevation in marshes driven by organic matter accumulation, where elevation is key for long term sustainability. However, despite current knowledge of how elevation impacts sustainability, we do not fully understand the influence of water-level management and plant species on organic matter accumulation and elevation change. A quantitative understanding of how hydrology and plant species influence elevation will help inform best practices for managers in a region where active wetland management is often essential for maintaining productive waterfowl habitat and healthy marshes. To better understand mechanisms driving elevation change in managed Chenier Plain marshes, we assessed elevation change and accretion using 23 rod-surface elevation tables (rSETs) and feldspar marker horizons. We also evaluated in situ belowground productivity and decomposition for three common perennial plant species: Phragmites australis, Schoenoplectus californicus, and Typha latifolia.

Presenter or Panelist 2: Eva Hillmann | Pontchartrain Conservancy, eva@scienceforourcoast.org

Hurricane Ida Impacts on Coastal Reforestation Projects of the Pontchartrain Basin, LA

Coastal reforestation reclaims coastal lands to preserve and support coastal forests, which mitigate coastal erosion, sequester carbon, and provide habitat for critical species. In the Pontchartrain Estuary of southeast Louisiana, swamp reforestation projects reclaimed > 400 acres of former swamp habitat in two regions of the estuary (Caernarvon Freshwater Diversion (CFD), Maurepas Landbridge (MLB)) from 2011 – 2021, with long-term survival of planted saplings (n= 80,000) between 60 – 80% depending on location. Various factors appeared to impact sapling survival, including soil stability, herbivory, competition, inundation, and storms, though none of these have been explicitly studied or described. More recently, we targeted new areas for reforestation, including the Northshore Lake Pontchartrain (NLP), LaBranche Wetlands (LAB), and Central Wetlands Unit (CWU). About 12,000 saplings have been planted across these new areas since 2017/2018, including approximately 6,000 saplings of Taxodium distichum planted just six months before Hurricane Ida in the NLP and MLB areas. Monitoring six months post-hurricane was the first clear indicator of how hurricanes impact newly planted saplings in the estuary. We observed high sapling survival in all areas, including 98% survival of 1-year-old saplings in the NLP area, 93% survival of 1-year-old saplings on the MLB, 96% survival of 2 to 3-year-old saplings in the LAB, and 74% survival of 2 to 3-year-old saplings in the CWU. Height growth rates were low and ranged between -0.02 to 0.08 m/yr., possibly due to topping during hurricane-force winds, while diameter growth was more robust and ranged between 0.09 to 0.36 cm/yr. These data indicate that newly planted saplings can survive hurricanes impacting coastal Louisiana and that the reforestation of coastal swamps in the Pontchartrain Estuary is a worthwhile investment for land and resource managers in this region.

Presenter or Panelist 3: Olivia Hurley | Louisiana State University, oliviaghurley@gmail.com

Environmental Conditions in Roseau Cane (Phragmites australis) Stands Across the Coast of Louisi

Phragmites australis, locally known as Roseau Cane, is one of the most invasive wetland plants on the planet with the invasion of distinct non-native haplotypes. Three non-native haplotypes are common in Louisiana with the Delta haplotype the most abundant in coastal marshes. In many areas, wetland managers are trying to control or remove Phragmites as it is a robust aggressive species that

outcompetes native plants and reduces habitat value for some wildlife species. In the Mississippi River Delta (aka Birdfoot delta) where subsidence and relative sea-level rise rates are high, Phragmites is valued for its ability to stabilize the shoreline and facilitate high accretion rates but has recently suffered from a die-off and overall decline. We conducted an intensive coastwide survey across four hydrologic basins of Louisiana: Atchafalaya Basin (AT), Mississippi River Delta (MRD), Rockefeller Wildlife Refuge (RR), and Vermillion Bay (VB) to sample vegetation, elevation and soil and creek and porewater chemistry. Our data shows that Phragmites stands in AT and VB were higher in elevation than at the other sites. We also found trends of greater aboveground biomass in RR and greater range in overall biomass in MRD than the other sites. Extremely high salinity was observed at RR porewater samples compared to sites. We also found high K, Na, S, and Ca concentrations in RR compared with the other basins, which is associated with high seawater content. There were high levels of nitrate-nitrite-N in MRD stands due to runoff of agricultural fertilizer from the Mississippi River. Ongoing research on leaf tissue chemistry, biomass and examining relationships among vegetation morphology and abiotic conditions will be presented. Overall, the findings from this study will provide insight on favorable environmental conditions for Phragmites growth to control its spread and to identify the causes of its die-off in the MRD.

Presenter or Panelist 4: NATALIE MATHERNE | LSU, nmathe8@lsu.edu

Investigating the Drivers of High Wetland Loss Rates in Brackish Marshes in the Mississippi Rive

Spartina patens are an important grass species in high elevation saline marshes of the coasts. However, S. patens are declining in cover, potentially associated with increased submergence and accelerated sea-level rise. In Louisiana, a notable loss of S. patens- dominated marshes occurred during Hurricane Ida in 2021. Adjacent marshes dominated by Sagittaria lancifolia experienced less of an impact. We hypothesize that S. patens marshes sub-optimal in elevation exhibit a hummock hollow topography that weakens the soil and makes them more susceptible to erosion than higher elevation S. patens marshes with a more even topography. Further, marshes dominated by the more flood-tolerant S. lancifolia are predicted to have greater soil strength than S. patens under flooded conditions. Two approaches are being used to test this hypothesis: a comparative field study and a greenhouse mesocosm study. The field study is focused on stable and deteriorating S. patens marshes and a stable S. lancifolia marsh to test differences in above-and belowground biomass, elevation and flooding dynamics, and soil shear strength. The greenhouse study involves a controlled test of S. patens and S. lancifolia- growing in three flooding treatments with a semi-diurnal tidal cycle and under two nutrient treatments. Preliminary results from the greenhouse study show that while a nutrient treatment did not cause a significant difference in stem density and height for either species, flooding difference had a large impact. Our preliminary results show that S. patens were approximately 17 cm shorter in low elevation than at high elevations. Conversely, S. lancifolia averaged 14 cm taller at low compared to high elevation. Increasing stem heights is an adaptation to flood stress as exhibited by S. lancifolia but not S. patens. The findings of this study will contribute to our understanding of the widespread decline of S. patens in many marshes and will help guide restoration strategies.

Presenter or Panelist 5: Tracy Quirk | Louisiana State University, tquirk@lsu.edu

Vegetation Die-Off in the Mississippi River Delta: Causes and Consequences

The Mississippi River Delta (MRD; aka the Birds foot delta) is ecologically and socioeconomically important, supporting abundant wildlife and fish as well as commerce and industry and the transport of

goods via navigation channels. Die-off of an important and dominant wetland plant species was initially reported in late summer 2016. Here, we use 15-years of coastwide reference monitoring data to examine conditions pre-, during, and post- die-off. The die-off seemed to target Phragmites australis, a robust non-native wetland plant that, in the MRD, is important for stabilizing the shoreline with its large and abundant network of rhizomes, and for facilitating high accretion rates. Our analysis indicated that the die-off actually began after the widespread drought in the Mississippi Watershed during the 2012 summer and Hurricane Issac in August 2012. These combined events caused salinities to exceed 20 psu throughout the delta June through August. By summer 2013, the percent cover of Phragmites in MRD CRMS stations had fallen from and average of 60% in 2011 to less than 3%. Subsequent vegetation recovery depends on the combination of inundation and pulses of salinity. The landscape-level consequences of the die-off of this species are not well understood but may include alternate states with less robust species or peat and ecosystem collapse. Future management of the delta will depend on our understanding of plant species tolerances and their effects on the system.

Ecosystem Restoration

Standard, Session #72

Barrier Islands and Sediment Resources

"This session discusses sediment resources for barrier island restoration, how extraction and placement of sand can have environmental implications and the challenges of getting restoration accomplished as storms continue to change the landscape. Understanding barrier island system evolution is crucial for restoration planning. An Operational Sediment Budget was developed to evaluate regional sediment transport controls and annual sediment fluxes to illustrate magnitude and direction of sediment transport throughout the littoral system. Data generated can be used to evaluate future restoration needs.

Sediment availability and funding are major constraints to implementation. Known offshore sediment resources are considered non-renewable and extremely limited. A regional geologic model for offshore Barataria Bight was developed to characterize and quantify sediment reserves. An unexplored paleodistributary system was identified with clean distributary sands and mixed-sediment with minimal overburden.

Sand shoals are also productive habitat for numerous coastal species and in the northern Gulf of Mexico provide an important refuge during hypoxic events. Impacts of dredging on benthic primary production on Ship Shoal off the coast of Louisiana were examined. Changes in sediment characteristics, coupled with impacts to benthic primary production and respiration have important implications for energy flow and overall productivity of sand shoal communities.

There can also be environmental impacts associated with placement. Environmental studies for restoration of the Chandeleur Islands considered the only true seagrasses found in Louisiana. Understanding the species composition and diversity along with identifying the environmental and physical factors influencing their distribution will guide restoration design for protection of seagrass resources.

Barrier islands are dynamic landforms that undergo significant changes from the inception of the concept plan to project completion. Barrier island restoration undertaken from 2020 through 2022 faced many challenges during design and construction. The final presentation will describe the storm impacts and the design modifications employed to mitigate the damage to the three barrier island restoration/nourishment projects. "

Session Organizer: | , Email:

Moderator: John Savell | USFWS, john_savell@fws.gov

Presenter or Panelist 1: Ben Beasley | Applied Coastal Research and Engineering, bbeasley@appliedcoastal.com

MASS BALANCE CALCULATOR FOR ESTIMATING FUTURE RESTORATION NEEDS USING SEDIMENT BUDGET FLUXES

Barrier island and headland beaches of south Louisiana are deteriorating and migrating landward, reducing their effectiveness to insulate wetlands, deltaic plain communities, and infrastructure from

storm energy and flooding. A combination of factors contributes to this decline, including inadequate sediment supply, erosive wave action, and relative sea level rise, for which significant resources have been allocated for restoration.

In 2019, Applied Coastal completed an Operational Sediment Budget (OSB) for the south Louisiana barrier island coastline to evaluate regional sediment transport controls on barrier island system evolution. The results are annualized sediment fluxes that illustrate magnitude and direction of sediment transport throughout the littoral system. Currently, efforts are underway to update the OSB with recent bathymetric and lidar data for a time interval when restoration was most prevalent.

A series of ArcGIS tools is under development which will utilize sediment flux data from the OSB to evaluate future restoration needs. Input parameters such as length of evaluation period, fill volumes, and placement locations allow customization and flexibility for specific restoration projects. Full implementation will provide system-wide calculations capable of incorporating multiple projects with various timing, dredging and placement locations, and quantities. Standardized visualization of results enables comparison of parameters reflecting multiple scenarios, including future with and without projects.

Application of the OSB using these tools is expected to assist with implementing CPRA's Louisiana Sediment Management Plan (LASMP) and Barrier Island System Management (BISM) Program, providing efficient and cost-effective system-wide planning and evaluation capabilities for coastal restoration managers in support of project design, selection, and prioritization.

Presenter or Panelist 2: Stephanie Healey | SWCA Environmental Consultants, stephanie.healey@swca.com

A deep dive for Chandeleur Islands restoration: Surveying 3,000 acres of unique habitat

The Louisiana Coastal Protection and Restoration Authority (CPRA) is leading the engineering and design of a restoration project benefitting the Chandeleur Islands and the many species that use them. SWCA is supporting the Coastal Engineering Consultants, Inc Project E&D Team to provide environmental baseline studies for restoration of these barrier islands, which serve to protect coastal Louisiana from extreme wave action and storm surge. The seagrasses along the islands are unique as they are the only true seagrasses found within Louisiana's waters. SWCA conducted a preliminary seagrass survey along the Main Chandeleur Island and New Harbor Island during the peak growing season using a rapid assessment approach consisting of a hexagonal sampling grid with randomized sampling locations to assess species community structure and its stressors. Additionally, real-time satellite imagery was acquired at the time of survey for mapping of the current extent and will be used to map coverage aiding in identification of continuous and isolated seagrass beds. This study design is based on sound scientific design, consistent with an approach used in ongoing monitoring programs in Texas and Florida and allows for contributions to Gulf-wide discussions on methodology applicability. Analysis draws parallels between the existing barrier island structure and the distribution of the various species. Understanding the species composition and diversity along with identifying the environmental and physical factors influencing their distribution along the islands will guide restoration design for protection of the existing seagrass resources and provide insight on anticipated changes in species composition and distribution

due to physical changes in island structure and water flow dynamics influencing water quality around the island.

Presenter or Panelist 3: Rob Hollis | The Water Institute, rhollis@thewaterinstitute.org

Preserved Deltaic Sand Bodies Offshore Louisiana as Sediment Resources

According to the 2023 Coastal Master Plan (CMP), Louisiana is projected to lose up to 3,000 mi2 of land over 50 yrs if no further mitigation actions are taken. The CMP identifies the most cost efficient and impactful coastal management planning level strategies including marsh, ridge, and barrier island restoration. Sediment availability and funding are identified as the major constraints to implementation. Cost can be significantly minimized by reducing transport distance of sediment from borrow area to the restoration site. The existing inventory of potential sediment resources, excluding borrow areas within the Mississippi River, are considered non-renewable and extremely limited. Building upon efforts under the Louisiana Sediment Management Plan (LASMP), previous sediment resource investigations, and data from the Louisiana Sand Resources Database, over 245 miles of high-resolution geophysical data and 41 sediment cores were collected for this study to develop a regional geologic model for the offshore Barataria Bight region to characterize and quantify sediment resources reserves. Previously proven and exploited borrow sites were characterized by depositional environment, incorporated into a regional geologic framework, and informed further investigation based on sediment source-to-sink concepts. A previously unexplored paleodistributary system preserved offshore was identified that can be correlated to the Scofield Bayou system up-dip and contains clean distributary mouth-bar sands and mixed-sediment with minimal overburden. Sand thickness ranges from 4-15 ft along a ~17.5 mile trend. These initial results can inform subsequent design-scale sand prospecting efforts and the approach of integrating known sand bodies into a regional source-to-sink framework is being applied to other distributary systems along the shelf to develop a coastwide sediment resources inventory under the LASMP.

Presenter or Panelist 4: Alexander Douwes | University of Louisiana at Lafayette, alexander.douwes1@louisiana.edu

DREDGING ACTIVITIES DECREASE BENTHIC PRIMARY PRODUCTION OF SAND SHOAL COMMUNITIES

Sand shoals are relic barrier islands that hold significant quantities of sand that are increasingly being targeted as resources for coastal restoration projects. However, sand shoals also act as critical productive habitat for numerous coastal species and in the northern Gulf of Mexico provide an important refuge during hypoxic events. In this study, we assessed the impacts of dredging on benthic primary production on Ship Shoal off the coast of Louisiana via a modified Before-After Control Impact (BACI) design. We collected sediment cores during 3 seasons (spring, summer, fall) over 2 years from 3 regions of Ship Shoal (undredged reference regions, a region dredged between 2014-2017, and a region dredged between April 2021 and June 2022). Triplicate cores were collected from 3 sites per region and incubated under varying light intensities to develop photosynthesis-irradiance curves to determine the photosynthetic capacity of each core. Peak GPP (determined from P-I curves) and light availability decreased with depth of dredge pit resulting in daily-integrated benthic GPP being up to an order of magnitude lower in the relic, deeper (~12m) pit than the reference regions (~8m) during the June 2021 (highest productivity) season, with the new, shallower (~10m) pit exhibiting intermediate rates. Benthic respiration rates increased with dredge depth which when coupled with the reduced production capacities results in the sediments becoming increasingly net heterotrophic and may be a factor to the

increased hypoxia observed in dredged regions. Noted changes in sediment characteristics, coupled with understanding how benthic primary production and respiration are impacted by dredging have important implications for energy flow and overall productivity of sand shoal communities and management of future dredge projects.

Presenter or Panelist 5: Steve Dartez | Coastal Engineering Consultants, Inc., sdartez@ceci-la.com

Weathering the Storm: Impacts of the 2020-2021 Hurricane Seasons on Three Major Barrier Island Restroration Projects Under Construction

Louisiana barrier islands are considered the "first line of defense" from a coastal restoration and protection standpoint, providing storm damage reduction benefits, protecting interior wetlands and marshes, and providing essential habitats for diverse wildlife including many threatened and endangered species. Design teams in Louisiana can face unique environmental challenges including weak and variable soil conditions that are to be expected in a deltaic environment as well as the presence of oil and gas infrastructure, cultural resources, and threatened and endangered species. Further, hurricanes and tropical storms often cause significant erosion of barrier islands, particularly during construction and project implementation. Barrier islands are dynamic landforms that undergo significant changes from the inception of the concept plan to project completion. Multiple revisions and modifications are required during the design, permit, bid, and construction phases. The barrier island restoration efforts undertaken from 2020 through 2022 were not immune to these challenges and faced many challenges throughout their design and construction phases. Although there were eight storms that impacted the Louisiana coastline during 2020 and 2021, four had the most influence on the restoration projects that were under construction. These four storms include Tropical Storm Cristobal in June 2020; Hurricane Sally, a category 2 hurricane in September 2020; Hurricane Zeta, a category 3 hurricane in October 2020; and Hurricane Ida, a category 4 hurricane in 2021. The presentation will describe the storm impacts and the design modifications employed to mitigate the damages to the three barrier island restoration/nourishment projects that were under construction concurrently during this period. They include North Breton Island Restoration, Terrebonne Basin Barrier Island and Beach Nourishment, and West Grand Terre Island Beach Nourishment and Stabilization.

Presenter or Panelist 6: Brett Borne | Coastal Engineering Consultants, Inc., bborne@ceci-la.com

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Ecosystem Restoration

Standard, Session #73

Watershed Scale Restoration in Cameron Creole

The 65,000 acre Cameron-Creole Watershed (CCW) is a marsh system located in southwest Louisiana that has experienced extensive loss of wetland habitat over the past century. The watershed is only hydraulically connected to Calcasieu Lake through a series of five manually-operated gate structures along the 15+-mile southeast lake rim. In the face of accelerated sea level rise, managing the opening and closure of these structures is insufficient to achieve target water levels within the marsh. The resulting persistent inundation is weakening marsh vegetation and increasing conversion of marsh to open water.

CPRA, with the Water Institute of the Gulf, Mott MacDonald, Inc., and Neel-Schaffer, Inc., has undertaken a multi-phased modeling and planning effort to develop a regionally-integrated strategy for confronting the persistent inundation stress and improving marsh health within the CCW. These efforts have culminated in the 15% design features of CPRA's Calcasieu-Sabine Large-Scale Marsh and Hydrologic Restoration Project (CS-0087) and a CCW restoration framework to guide future efforts.

The first presentation in this session will further discuss the current threats to wetland habitat in the CCW. The second and third presentations will discuss completed MIKE, neural network, machine learning, and HEC-RAS modeling and analyses used to understand, develop, and refine alternatives to address those threats with watershed-scale benefits. The final presentation will discuss the CS-0087 project planning and management strategies employed to ensure this large-scale project is coordinated with and continues to benefit future CCW restoration efforts, thus maximizing the value of the investment of Louisiana's RESTORE Bucket 1 funds in the southwest region of the state.

Session Organizer: Leah Selcer | Neel-Schaffer, Inc., Email: leah.selcer@neel-schaffer.com

Moderator: Jerry Carroll | Coastal Protection and Restoration Authority of Louisiana, jerry.carroll@la.gov

Presenter or Panelist 1: Leigh Anne Sharp | Coastal Protection and Restoration Authority of Louisiana, Lafayette Regional Office, LeighAnne.Sharp@LA.GOV

Cameron Creole Watershed Management – Challenges Related to Rising Sea Level

CPRA has been performing structural operations management of southwest Louisiana's Cameron Creole Watershed (CCW) since 2012. The operations plan cites hydrologic targets that were a challenge to achieve prior to 2015's sea level rise acceleration and are impossible at current sea level. Opportunities for drainage from the marsh to Calcasieu Lake are now much reduced which results in persistent marsh inundation, weakening of vegetation, and landloss.

The CCW has five water control structures along the southeast Calcasieu lake rim. From 2012 to 2015, water level was manageable and high salinity was the primary reason for gate closures. From 2016 to present, except during the 2018 drought, all gate closures have been due to Calcasieu Lake high water level and the need to control marsh inundation. Salinity is much lower at high sea level because high lake levels and necessary gate closures trap rainwater within the CCW.

A 2019 analysis of Coastwide Reference Monitoring System (CRMS) data from within the Calcasieu Sabine Basin classified the area as "degraded impoundment" due to high inundation, low elevation, elevation loss, and landloss. Report recommendations included exploring additional pathways for drainage from the CCW.

CPRA is now working on watershed scale restoration planning to address issues in the CCW through the Calcasieu-Sabine Marsh & Hydraulic Restoration Project (CS-87), discussed later in this session. When implemented, the CS-87 project features will enable better water management and increased estuarine exchange.

The challenges facing CCW are not unique. The NGoM and all of Louisiana's coastal lakes and bays have seen a sharp water level increase since 2016. Structural management is now more challenging coastwide. The watershed scale restoration approach applied in CCW should serve as a model for restoration planning as we adapt to coastal change.

Presenter or Panelist 2: Josh Carter | Mott MacDonald, joshua.carter@mottmac.com

Hydrologic Modeling & Drainage Analysis of the Cameron Creole Watershed

"Recent study of the Calcasieu-Sabine Basin has generated new questions regarding the relative contributions of salinity and water level (stage) to wetland health. To further investigate the hydrologic impacts of natural forcings and the impacts of human interventions, physics-based and machine-learning based analysis have been undertaken. This presentation will summarize the complementary physics-based MIKE model analysis by the Water Institute of the Gulf and machine learning efforts by Mott MacDonald.

The Cameron Creole watershed (CCW) is bounded by LA State Highway 27 (east) and Calcasieu Lake (west), the Gulf Intracoastal Waterway (north), and natural chenier ridges (south). It is entirely impounded by berms, highway embankments, and natural features. The causes of wetland loss within the basin are two-fold – high salinities during summer months and flood stress post a cold front passage. These causes will be further discussed by Leigh Anne Sharpe in an accompanying session presentation.

The Water Institute examined stage and drainage patterns by analyzing CRMS locations within the basin, and through running the MIKE hydrodynamic model to test the magnitude of impact that the limited CCW gate opening area and opening frequency play on internal stage. Other external factors, such as Mermentau Basin structure operations and internal marsh hydrology, were also assessed as potential limiting factors to ideal marsh drainage.

On a parallel path, Mott MacDonald developed a neural network and used machine learning techniques to further illuminate the key influences on marsh stage (e.g. short-term or long-term precipitation averages, tidal ranges, and other phenomena). Both teams then used their complementary tools to analyze whether addition to or modification of existing hydraulic connection between the CCW marshes and Calcasieu Lake could benefit marsh hydrology.

Presenter or Panelist 3: Glenn Ledet | Neel-Schaffer, Inc., glenn.ledet@neel-schaffer.com

Application of Numerical Regional Hydrologic Modeling & Detailed Hydraulic Design Modeling

The Cameron Creole Watershed (CCW) is a marsh ecosystem adjacent to Calcasieu Lake in southwest

Louisiana that has experienced significant wetland loss over the past several decades due to saltwater intrusion and flood stress. These causes will be further discussed by Leigh Anne Sharp and co-authors in an accompanying session presentation. Recent efforts have shown that providing additional one-way drainage structures in addition to the five existing water control structures will help to reduce flood stress in the CCW. This presentation will summarize the benefits of proposed one-way drainage improvements through both a Regional MIKE modeling analysis by Mott MacDonald as well as a detailed design HEC-RAS modeling analysis by Neel-Schaffer.

A MIKE-FLOOD model of the Calcasieu-Sabine Basin was originally developed by The Water Institute to support previous efforts in the area (TWI, 2019). Mott MacDonald further elaborated on this Regional Modeling concept by developing a new updated high-resolution numerical modeling using the commercial modeling software MIKE-21. The updated numerical model was used to test project alternatives and it demonstrated that conveyance improvements in the existing grand bayou system and addition of one-way drainage structures of varying sizes at seven additional locations along the Calcasieu Lake Rim provided optimal drainage capacity of the CCW.

Following the MIKE Regional Modeling efforts, Neel-Schaffer developed a 2D unsteady HEC-RAS model to simulate detailed design conditions. The HEC-RAS modeling tools allowed the team to further refine proposed project alternatives and detailed design conditions from the Regional Mike model. Both teams then used their complementary tools to analyze to showcase the benefits of providing additional hydraulic connections between the CCW marshes and Calcasieu Lake and provide detailed hydraulic conditions to be used in the project design.

Presenter or Panelist 4: Arpit Agarwal | Mott MacDonald, Arpit.Agarwal@mottmac.com

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hydraulic connections between the CCW marshes and Calcasieu Lake and provide detailed hydraulic conditions to be used in the project design.

Presenter or Panelist 5: Katie Freer-Leonards | Coastal Protection and Restoration Authority of Louisiana, katie.freer@la.gov

Maximizing Large-Scale Project Benefits through Watershed Scale Planning

The purpose of the Calcasieu-Sabine Large-Scale Marsh and Hydrologic Restoration Project (CS-0087) is to leverage Louisiana's RESTORE Bucket 1 funds to reduce land loss within the Calcasieu-Sabine Basin. Specifically, the project seeks to reduce stress from inundation within the 65,000 acre Cameron Creole Watershed (CCW), thereby improving vegetative productivity and reducing the conversion of wetlands to open water. These objectives would be achieved by constructing 1) gravity drainage structures with backflow prevention along the lake rim, enabling more consistent marsh drainage into Calcasieu Lake and; 2) large-scale marsh creation and nourishment.

Home to a portion of the Cameron Prairie National Wildlife Refuge and large tracts of privately owned wetlands, the CCW is the site of multiple management, restoration, and mitigation efforts led and funded by a diverse range of parties. For the CS-0087 project to realize its full benefits potential, the team has modeled and coordinated solutions that would enable other parties to complement and extend the project features and functions in future restoration efforts. The team has also implemented atypical project structuring and schedule strategies to accelerate design and implementation of the features whose effectiveness will change as sea level rises.

This session will provide an overview of the planning and management strategies used by the CS-0087 Program Team to establish a regional restoration framework and develop a large-scale, multifaceted ecosystem restoration project within it.

Ecosystem Restoration

Standard, Session #74

Project Successes and Ecosystem Impacts - Rivers and Swamps

This session consists of 5 presentations related to coastal restoration in river-influenced and swamp environments, covering a variety of project types, locations, and approaches.

Session Organizer: | , Email:

Moderator: Heather Sprague | Arcadis, heather.sprague@arcadis.com

Presenter or Panelist 1: Dawn Davis | NOAA/NMFS/SERO/Habitat Conservation Division, Dawn.Davis@noaa.gov

Delta Wide Crevasses Project– Harnessing Natural Processes to Build and Sustain Land

The Delta Wide Crevasses (DWC) project provided an opportunity and need to address wetland losses resulting from high subsidence rates in the Mississippi River Delta. This restoration project, in technique, space, and time, mimics the natural process of crevasse and splay formation to promote natural growth and retraction as a result of river sediment deposition that is responsible for building much of the Mississippi River Delta through cyclical sub-delta progradation, maturation, and degradation. The techniques involved either constructing new crevasses by creating gaps in existing banklines or enlarging existing crevasses via dredging to increase flow. The DWC project constructed nine new crevasses and maintenance dredged 13 existing crevasses in three phases during 1999, 2005, and 2014 in the Mississippi River Delta with funding from the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) program. Land/water analyses of the 22 crevasses were conducted six times between 2001 and 2022. Overall land gain was 282 acres from all the crevasses over the 21 years of the project life. The highest average land gain rate occurred in the first 5 years after construction of the crevasses at 3.5 acres per crevasse per year with decreasing land gain rates at 20 years after construction at 0.5 acres per crevasse per year. The lower average land gain at 20 years after construction was an expected result as crevasse-splay development is rarely active for more than 10 to 15 years due to infilling of crevasses and crevasse splays. This is a proven restoration technique that is simple in design and easy to build and maintain. The Delta Wide Crevasses project is the most cost effective CWPPRA project in terms of land building at $13,020 per acre. In 2022, the CWPPRA Task Force approved an extension in funding for the project to construct an additional 20 crevasses over the next 20 years.

Presenter or Panelist 2: Kelin Hu | Tulane University, khu1@tulane.edu

Modeling habitat suitability for bottlenose dolphins with the Mid-Breton Sediment Diversion

Louisiana has experienced substantial coastal wetland loss. Preserving a viable and sustainable coastal ecosystem in Louisiana requires the re-introduction of fresh water and sediment from the river into nearby areas that have become increasingly saline since levees were built. The Mid-Breton Sediment Diversion, which is anticipated to have a maximum discharge of 50,000 cubic feet per second, is a proposed restoration project that has been studied for decades and is an integral part of Louisiana's Coastal Master Plan. Restoring and sustaining coastal wetlands in Breton Sound and surrounding areas is critical to the long-term prospects for dolphins, their prey, and all other estuarine wildlife. Operation of the Mid-Breton Sediment Diversion will further lower salinities in these areas, impacting the amount of

suitable habitat available in the basin for bottlenose dolphins (BND). In this study, a three-dimensional process-based hydrodynamic and salinity model is developed to calculate habitat suitability index (HSI) for BND in the Breton Sound and Pontchartrain-Chandeleur Basin under high, moderate, and low Mississippi river flow conditions with and without the Mid-Breton Sediment Diversion. The BND habitat is represented by the longest streak of days in a year that salinity is below 5 ppt. The purpose of this study is to identify and assess the suitable habitat for BND in the Breton Sound and other nearby basins. This is an ongoing study supported by the Coypu Foundation and the National Wildlife Federation (NWF). Preliminary results and the most recent updates will be presented at the SOC conference.

Presenter or Panelist 3: Andrew Reicks | Sky Wave at CDM Smith, reicksa@cdmsmith.com

Using Drone Data and Machine Learning to Quantify Ecosystem Diversity, Health, and Biomass

Assessing the progression and success of coastal restoration in the face of climate change and sea level rise is vitally important. For restoration projects this can include estimating carbon capture, monitoring site erosion, evaluating the effects of sea level change on vegetation, and assessing species diversity. Drones and machine learning are revolutionary technologies that allow us to answer questions at resolutions not possible using satellite data and scales not feasible using field data.

CDM Smith has used drone-mounted optical, 5-band, and 10-band multispectral cameras to collect data sets for tidal salt marsh restoration and at mixed upland and wetland sites. These data sets have been used to assess site topography, erosion, vegetative health, biomass, and species diversity and for locating invasive species. Two case studies using drones and multispectral cameras for restoration and land management will be presented.

The first case study is a coastal restoration project where drone-derived surface elevations and 5-band multispectral data were combined with traditional field sampling techniques to create a machine learning model to quantify site-wide above ground biomass of saltmarsh cordgrass (Spartina alterniflora) at a quarter meter resolution.

The second case study focuses on identifying and mapping invasive and native species at a mixed upland and wetland 100 acre site. A 10-band multispectral camera was combined with field sampling to produce training and validation data for a machine learning model. The final model included 14 species and achieved an overall accuracy of 80%.

These high resolution and spatially explicit models can provide land managers with valuable site-specific data on the potential effects of climate change and sea level change. This information can help them improve restoration efforts and is a key component to quantifying carbon capture and providing a more detailed picture of site-wide health and diversity.

Presenter or Panelist 4: George Washburn | Louisiana State University, gwashb1@lsu.edu

Increased levels of nitrate nitrogen and full sun are detrimental to baldcypress growth

Baldcypresss (Taxodium distichum (L.) Rich.) forests are crucial to the Southeast coastal region for the trees' ecosystem services. Many organizations have been trying to restore the ghost and dead forests found throughout the Gulf region through restoration events. Baldcypress seedlings and saplings face several abiotic and biotic stressors, including but not limited to elevated levels of salinity, nutrients, temperature, and light intensity. These stressors can be the limiting factor in the success or failure of these massive planting efforts.

To assess which stressors were of most concern to the restoration efforts, we conducted common garden experiments with baldcypress seedlings grown under these abiotic conditions and evaluated them for their survival, growth in height and diameter, and carbon storage. Our studies found that nitrate nitrogen at levels mimicking Mississippi river diversions and full sun rather than heavy shading for portions of the day were some of the most detrimental effects that sub-one-year seedlings could face, leading to more significant mortality, poor growth, and poor carbon storage. Also, the presence of older saplings being potted nearby led to substantial decreases in mortality, greater growth in height and diameter, and greater carbon storage.

This work implies that restoration management needs to consider the abiotic conditions of the areas they intend to plant baldcypress seedlings. Further, they need to consider the age of the seedlings/saplings used. This work speaks to the need for restoration efforts to plant baldcypress seedlings in areas immediately adjacent to older baldcypress. This type of planting also mimics a natural way that forests expand. If we want our wetlands to be restored with healthy thriving trees and continue to store carbon, we need to plant more baldcypress in close relation to each other or mature trees and decrease the fertilizer runoff issues in forested wetlands.

Presenter or Panelist 5: John White | LSU, Dept of Oceanography & Coastal Sciences, jrwhite@lsu.edu

Delineating River Diversion Impacts on Land Change at the Davis Pond Diversion

A published a study using almost 200 satellite images as well as results from over 280 soil samples taken at 140 stations, both in 2007 and 2018 demonstrated that the land in the Davis Pond receiving area has increased during the most recent decade of the diversion operations. We have since followed up that study, to create three different areas of influence in the ponding area based on the changes to the soil properties in our dense spatial grid. Using increases in bulk density, we modeled an area that received both sediments and associated dissolved nutrients. We also modeled an area that receive no significant sediment but did receive nutrients using the increase in 15N stable isotopic N over the 11 years, Finally, we modeled an area that received no nutrient and no sediments. All three areas are within the Davis Pond influence area. The vast majority of the land increase was in the area that received sediments and nutrients, while the area that received nutrient increased in land minimally, and the area with no sediments and no nutrients did not significantly change in land area at all. This study suggests that significant land increases occurs primarily in river sediment deposition areas. The region of sediment and nutrients did not change significantly in the C sequestration however the nutrient addition area did significantly increase in C content of the soil. An additional outcome from this study demonstrated that annual rainfall patterns lead to apparent marsh loss or gain depending on the wet dry cycle before the diversion was even created. This oscillatory pattern was not apparent in the past decade as the land area continued to increase, despite wet periods and river water diverted into the marsh.

Flood Risk Management: Coastal and Inland

Panel, Session #75

Case Studies in Implementing Urban Green Infrastructure

This panel will discuss lessons learned from conceptualizing and implementing the Gentilly Resilience District in New Orleans. The city has developed and executed green infrastructure projects at the parcel, neighborhood, and district scales through the implementation of this Resilience District. The panel will discuss lessons learned from four projects and programs:

1.An award-winning Climate Adaptation grant program that installed 190 residential water retention fixtures in partnership with Low-Income homeowners.

2.The instillation of connected stormwater-storing street basins, detention ponds, and bioswails.

3.The ongoing initiative to transform a 25-acre site into a multi-use detention basin and recreational green space.

4.The growth of a local green infrastructure industry through educating residents, incubating businesses, and awarding construction contracts to local and DBE businesses.

The panel discussion aims to provide case studies for other municipalities, especially on the Gulf Coast, who want to implement resilience projects and programming at the parcel, neighborhood, and district level.

Session Organizer: Abrina Williams | New Orleans Redevelopment Authority, Email: abrina.williams@nola.gov

Moderator: Abrina Williams | New Orleans Redevelopment Authority, abrina.williams@nola.gov

Presenter or Panelist 1: Meagan Williams | Urban Water Program Manager, memwilliams@nola.gov

Presenter or Panelist 2: Seth Knudsen | New Orleans Redevelopment Authority, scknudsen@nola.gov

Film, Session #77

Managing Rivers for Multiple Uses

Standard, Session #78

The Lowermost Mississippi River Management Program: Modeling and Strategic Management Support

The Mississippi River has been traditionally managed separately for three business lines of navigation, flood protection, and ecosystem restoration. Although management strategies for each are typically based on the individual priorities, all three rely on effective management of water and sediment throughout the river. The scope of the Lowermost Mississippi River Management Program (LMRMP) includes the identification of management strategies that unify the three business lines for the Lowermost Mississippi River (LMR) and the development of a framework for evaluating the likely outcomes of those strategies over timescales of 50-100 years. Using this framework, the potential implications of various sediment and water management strategies for the range of federal/state decision-maker and stakeholder interests (ecosystem restoration, flood risk reduction, maintaining navigation channels, etc.) will be investigated. The outputs of the evaluation framework will be used to illustrate the outcomes of holistic LMR management to decision-makers and stakeholders, including the U.S. Army Corps of Engineers (USACE), with the goal of precipitating changes in how the LMR is managed.

The presentations in this session provide an overview of the LMRMP project and an update on its progress, beginning with a description of the evaluation metrics that will be used to assess the performance of the management strategies and environmental scenarios considered in the project. Subsequent presentations describe a novel environmental modeling tool that has been developed to support the project, the methods by which model outcomes will be translated into strategic guidance, and examples of how operational dredge management data is repurposed to inform regional sediment management decisions.

Session Organizer: Christopher Esposito | The Water Institute, Email: cesposito@thewaterinstitute.org

Moderator: Joseph "Wes" Leblanc | Louisiana Coastal Protection and Restoration Authority, Joseph.Leblanc@la.gov

Presenter or Panelist 1: James Pahl | Louisiana Coastal Protection and Restoration Authority, James.Pahl@la.gov

Introduction and Overview of the RESTORE-funded Lowermost Mississippi River Management Program

Managing the Lowermost Mississippi River (LMR) for ecosystem restoration and protection, flood risk management, and navigation is a complex, long-term endeavor, and requires stewardship of LMR water and sediment. Historical and ongoing management actions and uncertainty of future sea-level rise, subsidence, and watershed-scale precipitation and river flows continue to challenge scientific knowledge of the system and management of the LMR for multiple purposes. More comprehensive data and improved decision support tools are therefore needed to evaluate existing LMR conditions and future management strategies.

The Lower Mississippi River Management Program (LMRMP) was conceived by the Louisiana Coastal Protection and Restoration Authority (CPRA) to develop and apply the information needed to inform more holistic water and sediment management that supports the long-term sustainability of the LMR and Louisiana's coastal zone. LMRMP builds upon the Louisiana Coastal Area Mississippi River Hydrodynamic and Delta Management Study previously conducted by CPRA and the US Army Corps of Engineers (USACE). It is developing River Hydrodynamics and Flow, Sediment Transport and Dredging, and Landscape Condition and Change science, and will support progress toward holistic management of Mississippi River sediment and water resources.

Funded by $9.3 million from the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States (RESTORE) Act Council, LMRMP was launched in 2018. CPRA's partners include the Water Institute of the Gulf (TWI), the US Geological Survey, USACE, Tulane University, the Louisiana Universities Marine Consortium (LUMCON), and Royal Engineering, among others. Most technical activities are scheduled to conclude in fall 2023. The presentation will review the full breadth of LMRMP technical investigations and serve as lead-in to the ensuing technical presentations in this session.

Presenter or Panelist 2: Christopher Esposito | The Water Institute, cesposito@thewaterinstitute.org

Physics-Based and Machine-Learning Hybrid Model Supporting Mississippi River Management Strategy

The Lowermost Mississippi River Management Program aims to evaluate benefits and costs of management schemes for the Lowermost Mississippi River (LMR), including unintended adverse impacts under a range of projected futures. Doing so requires a modeling approach that accurately predicts water flow, sediment transport, and channel bed evolution and sediment storage over the entire LMR for long time scales (50-100 yrs), and that can be efficiently applied to obtain results for a large range of scenarios, alternatives, and combinations.

The physics of water flow is well understood and predictable over these space and time scales. The same cannot be said for sediment transport, where physics-based models typically exhibit major uncertainties and limitations, or accumulate error when used over long time scales or complex spatial domains. Machine Learning (ML) approaches offer the potential for models that are fast, accurate over complex spatial domains, and are well suited to deal with unusual influences on sediment transport such as hysteresis in the upstream sediment supply or anthropogenic influences like intensive dredging on ad hoc schedules.

We will demonstrate a hybrid modeling approach wherein a validated USACE HEC-RAS sediment transport model is used to train suites of ML models of sediment transport throughout the LMR. The ML models are validated against modeled and observational data, and are then used in place of the HEC-RAS sediment transport model, while still being driven by HEC-RAS flow outputs. This approach, known as surrogate modeling, is proven in numerical weather prediction , where the physics is also complex and fast run times are a priority, but has not yet been widely adopted by the geomorphology community. We will demonstrate the effectiveness and utility of this approach at key locations in the LMR.

Presenter or Panelist 3: Nastaran Tebyanian | The Water Institute, ntebyanian@thewaterinstitute.org

Consequence Modeling Supporting Mississippi River Management Strategy and Real Time Forecasting

Keeping the Lower Mississippi River navigable while also mitigating the risks of flooding through levee maintenance and engaging in restoration projects to prevent further land loss is an enormous logistic challenge. The Lowermost Mississippi River Management Program (LMRMP) is developing modeling frameworks to support a more holistic management of the river in the next several decades as part of a collaboration of Louisiana's Coastal Protection and Restoration Authority, the Water Institute of the Gulf (Institute), Royal Engineering, USACE ERDC, and LSU. While developing effective management strategies for the river in its current state is an important step, it is equally important that these strategies are resilient to climate change. Changing patterns of rainfall and tropical storms, sea level rise, and subsidence all potentially affect the outcomes of river management strategies. In order to develop strategies that can achieve the diverse goals of river management set out by the program, the Institute has adopted a Robust Decision Making (RDM) framework to analyze the uncertainties and choices available to manage the river. Unlike deterministic model-based approaches, RDM does not try to predict the future as precisely as possible, instead using model simulations to aid in scenario and tradeoff analysis . Through RDM analysis the Institute has been able to provide decision makers with information about what potential climate scenarios cause current management practices to fail to meet their objectives, what levels of objective performance are possible under different management policies, and how different management objectives can tradeoff against each other in the uncertain future.

Presenter or Panelist 4: Mike Miner | The Water Institute, mminer@thewaterinstitute.org

A Regional Sediment Management Strategy for the Lowermost Mississippi River

Sand availability, quality, and transport distance have the greatest influence on restoration project costs and can limit project constructability, especially for barrier islands. The Lowermost Mississippi River (LMR) and dredging practices employed by the US Army Corps of Engineers (USACE) for navigation channel maintenance provide for a renewable sand resource delivered to the coast in predictable quantities that exceeds the annual needs of Louisiana Coastal Protection and Restoration Authority's Barrier Island System Management (BISM) Program. Under the LMR Management Program (LMRMP), a regional sediment management (RSM) strategy is being developed with the objective of leveraging USACE maintenance dredging to provide sand to BISM projects by analyzing a set of alternatives to identify those mutually beneficial to navigation, flood risk reduction, and coastal wetland ecosystem restoration. Studies on sediment transport and dredging below Venice, Louisiana, found that sand is not flushed through this reach due to reduced stream power, resulting in channel shoaling and triggering one of the nation's largest dredging operations (nearly 20 million yds3 annually). The RSM strategy uses LMRMP research and tools to predict sand supply rate, conduct a cost-benefit analysis that considers various sand storage and transport options, and coordinate with USACE, CPRA, and other stakeholders (LDWF, LDNR, USFWS, LMR Navigation interests, etc.) so that sand dredged for channel maintenance can be available for implementation of BISM projects. Benefits include a renewable sand resource for coastal restoration with minimal environmental impacts relative to excavating undisturbed seafloor habitat, a solution to limited capacity for dredged material storage, and reduced sedimentation in birdsfoot delta distributaries resulting in increased freshwater flow to nourish wetlands.

Presenter or Panelist 5: Andrew Courtois | The Water Institute, acourtois@thewaterinstitute.org

A Machine Learning Approach to Forecasting Sediment Delivery in the Mississippi River

Mississippi River sediment is both a solution for preserving a diminishing coastline and a nuisance for

maintaining navigation throughout the River. Recurring dredging operations throughout the lowermost river between Baton Rouge and the Gulf, are required to ensure safe, reliable navigation for deep draft vessels and their cargo. The scale of dredging operations required on a yearly basis is dependent on the River's annual sediment and water discharge. The magnitude and timing of dredging necessary to maintain appropriate depths is difficult to predict and often done in response to shoaling that disrupts navigation and port operations. This can result in costly downtimes as ships wait in anchorage (or are redirected to other ports) as berths and navigation channels are dredged. Presently, hydrographic surveys, river hydrograph data, and institutional knowledge are used to inform reactionary dredging operations. This research focuses on crowd-sourcing data from vessels working on the river and leveraging those data—in addition to historical and real-time river hydrograph and bathymetric data—to develop a machine learning model that forecasts sediment delivery days to months in advance at ports along the River. This provides a valuable tool to inform dredging operations and vessel berthing logistics in advance of shoaling events. This machine learning approach to predicting bed elevation in near-real time for certain locales of the river can be applied to forecast sediment transport and delivery to sediment diversions and employed to optimize diversion operations. This can also inform opportunities for beneficial uses of dredged River sand for coastal restoration that are often missed under a more reactionary approach to navigation channel maintenance.

Preparing for Climate Change

Standard, Session #79

Nature Based Solutions

"In the face of warmer global temperatures, increased drought and flooding, more severe and frequent storms, biodiversity loss, sea level rise, and coastal erosion, there's never been a more urgent time to integrate Nature-based Solutions to mitigate our communities' infrastructure, natural resources, and climate change challenges. To address these pressing issues of our time, Engineering with Nature (EWN) addresses nature's impacts with natural solutions. EWN is a design approach developed by the United States Army Corps of Engineers (USACE) that embodies natural features and processes into the mitigation and adaptive design process to increase long-term human, ecological, and infrastructure resilience.

Putting ecosystem priorities and the role of oceans on the global stage, the United Nations declared 2021-2030 the Decade on Ecosystem Restoration and the Decade of Ocean Science for Sustainable Development. These global compacts, signed by 70-plus countries, aim to prevent, halt, and reverse the degradation of ecosystems around the world using a nature-based approach and ensure ocean science can fully support countries in creating improved conditions for sustainable development of the Ocean. These efforts also play a critical role in achieving the UN's 17 Sustainable Development Goals (SDGs), and ties closely to the importance of leveraging the EWN approach to future readiness and resource protection."

Session Organizer: Devyani Kar | Stantec, Email: devyani.kar@stantec.com

Moderator: Madeline Foster-Martinez | University of New Orleans, mrfoster@uno.edu

Presenter or Panelist 1: Jason Bird | Jacobs Engineering, Jason.Bird@jacobs.com

Engineering with Nature® to Increase Infrastructure Resilience

Changing climate patterns and extreme weather events can have long term impacts on personnel readiness and military infrastructure. The DoD has created Climate Action Plans that call for developing long term strategies and plans to reduce vulnerabilities that pose threats to military mission, infrastructure and personnel. DoD facility managers are tasked with developing facility-specific measures for protecting infrastructure from the effects of climate change and extreme weather. Facility managers can benefit from greater awareness of the full range of risk reduction measures and value creation opportunities available through the integration of Engineering with Nature® (EWN) solutions. Developed by the Engineer Research and Development Center (ERDC) of the US Army Corps of Engineers (USACE), EWN enables more sustainable delivery of diversified economic, social, and environmental benefits associated with protecting DoD infrastructure. The EWN program, and Nature-based Solutions (NBS) in general, received major support from the highest level when President Joe Biden issued Executive Order 14072, "Strengthening the Nation's Forests, Communities, and Local Economies" on April 22, 2022, as well as the NBS Roadmap and NBS Resources Guide issued by the White House Council on Environmental Quality, White House Office of Science and Technology Policy, White House Domestic Climate Policy Office, in October 2022.

This session will describe the Engineering With Nature® (EWN®) Program's effort to support mission readiness, via recent examples of EWN efforts at Army, Marine Corps and Navy installations. Members from the EWN team will describe the process of engaging regional stakeholders and subject matter experts to further examine, develop, and implement NBS to address climate shocks and stressors in a diverse array of ecosystems—from the flood- and storm-vulnerable coastal regions in the US Southeast and key installations in Hawaii.

Presenter or Panelist 2: Ben Smith | Stantec, Ben.Smith@stantec.com

Enhanced Biological Carbon Storage from Nature-based Solutions.

Environmental restoration is the process of returning a system to an ecologically functional state. This process is primarily focused on ecosystem services, which include carbon sequestration. These project types often generate many co-benefits not limited to habitat enhancement, water quality treatment, infrastructure protection, air quality improvements, and soil erosion prevention. The Prime Hook National Wildlife Refuge was investigated for its carbon sequestration potential. This restoration project was undertaken following substantial hurricane damage and included rebuilding two miles of shoreline and 4,000 acres of tidal wetland. As part of the monitoring process following construction, land cover data has been collected each year to include herbaceous vegetation area. Although the project was undertaken for a variety of reasons, including the restoration of critical habitat for migratory birds, fish, and other wildlife, baseline and monitoring cover data could be used to estimate the enhanced carbon capture that has occurred onsite. The Prime Hook Project is estimated to have sequestered 4,161 more tons of carbon dioxide equivalents (CO2e) to date than the system would have if left degraded. The site is anticipated to reach 22,732 more tons of CO2e after 30-years, which is often the minimum contract period for a carbon offset project. These climate benefits offset approximately 3,916 US drivers and highlight the potential of environmental restoration to provide enhanced carbon sequestration.

Presenter or Panelist 3: Courtney McGeachy | Ocean Visions – UN Decade Collaborative Center for Ocean Climate Solutions, Courtney@oceanvisions.org

Leveraging the UN Ocean Decade to advance ocean-climate innovations and solutions to protect oceans and coasts.

The climate crisis is the greatest threat to ocean and coasts, which nurtures 80% of all life on Earth. At the same time, the ocean is critical to planetary climate regulation. The scale of climate challenges to the ocean and hence risks to the climate is immense and will take planetary-scale action across several dimensions. The Ocean Visions-UN Decade Collaborative Center for Ocean-Climate Solutions (OV-UN DCC) can contribute significantly to ameliorating the ocean-climate crisis by identifying, testing, developing, scaling, and amplifying ocean- based innovations and solutions globally. The OV-UN DCC leverages the UN Ocean Decade structure and United Nations Sustainable Development Goals to advance awareness of the need for integrated ocean-climate solutions, identify the tools available to develop and advance these solutions, and build effective collaborations and partnerships to move critical priorities forward. The focal areas the OV-UN DCC include advancing ocean-based solutions to climate change, building equitable solutions for the climate resiliency of critical marine ecosystems and coastal communities, regeneration of ecosystems and biodiversity to counter the impacts of climate change, and building ocean-based food security in the face of climate impacts.

Presenter or Panelist 4: Amanda Tritinger | ERDC, USACE, Amanda.S.Tritinger@usace.army.mil

Engineering With Nature Toolkit for Hydrodynamic Modeling

Environmental restoration is the process of returning a system to an ecologically functional state. This process is primarily focused on ecosystem services, which include carbon sequestration. These project types often generate many co-benefits not limited to habitat enhancement, water quality treatment, infrastructure protection, air quality improvements, and soil erosion prevention. The Prime Hook National Wildlife Refuge was investigated for its carbon sequestration potential. This restoration project was undertaken following substantial hurricane damage and included rebuilding two miles of shoreline and 4,000 acres of tidal wetland. As part of the monitoring process following construction, land cover data has been collected each year to include herbaceous vegetation area. Although the project was undertaken for a variety of reasons, including the restoration of critical habitat for migratory birds, fish, and other wildlife, baseline and monitoring cover data could be used to estimate the enhanced carbon capture that has occurred onsite. The Prime Hook Project is estimated to have sequestered 4,161 more tons of carbon dioxide equivalents (CO2e) to date than the system would have if left degraded. The site is anticipated to reach 22,732 more tons of CO2e after 30-years, which is often the minimum contract period for a carbon offset project. These climate benefits offset approximately 3,916 US drivers and highlight the potential of environmental restoration to provide enhanced carbon sequestration.

Presenter or Panelist 5: Julie Albert | Tulane University, jalbert6@tulane.edu

Recycling for the Coast

Franziska Trautmann and Max Steitz founded Glass Half Full, which started as a backyard operation to bring glass recycling back to the city of New Orleans in 2020. Its mission to crush the glass into sand for use in coastal restoration catalyzed the formation of the ReCoast Team in 2021. Funded by the National Science Foundation, the core ReCoast Team consists of over twenty scientists and engineers conducting the research needed to ensure that recycled glass sand is safe to use in our waterways and in coastal environments. Greenhouse, aquatic, and field experiments have been conducted to further this goal. This research in Louisiana has advanced our collective knowledge and understanding of the dynamic interconnections between technological innovation, economics, society, politics, history, and the environment. This new compilation of historic and scientific knowledge has enabled us to start the planning and permitting process for a bald cypress swamp restoration project in Bayou Bienvenue and for a cluster of projects in the Terrebonne Bay area in partnership with the Pointe au Chien Tribe. Remaining abstracts

Preparing for Climate Change

Panel, Session #80

Using data for decision-making to strengthen community and individual resilience

Data can be a powerful tool in decision-making to confront the challenges associated with climate hazards or other disasters. Ensuring that the data is complete, sufficient, and appropriate supports the development of plans, policies, strategies, and programs that adequately address the priorities and needs of communities most at-risk. Understanding the limitations of using data or data-support tools reduces the occurrence of unanticipated outcomes. This panel will discuss strategies used to translate data into action by local governments and individual citizens, challenges that come with using data or scattered data sources, and future directions to adapt and mitigate climate hazards. The discussion will highlight ways to supplement data sources with equity-centered approaches such as incorporating community voice and community-based participatory research practices. Panelists will feature grantees funded by the Gulf Research Program of The National Academies of Sciences, Engineering, and Medicine.

Session Organizer: Robert Gasior | National Academies of Sciences, Engineering, and Medicine, Email: rgasior@nas.edu

Moderator: Robert Gasior | National Academies of Sciences, Engineering, and Medicine, rgasior@nas.edu

Presenter or Panelist 1: Rebeca de Jesus Crespo | Louisiana State University, College of The Coast & Environment, rdejesuscrespo1@lsu.edu

Presenter or Panelist 2: David Johnson | Purdue University, davidjohnson@purdue.edu

Presenter or Panelist 3: Traci Birch | Louisiana State University, Coastal Sustainability Studio, tbirch@lsu.edu

Presenter or Panelist 4: Christopher Emrich | University of Central Florida, Christopher.Emrich@ucf.edu

Coastal Law, Policy & Funding

Panel, Session #81

What's Next for Mr. Go? Exploring the path forward with Federal funding for restoration

The Mississippi River Gulf Outlet (MRGO) is one of the most disastrous Federal projects in the nation's history, with devastating impacts to people and the environment. The Federal shipping channel impacted over a million acres of coastal habitat surrounding New Orleans and played a significant role in the deadly, catastrophic flooding of communities like the Lower 9th Ward and Chalmette during Hurricane Katrina. Since Katrina and the closure of the channel, much has been learned about the reach of channel impacts and some restoration progress has been made thanks to strong stakeholder engagement and leadership from the State of Louisiana.

However, a major obstacle in recovery from the channel impacts has been a dispute over who pays for MRGO ecosystem restoration work. Because of this dispute, to date, no Federal funding has been allocated for the Army Corps' 2012 MRGO Ecosystem Restoration Plan. In late 2022, Congress clarified that funding MRGO ecosystem restoration is a fully Federal responsibility. This major development allows a path forward for Federal funding commitments specifically for restoration of areas impacted by MRGO. It also left a lot of people wondering 'What is next?'. This panel will explore the next steps for restoring and rebuilding the marshes, ridges, shorelines, and other massive habitat areas degraded or destroyed by the MRGO, which are critical to protecting the Greater New Orleans area from impacts of storm surges and sea level rise. Representatives from local communities and governments, the State of Louisiana, and the Army Corps will discuss the MRGO, covering the following topics:

- *Progress to date*
- *Cost share clarification and the path forward*
- *The MRGO nexus between the Coastal Master Plan and the Army Corps plan*
- *City of New Orleans and St. Bernard Parish priorities for MRGO ecosystem restoration*
- *Stakeholder engagement and how impacted communities benefit directly from restoration economy*

Session Organizer: Amanda Moore | National Wildlife Federation, Email: moorea@nwf.org

Moderator: Amanda Moore | National Wildlife Federation, moorea@nwf.org

Presenter or Panelist 1: Austin Feldbaum | City of New Orleans, afeldbaum@nola.gov

Presenter or Panelist 2: Arthur Johnson | Lower 9th Ward Center for Sustainable Engagement and Development, ajohnson@sustainthenine.org

Presenter or Panelist 3: Kent Bollfrass | Coastal Protection and Restoration Authority, kent.bollfrass@la.gov

Presenter or Panelist 4: Guy McInnis | St. Bernard Parish Government, presidentmcinnis@sbpg.net

Presenter or Panelist 5: Michelle Boudreaux Meyers | US Army Corps of Engineers, Michelle.L.Meyers@usace.army.mil>

Hydrology, Geomorphology, and Ecology of the Coast

Standard, Session #82

Protecting and Restoring for Marine Mammals and Sea Turtles in Louisiana

Ongoing large-scale ecological restoration efforts in Louisiana estuaries include restoration for injuries to marine mammals and sea turtles, a portfolio of activities that are supported by NRDA settlement funds resulting from the 2010 Deepwater Horizon oil spill injury. This session will provide information on sea turtle and marine mammal strandings and Unusual Mortality Events in Louisiana; describe known threats, including examples of animals that have been trapped by construction activities; what to do if you encounter an injured or stranded animal; new efforts to build stranding response network capacity in LA; and ongoing and future restoration efforts for these resources.

Session Organizer: John Fallon | Audubon Nature Institute, Email: jfallon@audubonnstitute.org

Moderator: John Fallon | Audubon Nature Institute, jfallon@audubonnstitute.org

Presenter or Panelist 1: Lyndsey Howell | NOAA Office of Protected Resources, lyndsey.howell@noaa.gov

The Louisiana Sea Turtle Stranding and Salvage Network

Sea turtles in the Gulf of Mexico (GOM) are a shared resource, crossing state, federal, and international boundaries and relying on a system of interconnected beach, nearshore, and offshore habitats. The 2010 Deepwater Horizon (DWH) oil spill injured all life stages and species of sea turtles throughout the GOM. The DWH trustees implemented the Sea Turtle Early Restoration Project (STERP) to help restore sea turtles by addressing threats on the nesting beaches and in the marine environment. Under the STERP, the Louisiana Sea Turtle Stranding and Salvage Network (STSSN) is being enhanced by improving stranding response capability, coordination, data reporting, and mortality investigations. The primary threats and drivers of mortality to sea turtles across the northern GOM, historical state stranding trends, and the STERP enhancements implemented in Louisiana will be presented.

Presenter or Panelist 2: Lauren Noble | ERT, Inc., Lauren.Noble@noaa.gov

Increasing Capacity for Marine Mammal Stranding Response in Louisiana

This presentation will cover the goals of the Louisiana Trustee Implementation Group (TIG) funded Deepwater Horizon (DWH) restoration project to increase capacity for marine mammal stranding response in Louisiana. It will provide an overview of the Marine Mammal Stranding Network in Louisiana including stranding network operations and NOAA's responsibilities for protecting marine mammals. The past twenty years of stranding data from Louisiana are synthesized to provide a baseline against which to measure the actions implemented by the project to address gaps and enhance the capacity of Louisiana's Marine Mammal Stranding Network. We will discuss the progress to date and next steps towards achieving the project's goals to improve upon the timeliness of stranding response, enhance individual animal survival, and improve diagnosis of illness and cause of death in stranded cetaceans (whales and dolphins) to better understand their natural and anthropogenic threats. Improving marine mammal stranding response in Louisiana will result in data to better inform future restoration planning, monitoring, and adaptive management.

Presenter or Panelist 3: Gabriella Vazquez | Audubon Nature Institute, gvazquez@audubooninstitute.org

Marine Mammal and Sea Turtle Stranding Response in Louisiana

This presentation will provide an overview and highlight the marine mammal and sea turtle stranding response efforts by Audubon Nature Institute (ANI). ANI is the primary stranding response partner for NOAA Fisheries in Louisiana. Marine mammals and sea turtles strand regularly on Louisiana's coastline offering a snapshot of the health of coastal waters. Stranding response investigates reports of stranded animals to determine a cause of stranding or mortality. This data is used to evaluate the health of marine animals, evaluate health trends, identify threats and stressors, and to monitor if an Unusual Mortality Event (UME) should be established for marine mammals. An overview of marine mammal stranding statistics and trends in Louisiana will be discussed. Out-of-habitat marine mammal response, due to extreme weather events or restoration projects, is another major component of stranding response in Louisiana that will be presented.

Presenter or Panelist 4: Mel Landry | NOAA Restoration Center, Mel.Landry@noaa.gov

Future Efforts To Restore Sea Turtles and Marine Mammals in Louisiana

The Barataria Estuary is an ecologically diverse and biologically active region that sustains important commercial and recreational fisheries and coastal communities in southern Louisiana. This location has long been a focus of coastal restoration to counter land loss caused by subsidence, sea level rise, and severe storm impacts. These efforts were invigorated to restore for significant crude oil exposure and response activity impacts stemming from the 2010 Deepwater Horizon oil spill. Assessment of ecosystem-scale effects of restoration activities in the Barataria Estuary can be significantly improved with a comprehensive, baseline knowledge of local lower trophic level organisms as well as their population dynamics. For the purposes of this presentation, lower trophic levels consist of primary producers, primary consumers, decomposers, and detritivores spanning detritus, phytoplankton, zooplankton, microphytobenthos, microbes, meiofauna, macroinfauna, bivalves (exclusive of oysters), terrestrial insects, and select epifauna. These organisms serve a critical role in sustaining higher trophic levels, including commercially and recreationally valuable fisheries species. This presentation outlines a collaborative effort led by NOAA to summarize the current state of existing data related to lower trophic level communities in the Barataria Estuary. This summary identified what additional information is required to address key natural resource management and restoration practitioner needs. These findings will be used to develop a data collection plan that, if funded, will support evaluation of ecosystem-wide food-web effects of restoration within the Barataria Estuary.

Predicting and Planning for the Future of the Coast

Standard, Session #83

Using Modeling to Manage Coastal Ecosystems

Regardless of the ecosystems represented, all habitats along the coastal Gulf of Mexico are experiencing changing environmental conditions. Models that allow natural rersource managers to predict and plan for these changes are needed to effectively manage and preserve habitats. An understanding of the types of uncertainty introduced by these models and their implications is also valuable within the context of climate change modeling and policy setting. This session will highlight the use of hybrid modeling, machine learning, and model uncertainty quantification to advance the managemnent of coastal ecosystems.

Session Organizer: | , Email:

Moderator: Ioannis Georgiou | The Water Institute", igeorgiou@thewaterinstitute.org

Presenter or Panelist 1: Kevin Hanegan | Moffatt & Nichol, khanegan@moffattnichol.com

Hybrid Modeling of Future Estuarine and Ecological Conditions at Barataria Preserve, Louisiana

The Jean Lafitte National Park - Barataria Preserve in Barataria Basin protects 26,000 acres of primarily freshwater deltaic wetlands, among the most biologically productive ecosystems in North America. The park aims to protect and conserve the natural landscape, its biological diversity, and its human history. The Barataria Preserve is located in the upper Barataria Basin south of greater New Orleans. Hydrodynamics and circulation in the Basin are influenced by tides, winds, and precipitation, and modern freshwater inflows are limited to precipitation, urban runoff, and several controlled diversions from the Mississippi River.

To effectively manage the preserve habitats and infrastructure, the Park needs scientifically rigorous projections of key future coastal environmental conditions across the preserve landscape. In this study, we project future hydrodynamics, salinities, and wetland vegetation across the preserve with methods based in part on the Louisiana Coastal Master Plan modeling approach. A modified Integrated Compartment Model including wetland processes and a complementary high resolution hydrodynamic and salinity model of Barataria Basin were employed. Both models were calibrated using measured data and then used to simulate coastal landscape and hydrologic conditions over a future 50-year period. To account for uncertainty in key drivers, several future climate and restoration project scenarios were developed to provide a range of plausible outcomes.

Results highlight the vulnerability of Barataria Basin marshes and fresh marsh ecosystems to future inundation, especially with higher sea level rise, and the ability of large-scale ecosystem restoration projects to maintain estuarine salinity gradients and preserve habitats into future decades.

Presenter or Panelist 2: Hoonshin Jung | The Water Institute of the Gulf, hjung@thewaterinstitute.org

A WETLAND VEGETATION DISTRIBUTION MODEL FOR COASTAL LOUISIANA USING MACHINE LEARNING

Coastal marshes store carbon in vegetation biomass and in soil/sediments at higher per-area rates than

most terrestrial ecosystems. The conversion of coastal habitats to open water due to relative sea level rise and hydrological modifications may result in reduced climate mitigation potential due to differences in habitat-specific net carbon fluxes. Changes in net carbon fluxes due to habitat changes could influence Louisiana's efforts to reach net-zero greenhouse gas emissions by 2050. Thus, it is important to accurately predict coastal habitat changes under future environmental conditions. In the Coastal Master Plan, the Vegetation Dynamic Model (ICM-LAVegMod) has been used to predict wetland vegetation distributions based on future environmental changes. Although ICM-LAVegMod has shown overall reasonable results, accurate predictions are limited because the model uses only two variables (i.e., annual mean salinity and water elevation variation) to predict vegetation type and distribution. It is likely that other variables may explain the spatial distribution of vegetation, species composition, and associated carbon fluxes. For example, recent studies have reported that inundation regime has an important effect on the vegetation community and primary production of emergent marsh, whereby a decrease in above and belowground biomass may be correlated with an increase in inundation period. Therefore, it is necessary to consider additional variables potentially influencing the wetland vegetation coverage to improve model accuracy. In this study, a wetland vegetation distribution model will be developed using machine learning (ML). The ML results will be compared with remote sensing data to assess the ability to predict vegetation composition into the future. Additional key parameters that influence vegetation species and their distribution will also be identified.

Presenter or Panelist 3: Timothy Nelson | Moffatt & Nichol, tnelson@moffattnichol.com

A Hydrodynamic and Cypress/Tupelo Swamp Ecologic Model of the Atchafalaya Basin

At 895,000 acres, the Atchafalaya Basin (AB) is the nation's largest swamp wilderness, containing nationally significant expanses of bottomland hardwoods and forested wetlands. Moffatt & Nichol previously developed an Atchafalaya Basin Model (ABM) for the National Audubon Society in 2012 as a planning tool for evaluation of restoration and management initiatives in the AB. The model encompasses the entire floodway and coastal basin and was calibrated to the 2011 flood. M&N is currently supporting The Nature Conservancy's (TNC) stewardship and ecosystem restoration efforts in the AB by redeveloping the ABM. The updated ABM is a high resolution, flexible mesh hydrodynamic model with updated topobathymetric sources that is calibrated to the latest hydrologic monitoring data, including USGS discharge measurements along secondary channels. The updated model more accurately simulates the distribution of flows out of the Atchafalaya River into the surrounding floodplain through secondary channels and the regulation of backwater swamp inundation by vertical features (spoil banks, etc.). A Cypress/Tupelo Swamp Ecology Module, modeled after the wetland morphology modules in both the LA Coastal Master Plan Integrated Compartment Model and M&N's Terrebonne Basin model, was also developed to model the impacts of varying AB flows and inundation extents/durations on Cypress/Tupelo germination, survival, and regeneration. The ABM and coupled ecology module are together used to examine regeneration potential under current hydrologic conditions and will be used in future phases to characterize changes in suitability for fresh forested wetlands over time associated with different AB water management strategies.

Presenter or Panelist 4: Julie Whitbeck | National Park Service, julie_whitbeck@nps.gov

Integrating site-specific monitoring & future conditions modeling to manage a National Preserve

Located in a subsiding delta lobe of the Mississippi River, the Barataria Preserve protects 26,000 acres of primarily freshwater wetlands in the upper Barataria Basin. Its highest terrain is the natural levee ridges

of two former Mississippi River distributaries, yet most of its landscape lies less than 0.5 m above sea level. Combined with modern era isolation from River sediment resources, and exacerbated by impoundment, natural subsidence and global sea level rise are causing rapid increases in flooding depth, duration and spatial extent across the Preserve landscape. To inform effective stewardship of natural and cultural resources and to guide fiscally responsible planning and management of Preserve infrastructure over the next 50 years, the park commissioned a future conditions modeling project to forecast surface elevation, flooding extent, salinity and vegetative cover under a suite of 12 different climate and coastal management scenarios. The modeling work linked a down-scaled version of Louisiana's 2023 Coastal Master Plan integrated compartment model with a flexible mesh hydro-dynamic model. Now the park wishes to link actual observations of changing conditions with model forecasts to evaluate which model scenario best represents realized change and to document landscape transformation as it occurs. We envision a tool that will enable park managers to visualize and compare monitoring observations with critical environmental and ecological thresholds and with model-projected values at specific locations across the Preserve landscape, including the areas of most intensive infrastructure and public use. Here we sketch elements of our tool, we illustrate its use with salinity and flooding observations from the Preserve's monitoring datasets, and we show how park managers would use it to address questions about public access and resource stewardship.

Presenter or Panelist 5: Eric White | Coastal Protection and Restoration Authority, eric.white@la.gov

Decision making under uncertainty; quantifying uncertainties within the LA Master Plan models

The Louisiana Coastal Master Plan is predicated on a complex and rigorous numerical modeling framework. Four separate subroutines are utilized within the Integrated Compartment Model to simulate changes over time in coastal hydrology, barrier island evolution, wetland vegetation dynamics, and wetland elevation and morphology. These subroutines interact on an annual timestep and therefore any model errors or uncertainties in one model subroutine can potentially propagate through to the other subroutines, potentially compounding in magnitude of impact over time. In addition to these model-derived uncertainties, the future landscape composition of coastal Louisiana is also highly sensitive to future climate change; specifically relative sea level rise. This presentation will focus on quantifying the impacts of these two distinct sources of uncertainty in coastal modeling efforts; the impact of model error as compared to the impact of an uncertain future climate. Through a considered experimental design, both the spatial and temporal behaviors of model uncertainty will be examined. The primary model variable used for analysis will be coastal wetland area, since this is one of the primary decision drivers used in the master plan development process. However, additional variables such as salinity, sediment distribution, and vegetation coverage will be discussed as well. The relative magnitude of uncertainties from modeled processes will be directly related to the uncertainties that arise from future climate change: relative sea level rise, precipitation projections, increased temperature, and changes to coastal tributary hydrology. Finally, the impact of these uncertainties will also be placed into the context of the larger climate change modeling and policy setting; namely representative concentration and shared socioeconomic pathways used in many studies, such as the reports generated by the IPCC.

Predicting and Planning for the Future of the Coast

Standard, Session #84

Novel Approaches in predicting and planning for coastal change

Tackling the challenges presented by a changing climate and a changing coastline requires the development of transdisciplinary and novel approaches. These approaches may be novel in the methodologies employed to monitor for coastal change, or in the framework used advance collaboration across organizations. This session will highlight such novel approaches. Presentations will highlight the economic contributions of BOEM's Marine Minerals Program, the use of satellite data and open source tools to monitor for coastal change, and two presentations on the open-source, comunity-developed Gulf-Coupled Ocean-Atmosphere Waves Sediment Transport (COAWST) modeling tool.

Session Organizer: | , Email:

Moderator: Jessica Henkel | The Water Institute, jhenkel@thewaterinstitute.org

Presenter or Panelist 1: Mark Jensen | Bureau of Ocean Energy Management, mark.jensen@boem.gov

The Economic Contributions of BOEM's Marine Minerals Program

The Bureau of Ocean Energy Management (BOEM) oversees the exploration and development of energy and mineral resources in U.S. federal waters. This entails an offshore oil and gas program, a renewable energy program, and a marine minerals program. BOEM has historically prepared annual estimates of the economic contributions of the oil/gas program and the renewable energy program during each fiscal year (FY). However, FY 2022 was the first year for which BOEM has prepared economic contribution estimates for the marine minerals program. In this presentation, the authors will describe BOEM's methods for estimating the economic contributions of BOEM's marine minerals program and will share results for FY 2022.

BOEM's marine minerals program contributes sand resources to support beach renourishment and coastal restoration projects. To be consistent with the methods used for the offshore oil/gas program and the renewable energy program, BOEM has estimated the economic contributions arising from the spending associated with these coastal activities. This includes estimating project-level spending during FY 2022, developing industry-level spending profiles, and estimating the geographic distributions of the spending by U.S. state. BOEM uses IMPLAN, a common input-output modeling framework and data source, to estimate the resulting direct, indirect, and induced economic contributions of the marine minerals program in terms of employment, output, value added, and labor income. These estimates are under development for various beach renourishment and coastal restoration projects on U.S. coasts and we will provide the results of this analysis during our presentation. The FY 2022 projects whose economic impacts have been estimated include two substantial beach renourishment and coastal restoration projects in the state of Louisiana.

Presenter or Panelist 2: Amy Kopale | CDM Smith, kopaleam@cdmsmith.com

Satellite Data & Open Source Tools for Monitoring Coastal Change

With the impacts of climate change leading to more frequent and severe changes along our coasts, finding effective ways to measure coastal health and change over time is as important as ever. Recent

improvements in publicly available satellite data, machine learning, and cloud-based computing platforms have helped spur new methods for measuring these coastal impacts. This presentation will briefly discuss publicly available satellite data, its advantages and drawbacks, and applications for coastal monitoring. We will also introduce Google Earth Engine, a powerful cloud based service for advanced remote sensing analysis.

Throughout the presentation, we will highlight ongoing projects using remote sensing, open-source programming, and Google Earth Engine to evaluate environmental changes in the Gulf Coast. The first project uses these tools to assess coastal vegetation pre- and post-hurricane Ida. These results can be used to better understand environmental impacts, guide land management decisions, and improve future mitigation plans. The second project example uses these tools to apply an AI model that identifies new urban development to support several post-disaster strategies, including the effectiveness of new building codes in withstanding hurricane winds.

We hope this introduction to publicly available satellite data and free analysis platforms will evolve into more robust remote sensing and AI/ML methods for coastal analysis in the future and provide attendees with ideas for how they can leverage these tools in their own work.

Presenter or Panelist 3: Yanda Ou | Louisiana State University, you3@lsu.edu

Gulf-COAWST: A Noval Machine Learning and Artificial Intelligence Model for Hypoxia Prediction

We present a novel hypoxia forecast system for the northern Gulf of Mexico built on the Machine Learning (ML) and Artificial Intelligence (AI) model. The forecast system incorporates an ML model for the daily hypoxia area (1D) and an AI model for the hypoxia distribution forecast (2D). The ML and AI models were trained and calibrated using the daily hindcast (2007–2020) by a three-dimensional coupled hydrodynamic–biogeochemical model embedded in the Reginal Ocean Modeling System (ROMS). The ML model combines a zero-inflated Poisson generalized linear model (GLM) and a quasi-Poisson generalized additive model (GAM) and considers predictors with hydrodynamic and biochemical features. It provides an efficient yet more accurate daily hypoxia area forecast for the LaTex Shelf than the prevailing NOAA-supported forecast models for the recent years (2012–2020) with a high R2 (0.9200), a low RMSE (2,005 km2), and a low scatter index (15 %). A supervised AI framework that combines a radial basis function and a convolutional neural network (CNN) was developed for the prediction of the spatial extent of bottom hypoxia. The radial basis function was implemented for the transformation of date/time, ensuring the continuity of the temporal data. The transformed date/time data, along with the sine and cosine transformations of hydrodynamic and biochemical features, location (latitude, longitude), and depth, were input to a CNN, which consists of a convolutional layer with 64 units, followed by a dense layer with 100 units, and ended with a linear output unit. A preliminary implementation of the architecture provides an accuracy of 77% when performing the prediction of hypoxia from June 2020.

Presenter or Panelist 4: Z. George Xue | Louisiana State University, Department of Oceanography and Coastal Science, zxue@lsu.edu

Gulf-COAWST: A Regional Earth System Modeling Platform for the Gulf of Mexico

With a changing climate, the northern Gulf of Mexico is suffering from various coastal hazards, including sea-level rise and land loss, eutrophication and hypoxia, ocean acidification, hurricanes, and compound flooding. A key toolset to untangle the various processes involved in these coastal disasters is a Regional Earth System Model that incorporates atmospheric, oceanic, and river processes as well as, most

importantly, the interaction among them. Such a toolset is also expected to inform stakeholders and policymakers in planning and decision-making regarding various coastal hazards. The open-source, community-developed Coupled Ocean-Atmosphere Waves Sediment Transport (COAWST) modeling dynamically couples multiple models, including the Regional Ocean Modeling System (ROMS), Simulating WAves Nearshore (SWAN), WAVEWATCH III, the Weather Research and Forecasting (WRF) model, the INfragravity WAVE model (INWAVE), and the Community Sediment Transport Modeling System (CSTMS). Recently a process-based land surface/hydrological model (WRF-Hydro) has been incorporated into the COAWST platform and enables the dynamical coupling between ocean and land processes. Here we demonstrate several recent developments and applications of COAWST in the Gulf of Mexico, which includes hydrodynamics, sedimentation, nutrient cycling, compound flooding during hurricane events, land loss-associated carbon export from the estuary to the coastal ocean, multi-decadal assessment of the carbon cycling, climate change's impact on coastal watershed sediment yields, development of hypoxic water on the Louisiana-Texas Shelf as well as an operational processes-based Mississippi Basin modeling system. These studies feature the coupling among air-sea, physical-biogeochemical, atmosphere-ocean-wave-sediment-nutrient, and hydrological-oceanic processes and demonstrate the feasibility of regional earth system model development and its potential for coastal hazards management.

Ecosystem Restoration

Standard, Session #85

Swamp Reforestation in Coastal Louisiana-Lessons Learned

The session would focus on the status of swamp reforestation efforts in coastal Louisiana, including planting protocols, habitat suitability analysis, monitoring, and related research. Over the last decade, swamp reforestation efforts have been increasing due to programs by non-profits, state, and federal restoration programs. This expansion is geographic and in available funding. Therefore, it is increasingly important that information is shared to enhance the success and make the best use of the investments in reforestation. Presentations will be based on the ongoing program's successes and failures so that best practices can be shared.

Session Organizer: John A Lopez Lopez | Delta Science LLC, Email: LopezDeltaScience@gmail.com

Moderator: Don Blancher | Moffat & Nichol, dblancher@moffattnichol.com

Presenter or Panelist 1: John A Lopez Lopez | Delta Science LLC, LopezDeltaScience@gmail.com

Status of Swamp Reforestation Efforts in SE Louisiana
Status of Swamp Reforestation Efforts in SE Louisiana

A review of reforestation projects in southeast Louisiana since 2011 demonstrates expanding efforts by NGOs, State and Federal programs in SE Louisiana to accelerate swamp reforestation in marsh regions that were previously swamp habitats. More than 230 individual plant sites have been identified in 8 reforestation regions. Five regions are in Pontchartrain Basin, 2 in Barataria Basin, and 1 in Terrebonne Basin. In all regions, saplings were planted, and at two individual sites, bare-root trees were planted. Saplings or bare-roots were grown in one or two growing seasons. All plantings were done manually by volunteers, staff, or commercial planters. Planted stem density ranged from 60 to 200 trees/acre for saplings and 363 to 650 trees/acre for bare root trees. The dominant species planted was bald cypress (Taxodium distichum). The nutria (Myocastor coypus) excluder devices were commonly used for small-scale sapling plantings but not for large-scale planting efforts. In all planting regions, some form of coastal restoration preceded the planting and may have improved environmental conditions amenable for swamp habitat and contributed to the probability of successful reforestation. The types of restoration projects included: hydrologic restoration, riverine introductions, spoil bank gapping, or hydrologic management. It is likely that the implementation of additional Coastal Master Plan projects will support the long-term sustainability of reforested regions. Salinity reduction of surface and pore water was often a critical change, but not in all cases. Monitoring results indicate that bare root plantings have low survival (0% to 40%), and saplings have greater survival (60% to 82%). Tree mortality was attributed to a range of conditions, including herbivory, hurricane damage, fire, hydroperiod, vine overgrowth, unstable soils, elevated salinity, immediate post-planting flooding, and mechanical impacts.

Presenter or Panelist 2: Gary Shaffer | Southeastern Louisiana University, shafe@selu.edu

Hydrologic Restoration of the Lac des Allemands Swamp in Barataria
Hydrologic Restoration of the Lac des Allemands Swamp in Barataria

Hydrologic restoration of the Lac des Allemands swamp in Barataria, Louisiana, was completed in early 2018. This CWPPRA project was funded at $7-million, but was constructed at a cost of under $500,000. This translates into $208 per acre, arguably making it the lowest cost restoration in Louisiana's history. The project involved the creation of eight levee gaps that allowed water to move into and out of the swamp, which had been impounded for over 60 years. Within a single year statistically significant improvements were measured. Percent canopy closure was nearly identical for pre-construction years of 2016 and 2017. During post construction in 2018, canopy closure increased by about 20 percent and averaged about 70% through 2022. Diameter differences differed across sites and species. Importantly, the reference site showed no change in diameter difference between 2017 and 2018, whereas six of eight sites in the des Allemands Swamp experienced an increase, presumably caused by hydrologic restoration (i.e., increased sheet flow and drainage). Similarly, all three of the dominant species experienced increased diameter differences in 2018-2022, compared to 2017. According to Bonferroni-adjusted means, baldcypress had the greatest diameter differences, followed by water tupelo, and the midstory species had the least. Five of the seven des Allemands swamp sites produced more leaf material in 2018-2022 than 2017. Taxodium distichum produced far more litter than Nyssa aquatica and both produced far more litter than midstory species. Overall, herbaceous cover has not been dramatically different. However, there is a clear pattern of the increased canopy closure that relates to reduced herbaceous cover.

Presenter or Panelist 3: Gardner Goodall | Coalition to Restore Coastal Louisiana, gardner.goodall@crcl.org

An Overview of CRCL's C.R.U.S.H. Planting Series: Communities Restoring Urban Swamp Habitat

Since 2000 the Coalition to Restore Coastal Louisiana has been hosting swamp reforestation plantings across the Louisiana coast from Vermillion Parish to St. Bernard Parish. These plantings seek to restore degraded swamp habitat to its former glory in response to lower salinity in the soil. Since 2018 we have planted 11,650 trees over 75.7 acres through our CRUSH program, Communities Restoring Urban Swamp Habitat. The first three years of this program focused on plantings in the Pontchartrain Basin. The closure of MRGO and Maurepas Swamp River Reintroduction Project drew us to the Central Wetlands Unit and the Maurepas Land Bridge for our planting sites. This year in response to Hurricane Ida we have shifted our plantings to the Central Coast, planting in Pointe Au Chien, Avery Island, and Atchafalaya to engage audiences from Houma, New Iberia/Lafayette, and Morgan City.

As the CRUSH project sunsets into its last year, we look forward to the next chapter of swamp reforestation with the Central Wetlands Restoration Coalition- comprised of Pontchartrain Conservancy, Center for Sustainable Engagement and Design, Common Ground Relief, Meraux Foundation and the Louisiana Department of Agriculture and Forestry. CRCL has committed to planting 6000 trees over the next two years through this project supported by the CPRA Partnership Fund. Between all partnership organizations, this project will restore 62.68 acres of swamp, marsh, and submerged aquatic habitat in the Central Wetlands Unit. These plantings will engage communities in the Lower Ninth Ward and St. Bernard Parish and be executed out of our Restoration Headquarters on the Violet Canal.

Presenter or Panelist 4: Blaise Pezold | Meraux Foundation, blaise@merauxfoundation.org

Reforestation of the Central Wetlands, SE Louisiana

Since 2017 the Meraux Foundation (MF) has held 3 Central Wetlands Reforestation summits. The first summit included the Center for Sustainable Engagement & Development (CSED), Coalition to Restore

Coastal Louisiana, Common Ground Relief (CGR), Crescent Soil & Water Conservation District (CSWCD), Louisiana Department of Agriculture and Forestry (LDAF), Pontchartrain Conservancy, St. Bernard Wetlands Foundation (SBWF), and National Resource Conservation Service (NRCS). This summit was focused on getting partners to work together toward a common goal of reforestation in the Central Wetlands Unit (CWU). The 2nd summit during the winter of 2021-2022 focused on mapping and funding. CPRA attended and encouraged us to apply for funding as a collective. A 3rd summit was held in 2022, and the CW Reforestation Collective (CWRC) was formed. CRCL was asked by CWRC to lead grant efforts, and strict rules were set for acknowledging partners in social media and any publications. CWRC has since secured a grant from CPRA and applied for another from NOAA. In the Winter of 2021-2022, the MF, CSED, CGR, CSWCD, LDAF, SBWF, and NRCS reforested vast swaths within the CWU. The 27,000-acre CWU is dominated by fresh or intermediate marsh but was once dominated by swamp. Reductions in surface and pore water after the construction of the MRGO dam suggest the CWU is once again suitable for swamp habitat. The plantings of 1-gallon and 6-foot high Bald Cypress (Taxodium distichum) and Water Tupelo (Nyssa aquatica) were planted with Nutria excluder devices. Trees were planted linearly with 20 to 50-foot spacing along approximately twelve riparian zones of natural waterways. The objective of planting riparian zones is to maximize the extent, utilize the bank hydrology, seed dispersal, and test survival limits. Overall survival is estimated to be 60%. Future goals are planting fewer trees based on survival patterns, reforesting along natural bayous, and utilizing mapping to inform decision-making.

Flood Risk Management: Coastal and Inland

Panel, Session #86

Non-Structural Assessments and Mitigation in Coastal Communities

Various members of LFMA will provide insight into various components of non-structural mitigation in the state of LA. 1)Post Ida Damage Assessments on Grand Isle - how FEMA substantial damage was applied and how the rebuilding process with stronger building codes is improving resilience. 2)Elevation Q/A - Local grant managers and shoring contractors provide insight into why/how homes are elevated and discuss how conversations with property owners develop and guide project implementation. 3) Overview of the Louisiana Floodplain Management Associations' Disaster Response Team and the ways they are assisting and training local governments to analyze their building stock and develop strategies to mitigate and communicate with the residence in a post disaster flood situation.

Session Organizer: Michelle Gonzales | Jefferson Parish Government, Email: mgonzales@jeffparish.net

Moderator: Lauren Brinkman | City of Mandeville, lbrinkman@cityofmandeville.com

Presenter or Panelist 1: Kim Reeves | Orleans Shoring, kimreevescfm1031@gmail.com

Presenter or Panelist 2: Mike Stewart | Patterson Shoring, mike@psmsusa.com

Presenter or Panelist 3: Nic LeBlanc | Tangipahoa Parish, nleblanc@tangipahoa.org

Renewable Energy

Panel, Session #87

Green Banks

The Inflation Reduction Act created a new $27B fund – the Greenhouse Gas Reduction Fund – to address the climate crisis. This summer, EPA will distribute grant funding to eligible entities across two competitions: a $20 billion General and Low-Income Assistance Competition and a $7 billion Zero-Emissions Technology Fund Competition. The former is to collaborate with financing institutions, like green banks, and invest in projects that reduce pollution. The latter is to deploy residential rooftop solar and storage. Both are targeted towards disadvantaged communities; nonprofit entities are eligible to receive awards from both competitive opportunities. Thus, this fund could cause unprecedented deployment of renewable energy projects, at all levels, across the country. Panelists will provide insight into the program and green banks general. Panelists will explore the definition of green banks, and their deployment in New Orleans and across the state of Louisiana.

Session Organizer: Jenny Netherton | Southeastern Wind Coalition, Email: jennyn@sewind.org

Moderator: Ruda Pollard | City of New Orleans, ruda.pollard@nola.gov

Presenter or Panelist 1: Camille Manning Broome | CPEX,

Presenter or Panelist 2: Jackie Dadakis | Green Coast Enterprises,

Film, Session #88

Managing Rivers for Multiple Uses

Standard, Session #89

Mississippi River Sediment Dynamics: past, present, and future

The Mississippi River is a major source of water and sediment to the Gulf of Mexico. Several restoration strategies for the eastern Louisiana coast are linked to the Mississippi River. An estimated 79 to 92% of all freshwater, with the associated sediments and nutrients, enters the Gulf of Mexico (GOM) from the Mississippi River system heavily influencing the stability of the coastline and the health of the marine ecosystems. Numerous restoration projects in the State of Louisiana 2023 Coastal Master Plan utilize the Mississippi River resources, namely, freshwater, sediment, and nutrients. This session includes four diverse presentations including the development of a large scale WRF-Hydro Mississippi River Basin operational water and sediment forecast system, comparative analysis of historical and current sediment trends of the Lower Mississippi River, infill rates of borrow pits and the impact on the downstream maintenance dredging; and an overview of process-based (deterministic) and machine learning tools and their application to the hydraulics and sediment transport of the Lower Mississippi River.

Moderator: Joseph "Wes" Leblanc | CPRA, Joseph.Leblanc@la.gov

Presenter or Panelist 1: Agnimitro Chakrabarti | FTN Associates, aac@ftn-assoc.com

Mississippi River Hydraulics and Sediment Transport:From Deterministic to Machine Learning Tools

The past decade (2010-2020) saw the Lower Mississippi River (LMR) experience some of the longest high river periods (2018-2019) as well as the lowest flows (2017-2018). Between Oct 2018-Oct 2019, LMR remained over its mean annual flow (~600,000 cfs) for 11 months while the flow fell below ~150,000 cfs in winter of Oct 2017-Jan 2018. The LMR, below Bonnet Carre, also had the highest decadal averaged total annual flows (~510 km^3/yr) and the widest range of year-to-year total flow volume in the last 70 yrs of recorded history. The extreme nature of the LMR flow spectrum both in duration and magnitude is compatible with long term global climate change model predictions.

The need to understand, capture and quantify the changing trends of the river on water level, flow and sediment transport therefore becomes an important feature for planning and design of coastal restoration projects, navigation, port operations and river dredging. This requires a multi-pronged strategy that improves the information from simple desktop rating curve models, typically used for initial planning, by including the accuracy of physics based complex deterministic numerical models, that provide detailed spatial and temporal information for design of river works albeit at a higher cost, with the speed and low-cost of state of art deep learning tools that can produce real-time forecasts. In this study the results of a 2D Delft3D based ~100 mile long LMR model which simulates hydraulics and sediment transport will be shown. The model results will be compared with observed gage data and simple analytical rating curve-based estimates. Finally, the development of a Long Short-Term Memory (LSTM) based deep learning model will be discussed that combines observed and model data and improves the prediction of LMR discharge and suspended sediment. This study can be very useful for coastal restoration managers and practicing engineers in the river industry, interested in including modeling for design.

Presenter or Panelist 2: Ioannis Georgiou | The Water Institute, igeorgiou@thewaterinstitute.org

Mississippi River borrow pit infill rates and impacts to downstream maintenance dredging

Recent analytical and modeling studies on the Lowermost Mississippi River (LMR) have improved our understanding of sand flux at key locations and provide a framework for evaluating LMR sand as a renewable resource for coastal restoration projects. As part of Louisiana Coastal Protection and Restoration Authority's Louisiana Sediment Management Program (LASMP) implementation, this research aims to evaluate and quantify borrow area recharge rates within the LMR and determine if channel maintenance dredging requirements are reduced downstream of borrow areas. Time-series bathymetric surveys from two recent projects with LMR borrow areas—Spanish Pass Ridge and Marsh Creation and Upper Barataria Marsh Creation (borrow areas at Venice Anchorage (VA) and Alliance Bar, respectively)—were analyzed to characterize pit evolution and calculate infill rate. Existing Delft3D numerical models were updated, refined, and calibrated for each reach using time-series bathymetry and recent sediment data. Observations from VA borrow area show initially high infill rates (~200,000 m3/mo.) when more accommodation is available, and discharge is >20,000 m3/s, declining to ~60,000 m3/mo. proportional to discharge decline. Model results corroborate observed infill rates at VA borrow area showing a strong dependency to river discharge. For instance, there is little to no infilling when discharge is ~10,000 m3/s. However, infill rates are ~200,000 m3/mo. at a discharge of 20,000 m3/s and can reach 500,000 m3/mo. for a discharge of 25,000 m3/s. Model results also show maintenance dredging downstream of the dredge pit is reduced above Head of Passes (HOP) by as much as 9% with little to no reduction in dredging below HOP. This analysis provides a framework to forecast sediment recharge rates in LMR borrow pits to incorporate into LASMP sediment resource availability estimates and suggests LMR sand extracted for restoration can reduce navigation channel maintenance costs.

Presenter or Panelist 3: Ehab Meselhe | Tulane University, emeselhe@tulane.edu

The Great Flood of 1927: Comparative Analysis of Historical and Current Sediment Trends

The Mississippi River is a major source of water and sediment to the Gulf of Mexico. Several restoration strategies for the eastern Louisiana coast are linked to the Mississippi River. Anthropogenic factors, e.g., locks, dams, levees, cutoffs, bank-protection, resulted in substantial change in the sediment load of the Mississippi River. In this study, we compiled historical water and sediment data from ~ 1851 through 1929 and constructed approximate historical sediment rating curves. These historical rating curves are compared to the current records at Tarbert Landing, Baton Rouge, and Belle Chasse. Further, we utilized a 2D morphodynamic model to simulate and quantify the deposition footprint of the historical Caernarvon crevasse event that occurred during the Great Mississippi Flood of 1927 at Breton Sound Basin, LA, USA. This comparative analysis highlighted the change in sediment supply over the past century. We also investigated the implications of this change on the land-building potential from engineered diversions. This analysis also underlined the importance of measuring in-situ fine sediment flocculation parameters due to its present uncertainty and impact on inducing deposition of clay.

Presenter or Panelist 4: Xiaochen Zhao | Louisiana State University, xzhao24@lsu.edu

Gulf-COAWST: A High-resolution Process-based Operational Water and Sediment Forecast System

Full Title: Gulf-COAWST: A High-resolution Process-based Operational Water and Sediment Forecast System for the Mississippi River

The Mississippi River delivers tremendous water, nutrient, and sediment to the northern Gulf of Mexico, heavily influencing the stability of the coastline and the health of the marine ecosystems. Its associated hydrological processes are vital to modulate regional hydroclimate variability, especially given the increasing hydrological extremes (e.g., drought and flood) under a warming climate. A reliable prediction of water and sediment flux from the Mississippi River is urgently needed for the State of Louisiana for navigation, flood control, restoration, and the health of the coastal ecosystem. Here we present a new high-resolution processes-based operational modeling platform for the Mississippi River. The hydrological model covers the entire Mississippi River basin and is built on the state-of-the-art open-source community model (WRF-Hydro). The operational model incorporates a land surface model, degrading surface/subsurface routing, channel routing, a sediment model, and a coupler with the ocean model. The real-time system is operated on LSU's High-Performance Computing System and provides reliable hydrological forecasts (streamflow, suspended sediment concentration, etc.) on different spatial scales (100 m to basin scale) on a 24/7 basis. In addition to the operational mode, the model can also be driven by a wide range of mid- to long-term weather products and provide hydrological prediction on different time scales. The hydrological model is designed to be coupled with its ocean counterpart as an integrated earth system modeling platform that covers the entire Mississippi River Basin and the Gulf of Mexico region.

Preparing for Climate Change

Standard, Session #90

Expanding Approaches to Climate Adaptation

Understanding the overlapping nature of Louisiana's emissions of greenhouse gasses and air pollutants is critical to reducing the state's greenhouse gas emissions, and the impact of climate policies on Louisiana residents. We will first provide insights into the Louisianans that are closest to emissions sources - primarily residing in under-resourced and under-represented communities. We then provide insights into potential greenhouse gas reduction strategies -- an important climate resilience strategy for Louisiana and its residents. While the development of Louisiana's Climate Action Plan addresses greenhouse gas emission reduction, there is also an urgent need for adaptation at all scales to increase resilience to the impacts we already feel. Louisiana's executive branch of government has taken the first step to ensure that agencies are able to continue to serve residents. Through the Adaptive Governance Initiative, agencies have conducted a climate change vulnerability assessment and some have developed some climate resilience actions. We will highlight some findings from the vulnerability assessment and present current strategies to begin addressing these. But, to increase resilience to the changes that are already felt, we need action in all places in an intentional, inclusive, and comprehensive way. The newly established Center for Equitable Climate Resilience is beginning to address this need and push outside of traditional mechanisms and definitions for climate adaptation and mitigation. We will present best practices and lessons learned including case studies that will highlight gaps, successes, and novel approaches in pursuit of climate resilience across literacy, research, and action at the local scale. Meanwhile, the state of Louisiana is leading by example. A concrete example is the Louisiana Division of the Arts who recognized that community resilience conversation needed to include culture. Funding from the National Endowment for the Arts has supported tradition bearers to conduct Pass It On workshops to teach within their communities and initiated the Louisiana Folklore Society's Bayou Culture Collaborative initiative. These evolved in Climate Migration and Welcoming Newcomers workshops that have been presented at national and state conferences to provide those not familiar with the issues sufficient knowledge to participate in the conversation.

Session Organizer: Jeannette Dubinin | Center for Planning Excellence, Email: jdubinin@cpex.org

Moderator: Jeannette Dubinin | Center for Planning Excellence, jdubinin@cpex.org

Presenter or Panelist 1: Maida Owens | Louisiana Department of Culture, Recreation & Tourism, mowens@crt.la.gov

Presenter or Panelist 2: Renee Collini | The Water Institute, rcollini@thewaterinstitute.org

Redefining Climate Adaptation and Mitigation Processes for More Equitable Outcomes

Calls for more actionable information are on the rise as the impacts of a changing climate are being felt more acutely and frequently on the coast; however, often the decision of what constitutes actionable information is decided without those who need to take action. Further, the current federal and state systems we have in place are designed around a top-down funding and research structure, which includes scope and needs frequently being determined with no input from those who need the research findings or the funding. This leads to a myriad of gaps such as missing critical aspects of what information and capacity is needed to be resilient or funding passing through systems that are not

equipped to reach underresourced communities and individuals. Pursuit of a broader definition of climate resilience is necessary to move beyond our current gaps. This presentation will introduce the newly established Center for Equitable Climate Resilience, which was founded to push outside of traditional mechanisms and definitions for climate adaptation and mitigation. Acknowledging that climate resilience is about more than physical safety and that strategies must be as diverse and unique as the communities they will serve, the Center will collaborate with a network of individuals and organizations that will bring together research, lived experiences, and other resources to advance equitable climate resilience in the Gulf of Mexico. In this presentation, we will also review the best practices and lessons learned that will be applied as we embark on building capacity for bottom-up participation in climate adaptation and mitigation. Specific case studies will be leveraged to highlight gaps, successes, and novel approaches in pursuit of climate resilience across literacy, research, and action. The case studies explicitly discuss equity while exploring a range of decision-makers including individual neighborhoods and small-town staff to regional coordination.

Presenter or Panelist 3: Charles Sutcliffe | Governor's Office of Coastal Activities, charles.sutcliffe@la.gov

Preparing for Climate Change

Standard, Session #91

Blue Carbon: Opportunities and Uncertainties

Marshes in coastal Louisiana have been estimated to accumulate between 5.5 and 7.3 Tg C yr-1, accounting for some 6-8% of the global carbon accumulation in tidal marshes. There is gaining scientific consensus globally on the critical science and policy gaps, but clear recognition of the large uncertainties in quantifying carbon storage and net greenhouse gas flux for herbaceous coastal marshes. Additionally, the application of current policy mechanisms for carbon verification to Louisiana coastal wetlands does not offer a financially viable investment proposition given past, present, or anticipated future carbon market prices. As a result, the opportunity for restoration and protection of coastal wetlands to support both mitigation and adaptation to climate change is not being maximized. Louisiana and the northern Gulf of Mexico have opportunities to address some of these critical uncertainties. Coastal restoration in Louisiana is coordinated through one state agency, the Coastal Protection and Restoration Agency and the state of Louisiana develops policy for the ~1.4 million ha of wetlands (2016 area). There is also a wealth of previous and ongoing carbon research on coastal marshes in the northern Gulf of Mexico. The session will cover how the State of Louisiana has an incentive to increase funding opportunities to implement planned coastal restoration, identified in the LA Coastal Master Plan. This session will discuss some of the uncertainties and challenges, in particular uncertainties in carbon quantification and the importance of clarifying assumptions that are used within the carbon accreditation process. It will also cover the challenges of land ownership, with some examples of possible solutions. Finally, the session will discuss potential mechanisms for increased collaboration and coordination amongst carbon researchers and the potential structure, vision, benefits, and processes of a northern Gulf of Mexico States Blue Carbon Research Working Group.

Session Organizer: Tim Carruthers | The Water Institute, Email: tcarruthers@thewaterinstitute.org

Moderator: Brian Lezina | Coastal Protection and Restoration Authority, brian.lezina@la.gov

Presenter or Panelist 1: James Pahl | Coastal Restoration and Protection Authority, James.Pahl@LA.gov

The needs and opportunities for Louisiana and the Coastal Protection and Restoration Authority regarding blue-green carbon

The State of Louisiana has responsibility for the conservation, restoration and resilience of its coastal wetlands and open waterbodies. The Coastal Protection and Restoration Authority (CPRA) in particular holds primary responsibility for developing and implementing the state's strategy to protect, conserve, restore and enhance the state's coastal wetlands and barrier shorelines and reefs. The waters, plant and soils within these systems are the focus of "blue carbon" discussions, although given the state's substantial coastal freshwater forested and herbaceous wetlands, CPRA's interest is better referenced to as "blue-green carbon".

Governor John Bel Edward's Executive Order 2020-18 established a Climate Initiatives Task Force to develop a strategy to achieve net-zero greenhouse gas emissions by 2050 and included the directive for the CPRA Board to "consider recommendations of the Task Force for inclusion in the comprehensive plan for a sustainable coast." The Task Force's 2022 Climate Action Plan notably recommended implementing Coastal Master Plan projects, quantifying and monitoring blue[-green] carbon in Louisiana habitats, and

developing [a] crediting mechanism and market specific to blue[-green] carbon. CPRA was listed as a potential implementing partner for all three of these recommended actions.

CPRA has been involved in the development of carbon-related data and a sequestration methodology for more than a decade, and is currently exploring the costs and benefits of the Task Force recommendations and the appropriate agency role moving forward. Those decisions will dictate agency dedications of staff and funding in support of science and tool development as well as the development and administration of an agency-oriented tradeable blue-green carbon credit program. CPRA expects an iterative decision-making process on those points, in conjunction with other potential blue carbon partners. That process will be guided by the best available science, policy and legal information, and the development of a Northern Gulf of Mexico Research Working Group will be critical to providing that data. This presentation will highlight the role of the actions and information presented earlier in the session in informing CPRA's decision-making process.

Presenter or Panelist 2: Hilary Stevens | Restore America's Estuaries, hstevens@estuaries.org

Developing and Leveraging Communities of Practice to advance blue carbon science to support policy decisions

Coastal blue carbon habitats including salt marsh, mangroves and seagrasses are at the center of policy discussions around coastal resilience and climate mitigation due to their ability to sequester and store carbon while providing benefits such as flood protection and habitat. The US states with expansive coastlines are recognizing the importance of conserving blue carbon habitats to mitigate greenhouse gas emissions and climate-related impacts like sea-level rise. Inclusion of blue carbon in climate strategies can be challenging, and progress varies depending on factors such as data availability, funding resources and effective governance. Several state and regionally focused blue carbon collaborations have formed over the last 5 years to advance research, share information, forge connections, and help inform management and policy. Restore Americas Estuaries (RAE) has convened the Blue Carbon National Working Group to share knowledge and align priorities at the national level. The September 2021 Working Group Meeting resulted in a series of policy recommendations. In October 2022, RAE (with COMPASS) ran a Blue Carbon Roundtable to engage experts, researchers and policymakers to identify policy solutions on blue carbon challenges. In December 2022, RAE and Pew's Blue Carbon Network hosted a workshop focused on blue carbon collaboratives and the opportunities and benefits of developing collaborative communities of practice for blue carbon science. This presentation will summarize the key lessons learned from these workshops including the experiences of other blue carbon communities of practice around the US.

Presenter or Panelist 3: Jean Cowan | The Water Institute, jcowan@thewaterinstitute.org

Establishing a Northern Gulf of Mexico Blue Carbon Research Working Group

Working groups have been established in other areas of the United States, such as the Pacific Northwest, to create a collaborative platform for developing blue carbon as a conservation and management tool to mitigate the effects of climate change and provide potential economic opportunities to land managers. However, environmental conditions, species and habitats along the northern Gulf of Mexico are sufficiently different from elsewhere in the country to warrant a similar but discrete working group focused only on the Gulf Coast. While there is a wealth of previous and ongoing blue carbon research on coastal habitats in the northern Gulf of Mexico, there is no formalized body for researchers, landowners, and managers to collaborate, establish joint research priorities, and house an inventory of relevant

research and data that could support decision-makers in developing blue carbon as a management tool. Prior to the start of the 2023 State of the Coast conference, Gulf blue carbon experts will gather for an organizational meeting partially funded by a RESTORE Council grant to the Louisiana Coastal Protection and Restoration Authority to discuss the establishment of a Northern Gulf of Mexico Blue Carbon Research Working Group that could support decision-makers in considering opportunities to develop blue carbon as a coastal habitat conservation and management tool. This meeting will consider recommendations from a blue carbon roundtable held at the 2022 Restore America's Estuaries (RAE) conference. Meeting participants will be invited to share their knowledge and ideas for the potential vision, benefits, structure, and function of such a group. Additionally, participants will be invited to submit research areas, ongoing work, capacity, and interest to support a coordinated blue carbon research agenda in the future. This presentation will provide highlights of the discussions during this meeting, including next steps and future opportunities to join the working group.

Presenter or Panelist 4: Naveen Adusumilli | The Water Institute of the Gulf, nadusumilli@thewaterinstitute.org

NATURAL CARBON SEQUESTRATION & RESTORATION: LANDOWNER OPPORTUNITIES THROUGH PARTNERSHIPS

The focus of natural carbon sinks that was traditionally attributed to forests, in recent years, has expanded to consider coastal habitats such as mangroves, tidal wetlands, and seagrass meadows. These habitats play a critical role concerning various ecosystem services and sequester more carbon than the forests. However, coastal erosion losses are substantially impacting these benefits and creating broad economic losses. Louisiana is one such state that has been vulnerable to coastal erosion. Since the 1930s Louisiana lost a total of 2,000 square miles of land area.

Against this backdrop, the United States enacted the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) in 1990 to fund coastal restoration projects. Since its inception, 210 coastal projects totaling 100,000 acres have been restored. Similarly, Louisiana's Coastal Vegetative Planting Program, a partnership program between Louisiana Soil and Water Conservation Districts, the Natural Resources Conservation Service of the USDA, and private landowners, helps establish native wetland vegetation on critically eroding wetlands. The USDA, through its Wetland Reserve Easement Program (WREP) within the Farm Bill, supported restoration projects across 11 states totaling 27,000 wetland acres.

Although the ecosystem services and the carbon sequestration credits generated from these restored wetlands provide private and public benefits, landowners could often find it challenging to enter the carbon market space as most are uncertain regarding public-private partnerships, and contractual obligations. Local and regional economies might struggle to find financial vehicles to support long-term restoration projects. State and federally-funded projects might inadvertently prevent private partnerships. In this presentation, I will discuss these challenges and barriers to landowners and the potential opportunities to develop a much open ecosystem market space.

Presenter or Panelist 5: Tim Carruthers | The Water Institute, tcarruthers@thewaterinstitute.org

Navigating uncertainty and assumptions in calculating carbon flux for policy development

Scientific knowledge is often slower to advance than policy based upon that science. The result is established policies and practices with known data gaps and uncertainties. The standard scientific

approach to uncertainty is to err on the side of caution, using a precautionary approach and keeping the status quo by taking no action. However, in addition to rapid changes in sea surface temperature, sea level, and weather and storm patterns, it is now recognized that ecosystems are highly dynamic and generally do not return to a known stable state after disturbance. Therefore, it is reasonable to question whether 'inaction' is always the more conservative approach. Specifically, for managing stored carbon, the precautionary approach could be defined as 'keeping the carbon where it is currently stored', i.e., coastal wetlands. With the current rapid conversion of emergent wetlands to open water in Louisiana, maintaining the status quo of carbon stored in coastal wetlands will require restoration action. Standards such as VERRA and the Gold Standard that certify carbon credits for sale on the voluntary market are highly conservative in their estimates of carbon flux for coastal wetlands, potentially under accounting carbon stored in these habitats. Net carbon flux calculations for wetlands are highly sensitive to key assumptions. Therefore, data gaps and uncertainties are limiting the establishment of policy pathways that provide a cost-effective methodology to monetize carbon to incentivize coastal restoration. This presentation will identify some of these key assumptions and uncertainties and provide examples of how some of these critical uncertainties influence quantifications of carbon flux at different spatial scales. Filling targeted gaps in scientific data and understanding has the potential to reduce uncertainty so that assumptions can be revised to inform progress towards a financially viable carbon verification mechanism for coastal wetlands.

Coastal Law, Policy & Funding

Panel, Session #92

How the National Flood Insurance Program Is Influencing the Face of the Coast

Since the 1960s, the National Flood Insurance Program (NFIP) has played an important role in shaping, and protecting, riverine and coastal environments. The Program underwent major reform in 2012 with the Biggert-Waters Act, which was largely amended by the Homeowner Flood Insurance Affordability Act of 2014. Congress has temporarily extended the Program more than 25 times since 2017, when the last multi-year authorization expired. In 2022, the NFIP underwent its greatest change ever in rate calculation, with Risk Rating 2.0 – raising prices for 77% of policyholders. Now, the Program is again in debt ($20.5B), and participation has fallen by over 3.5%.

At the same time, FEMA continues to implement administrative changes to the Program, and Congress is considering legislative action, that will have profound impacts on whether and how we use our coasts. During this session, panelist with expertise in various component of the NFIP will discuss how these changes are likely to affect the Gulf and why Congress has had such a difficult time making meaningful reform. Subject matter experts will cover:

– FEMA's implementation of the flood insurance program through Risk Rating 2.0, and how those changes are affecting affordability and development opportunities in coastal areas

– FEMA's treatment of levees and coastal erosion under Risk Rating 2.0, and how FEMA's standards affect coastal restoration projects/opportunities

– FEMA's recent and ongoing mapping of coastal high hazard areas and the corresponding development restrictions applicable to mapped areas

– FEMA's minimum development standards, including implementation of the Endangered Species Act through the NFIP

– Other changes to floodplain mapping, including mapping of erosion prone areas and inclusion of Sea Level Rise, and how this new mapping could affect development opportunities

- Impacts of various decisions made under the NFIP on communities with environmental justice concerns

Session Organizer: Molly Lawrence | VanNess Feldman LLC, Email: mol@vnf.com

Moderator: Molly Lawrence | VanNess Feldman, mol@vnf.com

Presenter or Panelist 1: Peter Waggonner | GNO, Inc, pwaggonner@gnoinc.org

Presenter or Panelist 2: Maggie Talley | Jefferson Parish, MTalley@jeffparish.net

Presenter or Panelist 3: Dwayne Bourgeois | North Lafourche Levee District, DwayneB@NLCLDD.com

Presenter or Panelist 4: Molly | Lawrence, mol@vnf.com Van Ness Feldman, LLC

Hydrology, Geomorphology, and Ecology of the Coast

Standard, Session #93

Restoring and Monitoring Louisiana Estuarine Habitat after Deepwater Horizon

Ongoing large-scale ecological restoration efforts in Louisiana estuaries include creation of habitat for oysters, fish, birds, and other wildlife, monitoring restoration progress, and adaptively managing individual projects and the portfolio of restoration activities that are supported in large part by the $5 billion in NRDA settlement funds for Louisiana resulting from the 2010 Deepwater Horizon oil spill injury. This session will describe four of the estuarine habitat restoration and monitoring projects designed to restore for injured resources in Louisiana. Collectively, the presentations will explain the role and goals of the Louisiana Trustee Implementation Group in identifying restoration priorities; creation of oyster brood reefs and early monitoring results; avian habitat creation, monitoring, and lessons learned for best practices; development and application of a strategy to create and assess fish habitat; and identification of lower trophic level data needed to evaluate the prey base for the estuarine food web, model future possibilities, and adaptively manage estuarine habitat.

Session Organizer: Mel Landry | NOAA, Email: mel.landry@noaa.gov

Moderator: Mel Landry | NOAA Restoration Center, mel.landry@noaa.gov

Presenter or Panelist 1: Jon Wiebe | Louisiana Dept. of Wildlife and Fisheries, jwiebe@wlf.la.gov

Addressing Avian Resource Restoration Priorities in Coastal Louisiana

Deepwater Horizon oil spill and related activities are responsible for significant avian losses (adults, offspring, and foregone production), and have factored prominently in the accelerated loss of critical coastal avian habitats. In response, Trustees prioritized the restoration and enhancement of coastwide bird nesting and foraging habitats as the principal means by which these losses would be addressed. This multi-disciplined, collaborative effort is being successfully implemented in large part due to our team's ability to clearly define and consistently convey programmatic goals and objectives informed by critical evaluation of past actions and lessons learned. Active and intentional stakeholder engagement across multiple professional disciplines remains critical to our success to date and continues to generate unforeseen benefits. In so doing, Trustees are addressing resource restoration priorities for the state's avian resources and the individuals charged with their management and conservation.

Presenter or Panelist 2: Denise Kinsey | Louisiana Dept. of Wildlife and Fisheries, dkinsey@wlf.la.gov

OYSTER RESTORATION IN LOUISIANA: BENEFITS FROM NON-HARVESTABLE OYSTER REEF RESTORATION PROJECTS

The Deepwater Horizon oil spill and the following response injured oyster populations in the Gulf of Mexico via direct mortality, disruption of the supply of larvae from nearshore to offshore reefs, and the loss of habitat. To address oyster injuries, the Deepwater Horizon Louisiana Trustee Implementation Group (LA-TIG) developed three oyster goals: to restore oyster abundance and spawning stock in support of a regional oyster larvae pool on subtidal and nearshore oyster reefs; to restore resilience to oyster populations for sustainable reefs over time; and to restore a diversity of oyster reef habitats that provide ecological functions for estuarine-dependent fish species, vegetated shoreline and marsh habitat, and nearshore benthic communities.

The Trustees have allocated about $40.8 million in oyster recovery funds for constructing cultch plants and brood reefs and for supporting hatchery production. Approximately $2 million of those funds were allocated in 2021 to create four brood reefs--located at Petit Pass, Karako Bay, Lake Machias, and Mozambique Point in Plaquemines and St. Bernard Parishes. These reefs, protected from oyster harvest under legislation rules, were planted with approximately 5,000 cubic yards of limestone at each site for a total of about 20,000 cubic yards of new oyster reef. The objective of the brood reefs is to establish protected oyster reef complexes that can help repopulate nearby public and surrounding oyster harvest areas.

In similar fashion, in July 2018, the LA TIG provided $6,000,000 of NRDA "Provide and Enhance Recreational Opportunities" funds to enhance 11 existing coastal finfish reefs by adding new reef material to increase the habitat complexity of the reef complex. While not technically classified as oyster brood reefs, these reef enhancements provide protected reef areas which have increased recreational fishing opportunities to the public and which are also permanently closed to oyster harvesting.

Presenter or Panelist 3: Melissa Carle | NOAA Fisheries, Office of Habitat Conservation, melissa.carle@noaa.gov

Restoring coastal habitats to support fish and invertebrate species in Louisiana's estuaries

The Deepwater Horizon oil spill resulted in the loss of billions of fishes and water column invertebrates in coastal and offshore waters and also damaged the coastal Louisiana habitats they rely on. Recognizing linkages between fish and invertebrate species and coastal habitats, the Deepwater Horizon Programmatic Restoration Plan identified coastal habitat restoration as an important mechanism for helping restore those species. Extensive marsh habitat restoration is currently underway in Louisiana, in part supported by Deepwater Horizon funding. This restoration contributes both to implementing the Louisiana Statewide Master Plan and to restoring fish and invertebrate productivity. For example, the Large Scale Marsh Creation – Upper Barataria Component project was designed to include specific features to improve habitat value of the constructed marsh for fishes and invertebrates. Monitoring for this project will include assessment of nekton utilization of sub-habitats within the marsh, including the marsh platform, tidal creeks, and ponds, and marsh edge. Beyond project-scale monitoring, we are also looking more broadly at how fishes and invertebrates utilize natural and restored marsh habitats in coastal Louisiana through another Deepwater Horizon-funded project, Monitoring the Effects of Coastal Wetland Restoration on Fish and Invertebrates. This project will analyze existing fisheries independent data to assess nekton community composition and abundance relative to marsh landscape configuration and the locations of existing restoration projects. It will also conduct three years of new data collection to assess community composition and density of fishes and invertebrates utilizing existing marsh restoration projects of various ages along with reference marsh sites. These efforts represent initial steps to better quantify the benefits that coastal wetland habitat restoration in Louisiana is providing to fisheries resources.

Presenter or Panelist 4: Erin Kiskaddon | The Water Institute of the Gulf, ekiskaddon@thewaterinstitute.org

Lower trophic level baseline data collection plan to support restoration of Barataria Estuary,LA

The Barataria Estuary is an ecologically diverse and biologically active region that sustains important commercial and recreational fisheries and coastal communities in southern Louisiana. This location has long been a focus of coastal restoration to counter land loss caused by subsidence, sea level rise, and

severe storm impacts. These efforts were invigorated to restore for significant crude oil exposure and response activity impacts stemming from the 2010 Deepwater Horizon oil spill. Assessment of ecosystem-scale effects of restoration activities in the Barataria Estuary can be significantly improved with a comprehensive, baseline knowledge of local lower trophic level organisms as well as their population dynamics. For the purposes of this presentation, lower trophic levels consist of primary producers, primary consumers, decomposers, and detritivores spanning detritus, phytoplankton, zooplankton, microphytobenthos, microbes, meiofauna, macroinfauna, bivalves (exclusive of oysters), terrestrial insects, and select epifauna. These organisms serve a critical role in sustaining higher trophic levels, including commercially and recreationally valuable fisheries species. This presentation outlines a collaborative effort led by NOAA to summarize the current state of existing data related to lower trophic level communities in the Barataria Estuary. This summary identified what additional information is required to address key natural resource management and restoration practitioner needs. These findings will be used to develop a data collection plan that, if funded, will support evaluation of ecosystem-wide food-web effects of restoration within the Barataria Estuary.

Panel, Session #94

The State of the Private Oyster Industry in Louisiana- An Industry -Panel

"Part 1: Setting the stage with a PowerPoint presentation Informing the audience about the Louisiana Oyster Industry - 20 minutes (two 10min presentations)

(1) The Traditional Oyster Industry – TBD

(2) The Alternative Oyster Culture (AOC) Industry (off bottom cage culture) - Dr. Dan Petrolia, Mississippi State University

Part 2: Panel Discussion - 70 minutes (TBD and Petrolia will leave the stage for the panelists)

(3) Introduction of Industry Panelists by Darrah Bach

(4) Initial 2-3 pre-arranged questions presented to the panelists to stimulate questions from the audience.

(5) Questions from the audience to panel members (if there is a pause in audience questions, Bach will have other prepared questions to ask panelists)

(6) Any concluding remarks from industry Panelists. "

Session Organizer: | , Email:

Moderator: Darrah Bach | CRCL, darrah.bach@crcl.org

Presenter or Panelist 1: Brad Robins | Robin's Oysters, LDWF Oyster Task Force, bradrobin64@gmail.com

Presenter or Panelist 2: Jacov Jurisich | Oysters JJ, LDWF Oyster Task Force, oysterjj@bellsouth.net

Presenter or Panelist 3: Kirk Curole | Bayside Oyster Company, kirkcurole@gmail.com

Predicting and Planning for the Future of the Coast

Standard, Session #95

RESTORE Act Center of Excellence for LA: Research highlights and Coastal Master Plan utilization

The mission of the RESTORE Act Center of Excellence for Louisiana (LA-COE) is to provide research directly relevant to the implementation of Louisiana's Coastal Master Plan by administering a competitive grants program and providing the appropriate coordination and oversight support to ensure that research goals are tracked and achieved. Since its establishment in 2016, the LA-COE has provided over $5.3M in funding through two request for proposal (RFP) cycles and has supported 47 Louisiana undergraduates, graduates, and post-doctoral researchers, resulting in 19 published journal articles.

In July 2021, LA-COE announced the second grant (RFP2) to fund eight two-year projects. In this session, three Principal Investigators (PIs) funded under RFP2, including Dr. Jonathan Willis (Nicholls State University), Dr. Giulio Mariotti (Louisiana State University) and Dr. Robert Habans (The Data Center), will present on a variety of research topics, including ridge restoration, coastal marsh edge erosion, and the impacts of event-driven changes (e.g., storms and flooding) on Louisiana's coastal communities. The session will also include a presentation by David Lindquist of the Coastal Protection and Restoration Authority (CPRA) to highlight how LA-COE funded research has been used to support the planning and implementation of Louisiana's Coastal Master Plan. This session will be moderated by Bingqing Liu, Deputy Director of LA-COE. The session will be 90 minutes including a moderator introduction, 4 oral presentations of 12 minutes, and discussion time.

Session Organizer: Jessica Henkel | RESTORE Act Center of Excellence for Louisiana, Email: jhenkel@thewaterinstitute.org

Moderator: Bingqing Liu | RESTORE Act Center of Excellence for Louisiana, bliu@thewaterinstitute.org

Presenter or Panelist 1: Krysten Boswell | Louisiana State University, gmariotti@lsu.edu

Marsh edge erodibility dependence on marsh properties in Barataria Basin

Marsh edge erosion caused by wave attack is a major mechanism of marsh loss in Louisiana. Marsh edge erodibility (the rate of marsh edge retreat per unit wave power) is key in determining the amount of marsh loss through this mechanism. Here, we investigate the spatial variability in marsh edge erodibility within Barataria Basin (Louisiana). GIS analysis indicates that marsh edge erodibility of intermediate and brackish marshes is greater than that of saline marshes. To understand how this variability is related to marsh properties, we conducted a basin-wide survey consisting of 54 sites across different salinities. Each site consisted of two locations, edge (~1 m from edge) and interior (~25 m from edge). At each location, we used a shear vane to collect 10 replicate soil shear strength profiles, with each profile consisting of measurements 5, 15, 25, 35, 45, and 55 cm below the marsh surface. We also measured elevation, bulk density, soil organic matter, and plant community composition at each location. Marsh strength of the top 55 cm of marsh soil was positively correlated with elevation. Within the top 20 cm of marsh edge, saline marshes were twice as strong as other marsh types. For depths greater than 20 cm, marsh strength was relatively uniform across marsh types. Interior marsh was generally weaker, with no major

differences in the top 20 cm, whereas with greater depths, saline marsh was slightly weaker than intermediate and brackish marsh. Marsh which was eroded by Hurricane Ida and redeposited in upper Barataria Basin (fresh) had similar soil shear strength to the intermediate marsh it originated from.

Presenter or Panelist 2: Jonathan Willis | Nicholls State University, jonathan.willis@nicholls.edu

Ecological and Sociological Characterization of Ridges in Coastal Louisiana: An Overview

Coastal ridges are linear landforms within the deltaic landscape that intuitively support a variety of ecological processes and resultant ecosystem services. However, despite this ascribed value and their inclusion into restoration efforts, coastal ridges are poorly described in terms of ecological characteristics and sociological importance. To assist in resolving these data gaps, an ecological field study, as well as a sociological analysis, were undertaken addressing key aspects of coastal ridges. Nine ridges that span a combination of ages since restored (< 5 years, 10-15 years, reference), setting (saline, fresh to oligohaline), and origin (natural, spoil bank) were assessed with regard to ecological characteristics. Targeted ecological properties for this assessment included terrestrial vegetation extent and community composition, adjacent emergent and SAV vegetation community composition, as well as nekton, crustacean, and fish community composition in adjacent aquatic habitats, including cryptic species. Additionally ridge geophysical characteristics, including soil physico-chemical properties, ridge elevation profile, and ridge spatial extent are being evaluated through ground-truthed measurements combined with unmanned aerial systems using both lidar and hyperspectral sensors. The human dimension analysis has focused on an understudied community, Smithridge, and the sociological dynamics associated with ridge evolution through time. Findings thus far indicate significant differences in both terrestrial vegetation coverage and community composition, particularly between reference and restored sites. Data collection will continue through fall of 2023 and will be integrated into a conceptual model to enhance coastal restoration planning efforts.

Presenter or Panelist 3: Robert Habans | The Data Center, roberth@datacenterresearch.org

Environmental migration in coastal Louisiana

Louisiana's vulnerability to flooding and coastal disasters has shaped migration and development patterns and will continue to do so for the foreseeable future. Yet migration remains a complex process and a source of uncertainty in planning for adaptation to climate and coastal change. This presentation reviews conceptual and methodological challenges associated with quantifying environmental migration, including the availability of data. Residential mobility depends on a mix of social, economic, and policy factors aside from environmental causes; and available data on migration is often highly aggregated at the county level and thus limited in capturing variation in place-based social and economic factors and hazard exposure. Based on an analysis of a unique data set on address changes with a high degree of temporal and spatial resolution, preliminary findings are presented that quantify the effect of flood risk and disasters on migration outcomes in coastal Louisiana, including excess migration due to hazard exposure. Quantifying migration – especially future migration – is relevant to adaptation planning in a range of settings. The findings also point to the need to unpack migration's complex causes and consequences in both "frontline" and "receiving" areas.

Presenter or Panelist 4: David Lindquist | Utilization of research in the implementation of the Coastal Master Plan, David.Lindquist@LA.GOV

Utilization of research in the implementation of the Coastal Master Plan

The mission of the RESTORE Act Center of Excellence for Louisiana (LA-COE) is to support research directly relevant to the implementation of Louisiana's Coastal Master Plan by administering a competitive grants program and providing the appropriate coordination and oversight to ensure that success metrics are tracked and achieved. The Coastal Protection and Restoration Authority (CPRA) uses the best available science and engineering to inform all phases of Master Plan development and implementation. This includes project planning, conceptual design, feasibility studies, engineering and design, and project/program adaptive management. Given this, and the variety of projects and programs included in the Coastal Master Plan, there is an opportunity for researchers from Louisiana-based institutions to provide critical research to support the protection and restoration of Louisiana's coast.

While the results of the second phase of LA-COE funding (RFP2) are still in progress, there were several projects funded under LA-COE RFP1 that have directly supported Louisiana's coastal protection and restoration program. This includes model improvement through environmental process simulation and better monitoring datasets, refinement of coastal subsidence estimates, research to inform project design to better support fauna, and research into the potential impacts of proposed Mississippi River Diversions. This presentation will highlight LA-COE research that has been utilized in the Master Plan implementation process, and provide insights into potential future areas of research need.

Disaster Impacts, Mitigation and Recovery

Panel, Session #96

Legacy Offshore Oil and Gas Infrastructure in the Gulf of Mexico

Legacy offshore oil and gas infrastructure refers to platforms, pipelines, and other infrastructure that are no longer used for oil and gas production but remain, in whole or in part, in the Gulf of Mexico and its coastal waters. In recent years, concerns about the aggregate fate of decommissioned infrastructure have increased. This is in part a response to Government Accountability Office (GAO) reports highlighting the issue, as well as the declining production and increased rate of decommissioning of many shallow-water wells in the Gulf. A GAO report (GAO-21-293) estimated that 97% or 18,000 miles of decommissioned pipelines remain in place – unmonitored and unmaintained – on the Gulf of Mexico sea floor. According to the Bureau of Safety and Environmental Enforcement, in 2015 there were 241 inactive platforms, and 294 platforms were on expired or terminated leases. With climate change predicted to worsen weather conditions, including hurricane intensification, there are increased risks to legacy oil and gas infrastructure being moved and damaging active infrastructure, posing risks to navigation, and resulting in oil spills. In light of these risks, the National Academy of Sciences' Gulf Research Program (GRP) seeks to facilitate discussion of the multifaceted issues related to legacy oil and gas infrastructure in the Gulf.

This panel session includes an interdisciplinary group of scientists and practitioners to discuss research, regulations, and policies on legacy oil and gas infrastructure in the Gulf of Mexico. Dr. Jennifer Bauer from the National Energy Technology Lab will talk about her work on quantifying risk related to mudslides and other hazards that interact with legacy infrastructure. Ms. Jessica Mallindine from BSEE will discuss managing the Gulf Outer Continental Shelf for multiple uses and accounting for past uses. Dr. Matt Streich from Texas A&M Corpus Christie will present his work on the pros and cons of legacy infrastructure for sportfishing.

Session Organizer: Jennifer Summers | Gulf Research Program, Email: jsummers@nas.edu

Moderator: Jennifer Summers | Gulf Research Program, jsummers@nas.edu

Presenter or Panelist 1: Jennifer Bauer | National Energy Technology Lab, jennifer.bauer@netl.doe.gov

Presenter or Panelist 2: Jessica Mallindine | Bureau of Ocean Energy Management, jessica.mallindine@boem.gov

Presenter or Panelist 3: Matt Streich | Texas A&M Corpus Christie, matthew.streich@tamucc.edu

Flood Risk Management: Coastal and Inland

Standard, Session #97

Strategies to address Flood Risk

This session includes presentations related to watershed flooding and planning to manage flood risk.

The Louisiana Watershed Initiative (LWI) is supporting the development of models to support work in watersheds across the state. Region 2 is made up of nine HUC-8 watersheds covering approximately 9,500 square miles in the north central part of the state. Unique to Region 2 is the modeling of the Old River Control Complex (ORCC). The ORCC represents the most downstream end of the watershed region and determines the downstream boundary conditions and backwater for large areas upstream.

In 2017, the Calcasieu Parish Police Jury commissioned the Parishwide Watershed Planning and Strategic Analysis project in an effort to develop a Regional Watershed Management Plan (RWMP) aimed at reducing flood risk. The comprehensive study uses a watershed-based approach to develop a long-term action plan to guide investments in flood mitigation projects and inform management decisions over the next 50-years. Many of the innovative tools developed are laying the foundation for effective floodplain and watershed management.

Assessing risks from natural hazards entails understanding both how a given hazard will propagate through the physical environment and the consequences it will have for the people and assets in harm's way. Go-Consequences is an open-source consequence modeling system to model thousands of storm simulations quickly and in an automated manner. Paired with a new statewide structure inventory dataset, this will allow the most accurate means to date for assessing economic damages to residential, commercial, and industrial structures from flooding.

The 276 acre University Lakes system has long been an iconic destination serving the citizens of Baton Rouge, the people of LSU, and adjacent communities. Since previously dredged from 1981-83, the six-lake system has progressively experienced flooding, eutrophication, algal blooms, and fish kills largely due to nutrient loads and sediment present in upland runoff. The re-design seeks to improve water quality and flood risk reduction , increase natural habitat, and provide expanded and safer recreational options for the six lakes within the University Lakes System. """

Session Organizer: | , Email:

Moderator: Robert Miller | University of Louisiana at Lafayette, robert.miller@louisiana.edu

Presenter or Panelist 1: Jim Keith | Freese and Nichols, Inc., Jim.Keith@freese.com

Out with the Old River: A New Approach to Statewide Modeling in Louisiana

Freese and Nichols, Inc. (FNI) is working with the Louisiana Department of Transportation and Development (DOTD) for the Louisiana Watershed Initiative (LWI) Modeling Contract encompassing Region 2. The 5-year, $18M contract involves the development of calibrated 1-D/2-D HEC-RAS models for use in consequence and risk assessment, informing the implementation of flood risk reduction projects with parish, state and federal entities. Region 2 is made up of nine HUC-8 watersheds covering approximately 9,500 square miles in the north central part of the state. Each HUC8 will be developed using a tiered approach in terms of the spatial extent of the model, the hydraulic modeling technique,

and spatial resolution. Unique to Region 2 is the modeling of the Old River Control Complex (ORCC), a system of structures that control the diversion of flow from the Mississippi River to the Atchafalaya River, while also providing navigation between the Mississippi, Atchafalaya, and Red Rivers. The ORCC represents the most downstream end of our region and determines the downstream boundary conditions and backwater for the Lower Red and Black Rivers upstream. This presentation will discuss the challenges of managing and executing a project of this magnitude, including the development of tools and processes that allowed for project teams distributed across multiple offices to consistently develop the H&H models. Additionally, the operation and modeling of the ORCC will be discussed. Learning Objective: By attending this presentation, attendees will gain an understanding of the LWI program, learn technical approaches for large-scale watershed modeling, and obtain insight into one of the most unique hydraulic structures in North America.

Presenter or Panelist 2: Brooke Newlin | C.H. Fenstermaker & Associates, L.L.C., brooke@fenstermaker.com

Calcasieu Parish Regional Watershed Management Study Update

In 2017, the Calcasieu Parish Police Jury commissioned the Parishwide Watershed Planning and Strategic Analysis project in an effort to develop a Regional Watershed Management Plan (RWMP) aimed at reducing flood risk. The comprehensive study uses a watershed-based approach to develop a long-term action plan to guide investments in flood mitigation projects and inform management decisions over the next 50-years. As the five-year study is nearing completion, many of the innovative tools developed as a part of the Parish's $12 million investment in the study are laying the foundation for effective floodplain and watershed management in Calcasieu Parish. These tools include 1) twelve, detailed 2D hydraulic watershed models (HUC12-14) that have been calibrated and validated to historical data collected by the Parish's gauging system, 2) a GIS-based impact analysis tool used to evaluate the effectiveness of mitigation strategies by processing hydraulic model results and newly created building inventory for the respective watershed to determine a reduction in damage costs, 3) a Drainage Infrastructure Report Card which provides a comprehensive assessment of the current state of the Parish's drainage system including drainage channels, bridges/culverts, ponds, critical infrastructure facilities, and floodplain management policies, and 4) an informative, GIS-based website where the public can learn about drainage in Calcasieu Parish from a regional perspective and can access a wide variety of resources related to reducing flood risk. Many of these datasets have been leveraged by the Louisiana Watershed Initiative for use in the HUC8 regional model being developed for Region 4. Throughout the study, Calcasieu Parish has worked closely with experts leading LWI to ensure the Parish's local efforts are coordinated with the State's regional efforts.

Presenter or Panelist 3: Lorena Penuela Cantor | The Water Institute, lpenuelacantor@thewaterinstitute.org

CONSEQUENCE MODELING DEVELOPMENT IN SUPPORT OF THE LOUISIANA WATERSHED INITIATIVE AND LOUISIANA

Assessing risks from natural hazards entails understanding both how a given hazard will propagate through the physical environment and the consequences it will have for the people and assets in harm's way. One important consequence of flood risk is the damage to structures and their contents from inundation. Just as flood depths and extents can be simulated numerically in hydrology and hydraulics (H&H) models such as HEC-RAS (Hydrologic Engineering Center River Analysis System), specialized

models are also used to estimate these and other flood consequences in formats that are meaningful for decision-makers and planners. These models can be used for various purposes including risk reduction project benefit-cost analysis and emergency resource deployment. However, these existing models, such as HEC-FIA (Hydrologic Engineering Center Flood Impact Analysis), are not well suited to the future needs of state agencies, being limited in scope, time-consuming to set up, and not well-suited for automation.

Through collaboration with the U.S. Army Corps' Hydrologic Engineering Center (HEC), The Water Institute has explored the use of new tools such as Go-Consequences, an open-source consequence modeling system to model thousands of storm simulations quickly and in an automated manner. For the Louisiana Watershed Initiative (LWI), consequence dashboards are being developed for project evaluation that will allow decision-makers to rapidly compare the consequences of storms with and without project conditions. Paired with a new statewide structure inventory dataset, this will allow the most accurate means to date for assessing economic damages to residential, commercial, and industrial structures from flooding. Additionally, for Louisiana Flood Forecasting (LFF), the Institute has developed dashboards that can provide estimates of flood consequences for storms in near-real-time based on automatically updated flood projections.

Presenter or Panelist 4: Benjamin Hartman | W.F. Baird & Associates Ltd. (Baird), bhartman@baird.com

Hydrodynamic and Hydrologic Modeling for Redesign of Louisiana State University Lakes

In 2016, the Baton Rouge Area Foundation sponsored a master planning process to revitalize the 276 acre University Lakes system, which has long been an iconic destination serving the citizens of Baton Rouge, the people of LSU, and adjacent communities. Since previously dredged from 1981-83, the six-lake system has progressively experienced flooding, eutrophication, algal blooms, and fish kills largely due to nutrient loads and sediment present in upland runoff. The re-design seeks to improve water quality and flood risk reduction , increase natural habitat, and provide expanded and safer recreational options for the six lakes within the University Lakes System. Hydrologic models (PCSMM and HEC-RAS 2D) were used to changes in water surface elevations across the watershed from control structure modifications and 600,000 cubic yards of dredge fill placement occupying existing reservoir capacity. Delft 3D was used to recreate hydrodynamic patterns and evaluate sediment trap efficiency associated with forebays in City Park and University Lake. This presentation summarizes the modeling effort, design recommendations, and maintenance intervals.

Presenter or Panelist 5: Billy Williamson | LA Department of Transportation and Development, Billy.Williamson@LA.GOV

Out with the Old River: A New Approach to Statewide Modeling in Louisiana

Freese and Nichols, Inc. (FNI) is working with the Louisiana Department of Transportation and Development (DOTD) for the Louisiana Watershed Initiative (LWI) Modeling Contract encompassing Region 2. The 5-year, $18M contract involves the development of calibrated 1-D/2-D HEC-RAS models for use in consequence and risk assessment, informing the implementation of flood risk reduction projects with parish, state and federal entities. Region 2 is made up of nine HUC-8 watersheds covering approximately 9,500 square miles in the north central part of the state. Each HUC8 will be developed using a tiered approach in terms of the spatial extent of the model, the hydraulic modeling technique, and spatial resolution. Unique to Region 2 is the modeling of the Old River Control Complex (ORCC), a system of structures that control the diversion of flow from the Mississippi River to the Atchafalaya River,

while also providing navigation between the Mississippi, Atchafalaya, and Red Rivers. The ORCC represents the most downstream end of our region and determines the downstream boundary conditions and backwater for the Lower Red and Black Rivers upstream. This presentation will discuss the challenges of managing and executing a project of this magnitude, including the development of tools and processes that allowed for project teams distributed across multiple offices to consistently develop the H&H models. Additionally, the operation and modeling of the ORCC will be discussed. Learning Objective: By attending this presentation, attendees will gain an understanding of the LWI program, learn technical approaches for large-scale watershed modeling, and obtain insight into one of the most unique hydraulic structures in North America.