State of the Coast

Implementing a Sustainable Coast for Louisiana

June 8-10, 2010 ❑ Baton Rouge River Center ❑ Baton Rouge, Louisiana

Dear Attendees:

On behalf of our partners and sponsors, I'm pleased to welcome you to the State of the Coast Conference. The presentations, plenary sessions, poster session and keynote addresses you'll be attending over the next 3 days represent the culmination of many months of hard work by dozens of individuals and organizations that share our commitment to restoring and protecting this magnificent landscape. We hope their hard work is evident throughout your conference experience.

The original intent of this conference was to bring together scientists, engineers, landowners , stakeholders and decision-makers to help turn plans into projects and begin the real work of implementing a sustainable coast for Louisiana. Unfortunately, those efforts have taken on an even greater importance in the wake of the BP Deepwater Horizon Oil Spill. Though some of the agenda items and speaking presentations have been modified to reflect the current importance of addressing spill impacts on our already damaged coast, we believe that the singular overarching goal of the conference remains unchanged.

Despite uncertainties that existed prior to the spill and new uncertainties introduced by the spill, we cannot lose sight of the one fundamental certainty that has driven our work for decades, that a healthy, resilient and sustainable coastal Louisiana must be the foundation for our future. This conference seeks to begin rebuilding that foundation by ensuring that our decisions are informed by science, supported by stakeholders and diligently reflected in our policies and laws.

At a time when our coast faces significant and serious threats, we appreciate your attendance and participation. The restoration and protection of coastal Louisiana is not the sole responsibility of any one entity, agency or individual and we welcome you to the shared effort to implement a sustainable coast for Louisiana.

Sincerely,

Steven Peyronnin
Executive Director
Coalition to Restore Coastal Louisiana

Professional Development Hours

State of the Coast and American Society of Civil Engineers (ASCE) have partnered together to provide Professional Development Hours for the conference. Professional Development Hours (PDH) will be provided for all registered professional engineers. Attendees will receive 0.5 PDH per qualifying presentation. Speakers will receive 1 PDH for their presentation. As a value-added service, attendees will receive a PDH Log form in their registration packets to assist in tracking their acquired PDHs.

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Conference Schedule

Tuesday, June 8, 2010

7:30-8:30 am **Registration (Lobby, 1st Floor)**

8:30-9:30 am **Welcome Plenary Session**
Governor Bobby Jindal, State of Louisiana (Invited)
Lieutenant Governor Scott Angelle, State of Louisiana (Invited)
Introductions by Steven Peyronnin, Coalition to Restore Coastal Louisiana

9:30-9:50 am **Break with Morning Refreshments in Poster/Exhibitor Area**

9:50-11:50 am **Concurrent Session I**

Sediment Management I (Room A): Harry Roberts, Louisiana State University

An Overview of Sedimentary Resources for Coastal Restoration and Protection in Louisiana — *Syed M.Khalil, Louisiana Office of Coastal Protection and Restoration*

Potential Sand Resources in Buried Paleo-channels on the Continental Shelf Offshore Coastal Louisiana — *Charles W. Finkl, Florida Atlantic University*

Tiger and Trinity Shoals Complex: A Potential Sand Source for Coastal Restoration in Western Louisiana — *Clint Edrington, Louisiana State University*

Delta Deposition in the Northern Gulf of Mexico as Modulated by Sea Level — *Harry Roberts, Louisiana State University*

Structural Protection I (Room B): Jeff Duplantis, American Society of Civil Engineers

Challenges in the Design and Construction of Levees in South Louisiana — *Elif Acar-Chiasson, Shaw Environmental & Infrastructure, Inc*

Flood Risk Reduction Along the Inner Harbor Navigation Canal — *Mathijs van Ledden, Haskoning, Inc*

Coastal Physical Modeling Benefits to the Inner Harbor Navigational Canal Lake Borgne Hurricane Surge Barrier — *Scotty Emmon, AECOM*

Technology Systems Design Considerations for Remote Instrumentation Monitoring and Surveillance of Flood Protection Systems — *James B. Hummert, Jr, URS Corporation*

Soils of Diversions (Room C): Chris Swarzenski, US Geological Survey

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Restoration of Thin-Mat Flotant to Thick-Mat Flotant: Effects of Planting, Fertilizer, and Grazing — *Jenneke Visser, University of Louisiana at Lafayette*

Biodegradation in Wetland Organic Soils — *William Orem, US Geological Survey*

11:50-1:30 **Lunch with Keynote Speaker (Lunch Hall, 1st Floor)**
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The Geology and Geophysics of a Sediment Diversion: Results from West Bay — *Alexander S. Kolker, Louisiana Universities Marine Consortium*

Neck Deep in Mud at the Rockefeller Refuge — *Brett Gessey, HDR Engineering, Inc*

Historical/Current Status (Room C): Andy Nyman, Louisiana State University

The Mississippi River's Last, Vast Natural Delta: Use the Record, or Lose the Coast — *Richard Condrey, Louisiana State University*

Historical Changes in Wetland Area and Suspended Sediments in the Mississippi River Birdfoot Delta — *Andrew Tweel, Louisiana State University*

Marsh Vertical Accretion in Coastal Louisiana: The State of Our Understanding after 30 Years of Research — *Andy Nyman, Louisiana State University*

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Geologic Controls On Island Evolution, Chandeleur Islands Louisiana — *James Flocks, US Geological Survey*

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Assessing the Vulnerability of Coastal Louisiana Habitats to Accelerating Sea-Level Rise — *Patty Glick, National Wildlife Federation*

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12:00-1:50 **Lunch with Keynote Speaker (Lunch Hall, 1st Floor)**

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Sand Hunger at the Eastern Scheldt Storm Surge Barrier — *Leo Adriaanse*, *Rijkswaterstaat*

Hurricane Impacts (Room B): Scott Wilson, US Geological Survey

Observations of the Spatial and Temporal Distribution of Hurricane-induced Land Loss in Coastal Louisiana Over the Past 60 Years — *John A. Barras*, *USACE Engineer Research and Development Center*

Delta Lobe Degradation and Hurricane Impacts Governing Large Scale Coastal Behavior, South-Central Louisiana, USA — *Michael D. Miner*, *University of New Orleans*

Modeling of Hurricane Impacts on a Coastal Lake Bottom: South Central Louisiana — *Angelina M. Freeman*, *Environmental Defense Fund*

Lessons Learned II (Room C): Rudy Simoneaux, Office of Coastal Protection and Restoration

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12:00-1:50 **Lunch with Keynote Speaker (Lunch Hall, 1st Floor)**
Nancy Sutley, Chair of the Council of Environmental Quality

1:50-3:30 **Café and Beignets Plenary Session (Plenary Hall, 1st Floor)**
Five Years After the Storms – Are we on the right path?

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5:20-5:25 **Conference Wrap-Up**

Keynote Speakers

Dr. Larry Robinson

Assistant Secretary of Commerce for Oceans and Atmosphere

Dr. Robinson serves as Assistant Secretary of Commerce for Oceans and Atmosphere at the National Oceanic and Atmospheric Administration where he helps guide policy and program direction for NOAA's conservation, protection and resource management priorities.

Dr. Robinson supports and manages NOAA's coastal and marine programs, including marine sanctuaries for preserving areas of special national significance, fisheries management to sustain economic prosperity, and nautical charts for safe navigation. He also supports NOAA's participation as a lead agency in President Obama's Ocean Policy Task Force.

Dr. Larry Robinson was the vice president for research and a professor in the Environmental Sciences Institute at Florida A&M University (FAMU). Since 2001, he has served as director of the NOAA Environmental Cooperative Science Center (ECSC) headquartered at FAMU, which consists of a broad, multi-institutional consortium of predominantly minority-serving institutions. ECSC's multifaceted program has made a significant contribution to the promotion of diversity in the scientific workforce — especially within NOAA — due, in large part, to Dr. Robinson's outstanding leadership.

Between 1984 and 1997, Dr. Robinson served as a research scientist and a group leader at Oak Ridge National Laboratory. His work there included detection and assessment of special nuclear materials and application of nuclear methods in nonproliferation, environmental science, forensic science and the assessment of high purity materials. From 1997 to 2003, Dr. Robinson directed FAMU's Environmental Sciences Institute where he led efforts to establish bachelor and doctoral degree programs. In 2007, he became the first African-American to serve as the science advisor to the United States Department of Agriculture's Cooperative State Research, Education and Extension Service.

Dr. Robinson graduated summa cum laude with a bachelor's degree in chemistry from Memphis State University in 1979, and earned a doctorate in nuclear chemistry from Washington University in St. Louis in 1984.

Nancy Sutley

Chair, White House Council on Environmental Quality

Nancy Sutley is the Chair of the White House Council on Environmental Quality (CEQ). In her role as Chair, she serves as the principal environmental policy adviser to the President.

Prior to her appointment, Sutley was the Deputy Mayor for Energy and Environment for the city of Los Angeles, California. She represented Los Angeles on the Board of Directors for the Metropolitan Water District of Southern California and served on the California State Water Resources Control Board from 2003-2005. Sutley also worked for California Governor Gray Davis as Energy Advisor, managing state and federal regulations, legislative affairs, finances and press relations. She served as Deputy Secretary for policy and intergovernmental relations in the California EPA from 1999-2003. She advised on water and air pollution policy, and established budget and legislative priorities. During the administration of President William J. Clinton, Sutley worked for the EPA as a Senior Policy Advisor to the Regional Administrator in San Francisco and special assistant to the Administrator in Washington, D.C.

Sutley received her Bachelors degree from Cornell University and her Masters in Public Policy from Harvard University.

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The mission of the State of the Coast conference is to provide a forum to learn from recent advances in science and engineering as they relate to hurricane protection and ecosystem restoration in coastal Louisiana, to ensure that relevant and current knowledge is applied to existing and future coastal restoration and protection efforts, and to effectively inform policy and decision making.

NOTES

CONCURRENT SESSION I

Tuesday, June 8 9:50 a.m. - 11:50 a.m.

Sediment Management I (Room A)

Moderator: Harry Roberts
Louisiana State University

An Overview of Sedimentary Resources for Coastal Restoration and Protection in Louisiana

Syed M. Khalil[1] *and Charles W. Finkl*[2]

[1] *Louisiana Office of Coastal Protection and Restoration, Baton Rouge, LA 70801* [2] *Department of Geosciences, Florida Atlantic University, Boca Raton, FL 33431*

Louisiana's environmentally sensitive marshlands, beaches, and dunes require remediation if this destructive trend is to be mitigated. This can be achieved by placing dredged sediments on degraded beaches, dunes, and marshes. Restoration efforts will be severely compromised if sufficient compatible sediment is not located either offshore on the continental shelf or in rivers (main channel or distributaries). Sediment volumes required for initial restoration of degraded coastal Louisiana are estimated to be in the range of hundreds of millions of cubic meters. Barrier island restoration requires large sand volumes that must be dredged from offshore sources and pumped or transshipped to the project areas. Fluvial sand/sediment resources from the Mississippi River are not yet cost effective for barrier island restoration. These sediments can, however, restore interior marshes if sediment diversions are placed in appropriate locales. Qualitatively compatible and quantitatively adequate sediment is thus a vital factor in restoration efforts with almost 80% of the restoration-budget allocated to exploration, exploitation, and emplacement of sediment. Restoration and protection of coastal Louisiana thus requires a systematic approach in exploration of offshore sand as well as geoscientific data management that manages an enormous amount of geotechnical data to effectively reduce costs. The Louisiana Sand Resource Database (LASARD) has been initiated in response to this need to function as a database primarily for managing enormous amounts of historical and current geoscientific data. In order to be successful in its present enormous undertaking of restoring and protecting coastal Louisiana, the State needs a planned systematic approach to its marine sedimentary resources. This talk will provide an overview of sediment/sand resources in coastal Louisiana and will also emphasize the need of a regional approach of managing sediment. The Louisiana Sediment Management Plan (LASMP) which has been conceptualized and formulated for better planning and coordination and will be presented for the first time to the scientific community.

Implications

Restoration efforts for sediment starved systems such as those that occur along the Louisiana coast depends on emplacement of sufficient sediment volume to build up barrier and deltaic systems. Qualitatively compatible and quantitatively adequate sediment is thus a vital factor in restoration efforts with almost 80% of the restoration-budget allocated to exploration, exploitation, and emplacement of sediment. Because this cost is directly proportional to the distance of borrow sources from the project area, the success of restoration depends on locating sufficient sediment volumes that are suitable for placement on beaches and dunes, and for creating marshes. However, it is realized that identification and delineation of sand/sediment resources is not enough. A very systematic effort on a regional basis is needed for a planned and coordinated approach to restoration and protection of Coastal Louisiana which will be provided by the Louisiana Sediment Management Plan.

Potential Sand Resources in Buried Paleo-channels on the Continental Shelf Offshore Coastal Louisiana

Charles W. Finkl[1] *and Syed M. Khalil*[2]

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Deltaic sands in the Mississippi Delta region off Louisiana are vital to restoration of barrier islands due to the large volumes that are required. The cost-effective search for quality sand in a predominantly muddy environment needs a comprehensive and systematic approach. Analyses of high-resolution seismic reflection profile survey data, for example, shows that much of the delta region seafloor is characterized by fine-grained (muddy) deposits that are occasionally interspersed by sand deposits in paleo-distributaries and inter-distributaries of abandoned delta complexes, delta front sands, and shoal sands. Sand deposits are mostly identified as acoustically transparent facies whereas fines are discernable as layered signatures. Seismic profiles show that large distributary channels can occur as singularities or as broad channel fields comprised by smaller distributary channels. These kinds of channels range up to 30 m in thickness but average about 15 m. The textural characteristics of distributary deposits are highly variable, ranging from 20% to 90% sand. Distributary channel sands may be exposed on eroded seafloor or buried by sheets or splays of mixed sediments (muddy overburden). The thickness of muddy overburden is crucial, from a cost-benefit point of view, to exploitation of underlying channels sands. Generally, a ratio of 1:1 (muddy overburden to channel sand) is a cutoff value below which exploitation becomes uneconomical. It is not economical, for example, to sidecast 3 m of muddy overburden to exploit 1 m of channel sand (3:1 ratio) but if 1 m of muddy overburden covers 3 m of channel sands (1:3 ratio), then it becomes economically attractive to mine the sand. Because parts of some buried paleo-channels contain sands that are suitable for barrier island restoration, these deposits should be further studied to ascertain their potential as a sand resource. They retain comparative advantage when they occur closer to projects than do sandy shoals and banks.

Implications

Offshore sand and mixed sediment deposits are finite resources, the use of which must be judiciously applied if the needs of barrier island restoration are to be met. Although large sand bodies occur offshore in shoals and banks, their great distance from some restoration sites increases transport costs. Because sand resources in some paleochannels occur closer to project sites, it thus seems responsible to investigate the potential of paleochannels as sediment sources for restoration work in coastal Louisiana. Determination of sand resources in paleochannels via geophysical and geotechnical means has important implications to project cost and availability of additional sediment sources in a shelf region that known for its extensive fine-grained sediments (i.e. muds) and limited supply of coarser grained sandy deposits that are required for beach and dune restoration. Location of usable paleochannel deposits closer to restoration sites will reduce overall project costs and increase marine sand reserves.

Tiger and Trinity Shoals Complex: A Potential Sand Source for Coastal Restoration in Western Louisiana

***Clint H. Edrington*[1], *Harry H. Roberts*[1], *and Syed M. Khalil*[2]**

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During the transgressive phase of delta building, a sediment starved delta lobe succumbs to subsidence and physical oceanographic processes, and is eventually reworked into a submarine shoal. Two such shoals, located on the western Louisiana inner continental shelf, are Tiger and Trinity Shoals. These adjoining submarine sand bodies are thought to be remnants of separate Holocene Mississippi River delta lobes. A study was sponsored by Minerals Management Service (MMS) and Louisiana Office of Coastal Protection and Restoration (OCPR) to evaluate the potential dredgeable sand from these bodies to help facilitate coastal restoration in this part of Louisiana Coast. An initial marine geophysical survey collected approximately 1,150 km of high resolution subbottom profiles (chirp sonar) across the study area. Based on initial interpretations of profiles, 46 vibracores were extracted. Cores were analyzed for sedimentological studies and also sampled for geochronological studies. Analyses and synthesis of preliminary results reveal both similarities and contrasts between Tiger and Trinity Shoals. The sand fraction of both shoals decreases vertically in grain size with depth, and laterally from east to west. However, the sand in Trinity Shoal is almost entirely very-fine sand, whereas the sand in Tiger Shoal's ranges from medium sand in its extreme eastern section to very-fine sand towards west. The stratigraphic framework of the study area as interpreted from the subbottom profiles indicates that the Tiger shoal is lesser both in thickness and in surficial area than Trinity Shoal. This obviously is an indication that volume of sand in Tiger Shoal is much less than in Trinity Shoal. This study also intends to shed light on geochronology and stratigraphic architecture of both the shoals by evaluating the sedimentology, stratigraphy, and depositional history of Tiger and Trinity Shoals.

Implications

The dredging of offshore sand resources for coastal restoration projects has the potential to play a critical component in the overall effort to mitigate land loss in south Louisiana. However, the delineation of sand resources is not enough. There are other factors viz. the high cost of dredging, transportation, and then emplacement which are crucial for any restoration project. Coastal managers need data on sand volumes along with the physical properties of delineated sand sources for cost-benefit analysis, whereas coastal researchers need information of depositional models to exploration offshore sand resources. This study will provide geological and geophysical data of the sand resources of Tiger and Trinity Shoal Complex to both the communities.

Deltaic Deposition in the Northern Gulf of Mexico as Modulated by Sea Level

Harry H. Roberts

Coastal Studies Institute, Louisiana State University

Baton Rouge, LA 70803

Deltaic deposition in the northern Gulf of Mexico has taken place under constantly changing conditions of sea level during Quaternary times. During this period, sea level has fluctuated well over 100m in repeated cycles of approximately 140kyrs duration. Each cycle has involved global cooling and glaciation resulting in a falling sea level followed by global warming and deglaciation resulting in a sea level rise. These cycles have forced the advance and retreat of fluvial-deltaic depositional systems as they tracked sea level across the continental shelf. The preservation potential of fluvial and deltaic deposition associated with these cycles is greater at the shelf edge and in the deeper Gulf than updip sites on the continental shelf and near the present shoreline where erosion during transgressions and entrenchment during periods of sea level fall erode previously deposited sediments. The result is stacked deltas at the shelf edge and stacked fans on the continental slope and basin floor, products of multiple sea level and associated depositional cycles. The imprint of these cycles on the continental shelf is quite different. The shelf is characterized by multiple entrenched alluvial valleys and channels as well as highly eroded delta remnants. Sand bodies developed from the concentration of coarse sediments related to the erosion of deltaic and other coastal sediments are also present (e.g. the submarine shoals and barrier islands off Louisiana and the sand ridges off Mississippi, Alabama, and western Florida). Over the rising -to-high part of the latest Pleistocene-to-Holocene sea level cycle, the Mississippi River produced a series of six major delta-building pulses that have built the delta plain as we know it today. Following the latest Pleistocene glacial maximum, sea level rose rapidly from approximately -120 m, which is beyond the present shelf edge break in slope, to a few meters from present levels. However, at approximately 7-8 kyrBP the rapid sea level rise rate decreased significantly. At this point, all the world's great rivers started delta-building and sedimentation from the Mississippi River was able to prograde the coastline and not simply fill and backstep into the large alluvial valley produced during the falling limb of the sea level cycle. These events have determined the depositional fabric and geomorphology of Louisiana's present coastal plain and shelf. A detailed knowledge of this geololgic framework is essential for making informed decisions concerning many aspects of coastal restoration.

Implications

Understanding the sedimentary framework of the modern Mississippi River Delta and its alluvial valley are fundamental to the success of must coastal restoration efforts. Knowing where to explore for sands to rebuild our disappearing barrier islands, where best to extract sediments for building coastal protection structures, estimating where subsidence that impacts restoration project effectiveness will be maximized and where it will be minimal, and where to place river diversions so they will be most efficient in building new land and enhancing surrounding marshlands are but a few examples that require a detailed knowledge of Mississippi River Delta history and associated geologic framework.

Structural Protection I (Room B)

Moderator: Jeff Duplantis
American Society of Civil Engineers

Challenges in the Design and Construction of Levees in South Louisiana

Elif Acar-Chiasson
Shaw Environmental & Infrastructure, Inc.

Since the devastation caused by recent hurricanes, flood protection has positioned itself as one of the most sensitive subjects to the citizens of South Louisiana. The two major components of flood protection projects, levees and flood-control structures, have been the focus of much criticism due to the failures that occurred during Hurricane Katrina. This presentation will focus on the major challenges currently facing the levee districts, local sponsors and design engineers in the design and construction of the levee component of flood protection projects across South Louisiana.

Implications

The major challenges faced by local governments and state agencies in the construction of levees are the implementation of design criteria, locating borrow sources, dealing with existing subsurface conditions, environmental impacts (mitigation), pipeline and other utility relocations, and land acquisitions. Depending on how each challenge is handled, the time and dollars it takes for a levee to be constructed could be significantly increased.

Flood Risk Reduction Along the Inner Harbor Navigation Canal

Mathijs van Ledden[1], *Maarten Kluyver[1], Nancy Powell[2]*
[1] Haskoning Inc., [2] US Army Corps of Engineers, New Orleans District

The IHNC project is one piece of the new Hurricane Storm Damage Risk Reduction System (HSDRRS) that is being built after Hurricane Katrina in 2005. This project will reduce risk along the New Orleans' Inner Harbor Navigation Canal from powerful storm surge in the event of future hurricanes. At the Lake Borgne side, two navigation gates along the 3 kilometer long floodwall are under construction to prevent water surging up the canal. Another barrier is planned on the Lake Pontchartrain side and the walls and levees along the IHNC canal system have been strengthened in order to achieve protection against surge and associated waves with a 1% annual exceedance in 2011. The much needed barriers for the IHNC will greatly reduce the risk of flooding for hundreds of thousands of residents in the St. Bernard, New Orleans East, Ninth Ward and Gentilly areas.

This paper will discuss in-depth the hydraulic changes due to the construction of the barriers at Lake Borgne and Lake Pontchartrain. Normal tidal conditions but also hurricane conditions will be addressed. Results from detailed numerical models but also simplified analytical methods are being presented to increase the hydraulic understanding of this complicated system. Also, the effect of different sea level rise scenarios on the hydraulic behavior will be reviewed.

Implications

A thorough understanding of the hydraulic behavior of the IHNC system is key input to manage and operate the IHNC system after 2011. It gives insight in the timing, sequence and hydraulic conditions prior to closure and after opening of the various gates in the system. This information can assist responsible agencies in their decision making how to effectively operate this part of the HSDRRS. Moreover, the assessment of the different sea level rise scenarios is important in planning efforts to achieve the desired level of flood risk reduction in the coming decades.

Coastal Physical Modeling Benefits to the Inner Harbor Navigational Canal Lake Borgne Hurricane Surge Barrier

Scotty Emmons[1], *Peter Grant[2], and Jena Gilman[3]*
[1] AECOM, New Orleans, Louisiana, USA, [2] AECOM, Redmond, Washington, USA, [3] AECOM, Seattle, Washington, USA

The New Orleans Inner Harbor Navigation Canal (IHNC) Lake Borgne Hurricane Surge Barrier is composed of nearly two miles of flood protection including vertical floodwalls, a vertical lift gate at Bayou Bienvenue, and 150-ftt wide buoyant sector gates on the Gulf Intracoastal Waterway (GIWW). The project, being the largest civil works design-build project ever undertaken by the United States Army Corps of Engineers, was supported by two dimensional (2-D) and three dimensional (3-D) 1:20 Froude scaled physical model studies of the floodwall and sector gates, respectively.

2-D physical model studies of the floodwall structure with different bathymetric site conditions were performed to evaluate scour of the design riprap under 1% and 0.2% probability storm conditions, resulting in an increase in the selected riprap on the protected side, or populated side, of the floodwall structure.

A full bathymetric, or 3-D, representation of the GIWW and the proposed buoyant sector gates including the monolithic structure and approach walls was used in physical models studies to measure hydrodynamic pressures from surge, waves, overtopping, and reverse head of a 1% chance probability storm.

Wave pressure, and the resulting forces, and induced vibration of the buoyant sector gates were investigated using a hydroelastic model under storm surge and wave conditions to provide confirmation that analytically determined loads were conservative and the buoyant sector gate was adequately designed for stability. Additionally, gate opening hydrodynamic force curves were developed under variable reverse head conditions, representing a storm's recession and the evacuation of flood waters. The establishment of these force curves enabled design engineers to appropriately select an adequately sized hydraulic actuating cylinder.

Technology Systems Design Considerations for Remote Instrumentation Monitoring and Surveillance of Flood Protection Systems

James B. Hummert, Jr., P.E[1], *Dr. Kevin O'Connor, P.E[2], David Rutledge, P.E[3]*

[1] URS Corporation, [2] GeoTDR, Inc., [3] GeoTDR, Inc.

This presentation will review state-of-practice instrumentation and remote data acquisition systems technologies being used to monitor flood protection systems world-wide. Both conventional instrumentation and metallic/optical time domain reflectometry applications will be discussed. The presentation will include application of GPS structural monitoring systems for both embankments and floodwalls.

There will be presentation of one or more emerging technologies including distributed temperature sensing techniques for monitoring levee systems on a day-to-day basis and during storm events using fiber optic cables. In addition, the use of new solid state IP video camera systems for remote surveillance of critical levee sections will be discussed.

Methodologies for leveraging the instrumentation data to develop comprehensive baseline data sets that can be used as part of an early alert system will be presented. Where applicable case history results from the London Avenue Canal Load Test and other recent instrumentation projects will be used. Lessons learned from these projects will be summarized.

The presentation will conclude with a discussion of how these types of systems can be integrated into an engineered risk management program using risk based screening tools and alignment with the potential failure modes associated with typical coastal flood protections systems.

Implications

Flood protection systems within the United States are vast, aging and becoming more critical all the time. Methods of remote surveillance coupled with early alert systems can be valuable tools to provide incremental risk reduction associated with management of flood protection systems.

Soils of Diversions (Room C)

Moderator: Chris Swarzenski
US Geological Survey

Consequences of Increased Nutrient Loading to Coastal Marshes Belowground

R. Eugene Turner
Louisiana State University

Most plant production by emergent coastal marshes occurs belowground. This belowground production adds to the accumulation of organic matter sustaining salt marshes as sea level rises, thus preventing excessive flooding, eventual plant death, and habitat loss. The ubiquitous nutrient enrichment of coastal marshes stimulating aboveground plant growth may result in higher rates of inorganic matter accumulation that compensates for some of the marsh flooding caused by sea level rise. But will the soil system be compromised? We conducted field experiments and observations at a combination of geographically diverse and regionally-specific sampling of above- and belowground plant biomass in western Atlantic and Gulf of Mexico marshes to understand the belowground responses of the dominant salt and fresh marsh plants to N, P, and Fe additions. The results indicate that nutrient enrichment may lead to lower root and rhizome biomass, and belowground production, and organic accumulation. Phosphorus additions, more than nitrogen, seems to reduce root and rhizome biomass accumulation in salt marshes. Higher soil respiration and a lower Eh are anticipated additional soil property changes, revealing a loss of belowground carbon. Further, the soil strength is reduced below the rooting zone. Several examples will be shown to demonstrate that the cumulative effects of increased nutrient loadings may be to decrease soil elevation and to accelerate the conversion of emergent plant habitat to open water, particularly at the lower elevation range of the plant and during the occasional large storm.

Implications

Sustaining and restoring coastal emergent marshes is more likely if they receive a lower, not a higher, nutrient load. This conclusion is at odds with the rationale for river diversions and sewage treatment wetlands in unconfined natural marshes when wetland conservation or restoration is the management goal. The results are consistent with the high land loss post-Katrina/Rita in the Caernarvon outflow path, but not in the reference marsh. A quantitative evaluation of the relations between river diversions and wetland soil ecosystems is needed. The increased nutrient loading from the Mississippi River watershed this century has also driven the formation of the low oxygen zone (Dead Zone) that forms off the Louisiana-Texas shelf each summer. Restoring either offshore or estuarine ecosystems necessitates, therefore, improving water quality in the watershed.

The Impact of the Caernarvon Diversion and Atchafalaya River Discharge on Louisiana Marshes

John Day [1], *Robert Lane* [1], *Matthew Moerschbaecher* [1], *Ron DeLaune* [1], *Robert Twilley* [1], *Irv Mendelssohn* [1], *Joseph Baustian* [1]

[1] *Louisiana State University*

Above and belowground biomass, porewater nutrients (NOx, NH_4, and PO_4 pt), salinity, sulfide, and soil Eh were measured bimonthly at the Caernarvon diversion at near (N1&2), mid (M1&2), far (F1&2), and reference (F1&2) stations. Aboveground and belowground decomposition was estimated using litterbags and belowground using cotton strips. Aboveground productivity as measured by EOSL peak standing crop ranged from 423 g/m^2/yr at site M2 to 1515 at F1. Aboveground productivity was significantly greater at N1 than at N2, M1, or M2. Peak belowground biomass ranged from 8315 g/m^2/yr at R2 to 17890 g/m^2/yr at N1. Sulfide and PO_4 were related to belowground and aboveground biomass, respectively. The decomposition bag data did not indicate a strong impact, but cotton strip decomposition rates at the Ref site were lower through most of the depth profile, however this difference was only significant at the lowest measured depth. Vertical accretion was 0.49-1.25 cm/y at N1; rates>RSLR.

Implications

Analysis of the results of short-term accretion compared to RSLR indicates that all Caernarvon sites are keeping pace with RSLR. Analysis of porewater parameters showed that stress on plants was low to moderate while nutrient concentrations were greatest at the Near sites. Belowground productivity at the measurement sites at Caernarvon area is among the highest reported in the literature. Decomposition was not strongly increased. The results indicate that marsh productivity and decomposition were not significantly negatively impacted. The study sites were streamside locations where there were strong inputs of freshwater, nutrients, and sediments. The results suggest that diversions should maximize sediment input and allow for drainage.

Restoration of Thin-Mat Flotant to Thick-Mat Flotant: Effects of Planting, Fertilizer, and Grazing.

Charles E. Sasser[2], ***Jenneke M. Visser***[1], *and Guerry O. Holm*[2]

[1] *University of Louisiana at Lafayette, Lafayette, Louisiana*

[2] *Louisiana State University, Baton Rouge, Louisiana*

Floating marshes historically were widely distributed in the freshwater areas of the Mississippi River Deltaic Plain, and their present distribution remains widespread. However, in some areas vegetation associations have changed from thick-mat maidencane (*Panicum hemitomon*) dominated marsh to thin-mat spikerush (*Eleocharis baldwinii*) dominated. The effect of planting, grazing, and fertilizer application were tested at four thin-mat sites in northwestern Terrebonne parish. Grazing by nutria was the crucial factor in the survival of *P. hemitomon* at all sites. Grazing protection coupled with *P. hemitomon* transplantation doubled the root standing stock compared to control conditions of the thin-mat community. Simple grazing protection of the natural community did not produce increases in live root standing stock. The natural nutrient availability at the sites was adequate for the growth of *P. hemitomon*. Although fertilization initially stimulated aboveground coverage of *P. hemitomon*, after four years there was no statistically significant difference in end-of-season biomass of above ground plant material in non-fertilized versus fertilized treatments. The re-introduction of *P. hemitomon* into the thin-mat floating marsh built a thicker and stronger marsh mat. Marsh soil strength and mat thickness were both increased by *P. hemitomon* growth coupled with grazing protection. Soil strength gains were observed in the upper 20 cm of the soil profile. An additional 10 cm of mat thickness was observed above that of control conditions. Protection from grazing of the existing thin-mat marsh plant community did not enhance soil strength or apparent root mat thickness.

Implications

Control of nutria populations is essential for the restoration of thin-mat flotant, while addition of additional nutrients may not be required for *P. hemitomon* growth. Since *P. hemitomon* has very low seed viability, re-establishment has to be accomplished using vegetative methods. Planting large areas is extremely costly and alternative establishment techniques need to be developed.

Biodegradation in Wetland Organic Soils

William Orem[1] *and Christopher Swarzenski*[2]

[1] *U.S. Geological Survey, Reston, VA* [2] *U.S. Geological Survey Baton Rouge, LA*

Many wetland environments form organic matter-rich soils or peats. Waterlogged conditions in wetlands inhibit oxygen penetration into the soil, and organic matter degradation is dominated by anaerobic microbial processes. Peat accretes because wetland primary production exceeds anaerobic biodegradation, especially biodegradation of aromatic and aliphatic structural components of vascular plant. Anaerobic biodegradation in peats primarily involves a consortium of microorganisms that preferentially decompose oxygen-rich substances, such as cellulose from vascular wetland plants and complex carbohydrates from algae. This has been demonstrated by changes observed in the elemental composition and the ^{13}C nuclear magnetic resonance spectra of peat organic matter with increasing depth (e.g. over time). The anaerobic biodegradation process leaves the peat organic matter enriched in only slowly biodegraded and oxygen-poor aromatic (lignin) and aliphatic structures (waxes).

Anthropogenic activities impact natural peat accretion in many wetlands (e.g. south Louisiana, the Florida Everglades, and the Sacramento River Delta). Water allocation practices may cause drying, oxidation, and loss of peat mass. Chemical substances introduced into wetlands can also impact peat accretion and the physical integrity of peat deposits. Nutrient contamination has complex effects, stimulating both wetland plant growth and peat accretion, but also anaerobic biodegradation of peat. The introduction of electron acceptors, such as iron (III), nitrate, and sulfate also stimulates microbial populations and anaerobic biodegradation of the peat. Sulfate can enhance biodegradation by causing nutrient release from wetland soils (internal eutrophication), and by acting as an electron acceptor in microbial sulfate reduction. Preliminary studies in south Louisiana and the Everglades have demonstrate the potential of sulfate to enhance anaerobic biodegradation and destabilize peat accumulations.

Implications

In this presentation we review processes that control the degradation of soil organic matter. Factors affecting these processes have the potential to alter the organic structure of the peat and influence wetland stability.

LUNCH WITH KEYNOTE SPEAKER

Tuesday, June 8 — 11:50 a.m. - 1:30 p.m.

Dr. Larry Robinson

Assistant Secretary of Commerce for Oceans and Atmosphere

National Oceanic and Atmospheric Administration

CONCURRENT SESSION II

Tuesday, June 8 — 1:30 p.m. - 3:00 p.m.

Storm Surge Modeling (Room A)

Moderator: Joe Suhayda

Louisiana State University

Systems Approach to Coastal Storm Damage Reduction

Ty V. Wamsley[1], Mary A. Cialone[1], Jane M. Smith[1], Tate McAlpin[1] and Joannes J. Westerink[2]

[1] Engineer Research and Development Center, Coastal and Hydraulics Laboratory, Vicksburg, Mississippi, USA

[2] University of Notre Dame, Notre Dame, Indiana, USA

Natural and man-made protection and buffering features like wetlands and barrier islands do not decrease the mass of water driven into the region by the hurricane winds (mass is conserved) but they do change the momentum and redistribute the storm surge. Therefore, changes in one part of a system can create unintended consequences somewhere else in the system. The potential for these unintended changes must be considered for effective coastal flood protection design. For these reasons, the effect of proposed project alternatives on storm surge levels and waves must be examined over large spatial and temporal scales, or systems approach. A high resolution numerical modeling system capable of representing complicated coastal landscapes and simulating all the primary relevant physical processes, including winds, air-sea momentum transfer, atmospheric pressure, wind-driven waves, riverine flows, tides, and friction due to land cover will be presented. The role of natural features in reducing surge and waves will be discussed. In addition, how the long-term effects of SLR can be incorporated in the modeling system will be demonstrated the impact of SLR on surge and waves analyzed.

Implications

The modeling system presented in capable of representing both natural and manmade features on a regional scale and includes the relevant physical processes for evaluating the role of wetlands and barrier islands in storm surge and wave reduction. The importance of taking a holistic systems approach to coastal flood protection and how the modeling system can identify unintended consequences is demonstrated. Results from the model can assist in prioritizing protection and restoration projects. The systems approach concepts and models presented are now being applied for developing flood damage reduction plans.

eSURF a Surge Level Prediction Model for Hurricanes

***Maarten Kluyver**[1], Mathijs van Ledden[1], Nancy Powell[2]*

[1] Haskoning Inc. [2] USACE New Orleans District

eSURF is a forecasting model that can predict surge levels caused by hurricanes in a matter of seconds for the New Orleans and vicinity area. eSURF stands for Experimental Surge Forecast. The model is based on data generated by the ADCIRC model for numerous hypothetical storms. The ADCIRC model is a system of computer programs for solving time dependent, free surface circulation and transport problems in two and three dimensions. For these hypothetical storms the model utilize the finite element method in space and incorporates all relevant physical aspects regarding hurricanes and storm surge to produce a 2D maximum water elevation surface for a storm. This however comes at a certain cost. For the high level of detail it requires a computer to do a significant amount of calculations, hence it takes a significant amount of time (order of hours) to finalize a single model run. Due to the changeable nature of these complicated weather systems a hurricane can already changed its size or path within the time to complete a run.

eSURF takes away the dependency of elaborate time consuming model calculations in the critical hours before a Hurricane makes landfall. eSURF can make a surge level prediction in seconds. The program uses an innovative algorithm to come up with fast and accurate predictions of surge levels. In essence eSURF is an innovative tool that quickly manages an enormous amount of data. At the base are the ADCIRC results from hypothetical storms for the Louisiana coast, the 2566 surge level prediction points, the parameters of the forecasted hurricane and the eSURF algorithm.

In addition to this, eSURF can predict wave heights and wave periods and provide a risk classification based upon the forecasted hydraulic parameters in combination with known levee heights.

Implications

The availability of a fast prediction on surge levels prior to a hurricane making landfall can assist a number of authorities in a beneficiary way. For example Areas which are forecasted to be prone to greater flooding risk could be assisted first with temporary measures (e.g. sandbags). Furthermore evacuation orders, routes and the use of material could be planned effectively if areas of greater risk are identified early. Ultimately the model could be extended to include the entire Gulf Coast and provide the public with information on predicted surge levels with every public advisory from the NHC.

Modeling Hurricane Waves and Storm Surge in Coastal Texas, Louisiana and Mississippi Using Integrated Tightly Coupled Scalable Unstructured Mesh Computations

Joannes J. Westerink[1], *Casey Dietrich*[1], *Andrew Kennedy*[1], *Seizo Tanaka*[1], *Mark Hope*[1], *Clint Dawson*[2], *Jane Smith*[3], *Robert Jensen*[3]

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Coastal Louisiana, Mississippi and Texas are characterized by tremendous complexity in their geography, topography, bathymetry, and surface roughness. The rapid evolution of data collection systems allows the physical system to be accurately defined, and the rapid evolution of unstructured grid computational models allows these characteristics and the resulting waves and flows to be numerically resolved. The SWAN+ADCIRC unstructured grid modeling system has been developed to simulate fully coupled hurricane winds, wind-waves, storm surge, tides and river flow in this complex region. This is accomplished by defining a domain and computational resolution appropriate for the relevant processes, specifying realistic boundary conditions, and implementing accurate, robust, and highly parallel unstructured grid algorithms for both the wind waves and the long wave current/storm surge/tide model. Basin to channel scale domains and high resolution grids which resolve features down to 30 meters and contain up to 4.2 million nodes have been developed. This modeling system is run on up to 16,384 processors and requires as little as 24 minutes of wall clock time per day of simulation.

Implications

The present modeling system shows a high level of skill for deep water and nearshore waves, high water levels and hydrographs. Hindcasts of Katrina, Rita, Gustav and Ike indicate that large domains and highly refined localized resolution is key. The system very closely couples wind waves and circulation. The system captures the effects of wave radiation stresses in wave transformation zones which drive additional coastal set up and currents and modifies bottom friction in the circulation model to account for the effects of energetic wave mixing. It also accounts for water levels and currents in the wave computations.

Lessons Learned I (Room B)

Moderator: Ronald Paille
US Fish and Wildlife Service

Construction Lessons from East Grand Terre and Chaland Headland Restoration Projects

Andrew Wycklendt[1], *Shane Triche*[2], *Rachel Sweeney*[3] *and Barry Richard*[2]

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[2] *Louisiana Office of Coastal Protection & Restoration, Thibodaux, LA*

[3] *NOAA-National Marine Fisheries Service, Baton Rouge, LA*

Each barrier island restoration project provides different challenges. The location and condition of the island, construction access, surrounding oil infrastructure, the location and characteristics of the borrow area, fill density, need for marsh fill containment, breaches, and tidal currents are just a few of the elements that can be distinctly different, even for projects that are located only a few miles apart.

Chaland Headland was constructed between March 2006 and January 2007. It involved the placement of 1.8M cubic yards of beach fill and 950,000 cubic yards of marsh fill. The borrow area was located just 2.5 miles southwest of the project area and contained both the marsh fill and beach fill material. Due to the location of the marsh fill and beach fill material in the borrow area, side casting of the marsh fill prior to constructing the beach was required. Construction access dredging was required, as was the dredging of an oil infrastructure access canal. The sand section of the borrow area had silt contents varying between 10 and 40%, which affected the submerged construction slope. During the project the Contractor requested a change in the construction slope due to offshore loss and overfilling of the toe of the template. Determination of an appropriate construction slope will be one of the main points of discussion in the presentation.

East Grand Terre is currently under construction with completion expected by June 2010. This project has separate beach and marsh fill borrow areas. The sand borrow area contains less fines (5-15%) than the Chaland Headland borrow area and the Contractor is struggling to fill the seaward toe of the template. These two projects provide an ideal opportunity for comparison of the effect of design features on construction given their proximity and the use of the same dredge to construct both projects.

Implications

Dredging costs have been steadily increasing. This has resulted in the scaling back of project size (volume) to stay within budgets, which negatively impacts project performance. There are several measures that can be incorporated into the plans and specifications that can limit the risk to the Contractor and thus help reduce project cost. One of the key items is the expected cut to fill ratio and more importantly, the cut to pay ratio. Construction slopes can affect the expected cut to pay ratio and thus the price.

Other items such as available project volume, pumping distances, borrow area characteristics, construction access, oil pipelines, over dredge allowance, etc can have an impact on the construction cost. Some of these items cannot be controlled but other items can be optimized to meet the project goals while minimizing construction cost. A discussion of these various items would be useful for project reviewers and design engineers alike.

The Geology and Geophysics of a Sediment Diversion: Results from West Bay

***Alexander S. Kolker*[1]**, *Michael Miner*[2], *Valerie Cruz*[1], *Mead A. Allison*[3], *Ashley Barker*[1,4]

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It is widely accepted that coastal management plans for Louisiana should focus on partially diverting the flow of the Mississippi River in a way that would reintroduce freshwater, nutrients, and sediment to degrading coastal wetlands and ultimately build new land in areas that are currently open water. Despite excellent studies on the ecological impact of these diversions and historical examples of land-building from quasi-natural diversions in the form of modern subdeltas, little is known about land-building potential under present Mississippi River sediment regime and flow conditions. Here we present preliminary results of an analysis quantifying and characterizing sedimentation trends associated with the West Bay Diversion, the largest operational diversion designed specifically to build new land. Chirp sonar subbottom profiles reveal a 5 to 25-cm thick horizontally-laminated seismic package covering an area of several km^2. Sediment cores indicate that the laminated seismic packages are characterized by interbedded silty clays and fine sands. Other areas of the bay are characterized by a scour surface that is actively incising into bay and relict subdelta deposits, indicating that depositional processes do not dominate all areas of West Bay. In order to determine seasonal sediment deposition rates, cores were collected in May2008, June2009, and September 2009 for ^{7}Be (a naturally occurring, particle reactive radionuclide with a half-life of 53 days) analysis. Preliminary results show that deposition rates during high-flow events can be an order of magnitude greater than times of lower discharge. Ongoing investigation into longer-term patterns of sediment accumulation using ^{137}Cs and ^{210}Pb (half-lives of 30 and 22.3 yr respectively), in combination with results from geophysical surveys, will help to constrain the contribution of high-flow events in the long-term sedimentation record and assess their preservation potential in West Bay.

Implications

Improved understanding of the early depositional-erosional response of receiving basins to introduction of fluvial sediment load and discharge is important for developing adaptive management plans for existing diversions, strategically selecting sites for new diversions, and quantifying the temporal and spatial land-building expectations of sediment diversions. Moreover, identifying and quantifying the controls on sediment deposition and retention rates over various timescales provides much needed information to help design and manage future diversions to efficiently achieve their maximum land-building potential and ensure that limited restoration funds are invested wisely.

Neck Deep in Mud at the Rockefeller Refuge

***Brett L. Geesey**[1], Daniel J. Heilman[1], and T. Neil McLellan[1]*
[1] HDR Engineering, Inc.

Currently, 25 to 35 square miles of wetlands are lost each year along coastal Louisiana. The reasons for the loss are many and complex and vary among different locations within the state. One of the most rapidly eroding portions of the Louisiana Gulf shoreline is at the Rockefeller Wildlife Refuge in Cameron Parish. Estimates of long-term shoreline retreat range from 30 to 40 ft/year (Byrnes et al. 1995). Severe storms such as Hurricane Ike in 2008 can cause more than 50 ft of erosion over a few days. To combat the direct loss of wetlands at the Rockefeller Refuge, the Louisiana Office of Coastal Protection and Restoration (OCPR) teamed with the National Marine Fisheries Service (NMFS) to implement the Rockefeller Refuge Gulf Shoreline Stabilization Project (ME-18, CWPPRA Priority Project List 10). The project intent is to halt erosion along the 9.2 mile portion of the Refuge west of Joseph Harbor Bayou. Due to the challenges presented by extremely soft soils, requirement to protect the shoreline for up to hurricane conditions, and limited construction budget, a smaller demonstration project utilizing three alternative shoreline protection designs was proposed and constructed. This presentation will describe the overall project from the initial conceptual development through the construction of the demonstration portion of the project. The focus will be on the challenges of designing and constructing structures for hurricane conditions in soft soils along a Gulf-exposed portion of Louisiana's coast.

Implications

Due to the extremely challenging site conditions found within Louisiana's coastal areas, the use of conventional design and construction techniques can be impracticable for coastal protection and restoration projects. Throughout the design of the demonstration project, many alternative solutions were evaluated. Each alternative was evaluated not only for stability in the poor soil conditions and hydraulic stability, but to also be a cost efficient solution. This presentation will review the evaluation process and discuss how the alternatives eventually built were chosen. Some of the lessons learned throughout the construction process will also be discussed, as these lessons will need to be incorporated into the design of the full 9.2 mile project, as well as other protection projects located along the Louisiana Gulf coast.

Historical/Current Status (Room C)

Moderator: Andy Nyman
Louisiana State University

The Mississippi River's Last, Vast Natural Delta: Use the Record, or Lose the Coast

Richard Condrey[1], *Paul Hoffman*[2], *D. Elaine Evers*[1], *John Anderson*[3], *and Dave Morgan*[4]

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[4] *Carte Museum, Baton Rouge, Louisiana USA*

The record: In the 1500s, Spain's conquest of the "New World' was accomplished with its Padrón Real – its secret, evolving, base-map of the world described in Alonso de Chaves' ca. 1537 rutter. Our analysis of Chaves suggests that the Spanish found two major distributaries of the Mississippi River, in which the Atchafalaya River-Bayou Plaquemine (*Atchafalaya*) was greater than the Mississippi River below Donaldsonville (*Mississippi*)

By 1680 – seeking global domination – France, England, and Spain raced to find the mouths of the Mississippi River. France was now the international leader in cartographic science and the scientific excellence of two Frenchmen (Iberville and de l'Isle) secured her claim. In 1698 Iberville correctly located the Mississippi (using Barotto's 1687 GoM survey) and in 1699 described its network of distributaries. In 1700-1730, de l'Isle (researching the authoritative French, Spanish, and English surveys) rewrote Europe's maps of this critical portion of the New World. Our analysis of this record suggests major shifts in the dominance of the Mississippi's distributaries.

In 1763/64, England surpassed France in naval power and ability to measure longitude at sea, and joined Spain in controlling and mapping Louisiana – as recorded in the authoritative coastal surveys of Gauld and Evia. Our analysis of this record reveals a vibrant coast advancing into the sea through three major outflows. Here huge drift trees, vast offshore oyster reefs, and an active sub-aerial delta at the mouth of Bayou Lafourche where important features of coastal advance/protection.

The pattern: These state-of-the-art surveys and their associated maps describe the last natural delta of the Mississippi River -- a vast, seaward-advancing arc beginning below Baton Rouge and extending in an east-west direction across the current parishes of St. Bernard to Iberia. This extensive system was characterized by four, shifting distributaries (Atchafalaya, Mississippi, Bayou Lafourche-Barataria Pass, and Bayou Manchac).

Implications

Failure to use this historic record has resulted in a continuing loss of Louisiana's cultural resources – ranging from its coast to the legacy of its Native Peoples. At a minimum, the largely unused historic record (1500-1800) contains desperately needed, scientifically valid, quantitative information on the dynamic nature and delta-building properties of the Mississippi River. If we do not begin to understand what the Mississippi was on the eve of European conquest/alteration, we cannot rationally address our current land loss crisis. Or more simply, we cannot restore what we do not understand.

Historical Changes in Wetland Area and Suspended Sediments in the Mississippi River Birdfoot Delta

Andrew Tweel [1] *and R. Eugene Turner* [1]

[1] *Louisiana State University, Baton Rouge, LA*

A large proportion of the total wetland loss in Louisiana has occurred in the mineral-rich wetlands of the Mississippi River Birdfoot Delta. This deterioration started around 1950 and was preceded by a period of rapid deltaic expansion beginning in 1850. Around the same time, the area of cultivated land in the Mississippi River Basin increased rapidly, thereby increasing erosion and adding large volumes of sediment to the river. Sediment loads subsequently decreased considerably as soil conservation practices were established and as river bank revetments and dams were constructed. Historical surveys from 1778 to present were analyzed in a geographic information system to determine the spatial and temporal changes that occurred to the area of these deltaic wetlands. Historical suspended sediment records dating back to the 1840s were also analyzed to determine periods of increasing and decreasing sediment supply to the Birdfoot Delta. The rapid expansion, and subsequent areal decline, of the mineral-rich wetlands of the Mississippi River Birdfoot Delta will be discussed in relation to anthropogenically-influenced sediment regimes in the Mississippi River.

Implications

The results suggest that the amount of land in the 1930s era Birdfoot Delta, commonly used as the baseline condition against which many restoration targets are set, represents a peak following decades of increased sediment loading from land clearing in the Mississippi River watershed before the 1900s. Because land gains and losses in the Birdfoot Delta closely follow changes in suspended sediment loading in the river, whereas changes in wetland area in the deltaic plain do not, wetland gains and losses in these two systems are, therefore, governed by similar processes operating at different rates.

Marsh Vertical Accretion in Coastal Louisiana: the State of Our Understanding After 30 Years of Research

J. Andrew Nyman [1] *and Ron. D. DeLaune* [2]

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[2] *Department of Oceanography and Coastal Sciences, Louisiana State University, Baton Rouge, LA*

Global sea-level rise and local subsidence will drown emergent vegetation and create new shallow open water areas if coastal wetlands vertically accrete too slowly. Marsh vertical accretion needs to be measured over long periods that include years of low and high sea level. We reviewed accretion studies based on either ^{137}Cs or ^{210}Pb dating, which estimate accretion since 1964 or during the last 80 years, respectively. The first measurements were published in 1978 based on 6 cores from southeastern Louisiana. Since then, over 150 cores have been collected and dated throughout coastal Louisiana by various researchers. Spatial patterns demonstrate that accretion accelerates in response to subsidence up to a limit. Beyond the limit, accretion is inadequate and marshes convert to shallow open water over several decades. The most rapid accretion every recorded, 9.8 mm/yr, was associated with rapid wetland loss southeast of Houma where subsidence combined with global sea level rise was measured at 13.8 mm/yr. Until the 1990s, it was widely assumed that coastal marshes worldwide depended upon mineral sediments to vertically accrete and that sediment starvation caused all inadequate vertical accretion. However, it is not clear that that many marshes, from tidal fresh to saline, from Louisiana to Canada, depend upon organic matter produced by emergent vegetation to vertically accrete. Roots, rather than stems and leaves, appear to control accretion via vegetative growth. No data are yet available to determine if slow production or rapid decomposition prevents accretion via vegetative growth from exceeding 9.8mm/yr, but the most likely cause is slow root production. Decades of marsh vertical accretion can be lost via soil oxidation if low water levels, such as dur-

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ing natural drought and managed drawdowns, are too persistent or frequent.

Implications

One implication of marsh vertical accretion via vegetative growth is that the effect freshwater diversions is not confined to the relatively small area where mineral sedimentation is enhanced, but extends to the larger area where diversions alter factors, such as nutrient availably, sulfate availability, and salinity, that may govern root growth or soil organic matter decomposition. Data are needed to determine the direction and magnitude of these effects, which also are relevant to salt water intrusion, hydrologic restoration, etc. Research also is needed to determine if fire affects accretion via vegetative growth because natural and managed fires are common in coastal Louisiana.

CONCURRENT SESSION III

Tuesday, June 8 3:30 - 5:00 p.m.

Barrier Islands (Room A)

Moderator: Cheryl Brodnax
National Oceanic and Atmospheric Administration

Beach Topography/Bathymetry Changes to Segmented Breakers at Raccoon Island, Louisiana Over an Eight-Year Monitoring Period

Baozhu Liu[1,2], Gregory W. Stone[1,2] and Felix Jose[1]

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[2] *Department of Oceanography & Coastal Sciences, School of the Coast & Environment, Louisiana State University, Baton Rouge, LA 70803*

In 1997 eight segmented breakwater structures were constructed along Raccoon Island, Louisiana as a Demonstration Project (TE-29). Post-construction beach topographic/bathymetric surveys were conducted from 1997 to 2005 by scientists in the Coastal Studies Institute at Louisiana State University in order to monitor the progressive response of the beach to these breakwaters. Dominant sediment accumulation occurred immediately after the completion of the project, during which the so-called "reverse salients" unexpected beach response was observed. During 2000–2002, general sediment loss occurred from the breaker-barrier system. During 2003–2004, beach morphology was characterized by a net sediment influx, which lasted until Hurricane Ivan impacted the study site in Fall 2004. Moreover, a downward trend of total sediment volume was observed until the end of the monitoring period. Over the eight years of the monitoring period, deposition occurred on the beach behind the breakwaters #3 to #6, while erosion took place in front of the breakwaters and along the western part of the island where there was no protection from breakwaters. Severe erosion occurred in the offshore area in front of the breakwaters, and especially along the unprotected segment of the island, farther west of the protected eastern zone. This situation was clearly apparent along the western section of the island when the coast was impacted by major hurricanes (Isidore, Lili, Bill, and Ivan), while negligible sediment loss occurred along the eastern portion of the island protected by the breakwater structures. There was no obvious seasonal beach changes although there were seasonal differences in coastal hydrodynamics associated with summer and winter seasons. Winter storms associated with the passage of cold fronts were frequent and were strong enough to resuspend and transport sediments. Encouraged by the success of this project, another eight segmented breakwaters have been constructed along the middle part of the island.

Implications

The data presented here will provide valuable information in terms of design criteria for future coastal restoration efforts, especially for constructing breakwaters, at other sites with similar physical and hydrodynamic conditions. Moreover, the extended period of data collected also have provided new insights into the complex interaction among sediment flux in the littoral zone, innershelf sediment sources, and anticipated responses along the adjacent beaches where breakwaters may be built to protect the delicate beach-barrier system.

Geologic Controls On Island Evolution, Chandeleur Islands Louisiana

James Flocks[1], *David Twichell*[2], *Elizabeth Pendleton*[2], *and Wayne Baldwin*[2]

[1] *U.S. Geological Survey, Center for Coastal and Watershed Studies, St. Petersburg, USA* [2] *U.S. Geological Survey, Science Center for Coastal and Marine Geology, Woods Hole, MA, USA*

The Chandeleur Islands and surrounding waters provide habitat for a variety of threatened wildlife species, a platform for human infrastructure and recreation, and storm protection for interior environments and human population. The islands formed about 2,000 years ago as sea level rose over the subsiding St. Bernard delta complex of the Mississippi River, reworking existing sandy material into a barrier lithosome that presently ranges in thickness from 1 to 9 m and covers an extent of 760 km^2. The islands are in a state of decline. The sandy sediments are continually scavenged by storms, reworked by prevailing wave climate, and inundated by a relative sea-level rise, resulting in a net loss of island area.

This presentation highlights results from geologic investigations conducted between 2007 and 2008 by a collaborative team of academic, state, and federal agencies. High-resolution seismic-reflection and bathymetric data, and sediment cores were collected to characterize depositional components of the stratigraphy underlying and surrounding the islands. The barrier-island lithosome, the primary deposit of interest, is a sandy marine-transgressive deposit that rests unconformably on mixed sand-mud facies of the older deltaic deposits. The dominant source of sand for the barrier platform is derived from wave-induced erosion of the distributary deposits (sand content 50-60%) within the relict delta sequence. Sediment is not distributed uniformly throughout the lithosome, and sand is mostly limited to the central section of the barrier system where littoral divergence occurs. Lithosome geometry is controlled by two dominant factors: accommodation space provided by the underlying geologic framework, and wave-driven littoral-transport conditions. The stratigraphic assessment indicates that the underlying deltaic deposits presently affected by wave action lack sufficient amounts of sandy material to maintain the islands as subaerial features.

Implication

In the event that shoreline renourishment becomes a viable option for island management, the results of this study will provide the physical information necessary to identify the location and quality of suitable sand resources around the islands. The study further demonstrates the collaborative capability of federal and state agencies to conduct complex environmental assessments in remote areas that are critical environmental habitats, but have low perceived commercial value

A Cross-Shore Model of Barrier Island Migration over a Compressible Substrate and Importance for the Louisiana Coast

Julie D. Rosati[1] *and Gregory W. Stone*[2]

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Barrier islands that overlie a compressible substrate such as deltaic sediment in Louisiana load and consolidate the underlying subsurface. Through time, the elevation and aerial extent of these islands are reduced, making them more susceptible to inundation and overwash. The result is an increase in island migration, breaching, and segmentation. Deltaic systems, because of their fragile, low-lying environments, comprise regions of the world that need the protection provided by barrier islands yet often these islands are rapidly reduced in subaerial extent and relief. Restoration of barrier islands fronting deltaic systems is complex due to regional sediment sources and sinks, environmental sensitivity in the ecological region, and the weight-bearing loading of restoration that further compresses the substrate.

This research determined the degree to which consolidation affects the evolution of barrier island systems overlying a poorly-consolidated substrate. A two-dimensional (cross-shore) mathematical model was developed, tested with field data, and applied to evaluate how a compressible substrate modifies long-term barrier island evolution. The implications of two strategies for restoring these islands (a one-time "Initial" large-scale infusion of sand from an external source versus traditional "Incremental" beach nourishment and subsequent smaller maintenance volumes) were tested.

Barrier islands overlying a compressible substrate are more likely to have reduced dune elevations due to consolidation, incur overall volumetric adjustment of the profile to fill in compressed regions outside the immediate footprint of the island, and experience increased overwash and migration when the dune reaches a critical elevation with respect to the prevalent storm conditions. Initial large-scale infusion of sand from an external source was found to be more effective at stabilizing the island as compared to the traditional Incremental approach.

Implications

Design of large-scale restoration projects for barrier islands in Louisiana must incorporate compression of the deltaic substrate because of the additional weight of the sediment. A one-time, large restoration is more effective in stabilizing the islands as compared to the traditional approach of initial nourishment with maintenance fills. This study points to the need for low-cost monitoring of barrier island restoration projects to improve design criteria and predictive methods.

Dutch Perspective (Room B)

Moderator: Natalie Snider
Coalition to Restore Coastal Louisiana

Building with Nature: A Dutch Proposal to Use Natural Processes to Provide Flood Defense in Louisiana

Linda G. Mathies
DHV, New Orleans

Flood defense systems incorporating natural dunes and man-made dikes are essential for safety in the Netherlands, a country largely situated below sea level. Not only are there areas on the Dutch coastline where existing defenses must be improved to meet safety requirements, but the Netherlands also faces rising sea levels and greater use of the coastline by wildlife and for recreation. The Dutch are proposing a broader, stronger coast to answer these challenges by enhancement of natural processes both along the coast and adjacent to Ijsselmeer Dam.

Following Hurricane Katrina, this approach, referred to as "building with nature:, was incorporated into "A Dutch Perspective on Flood Risk Reduction and Landscape Stabilization", a report developed by a consortium of Dutch governmental agencies, consultancy firms, research institutes and NGOs under the Netherlands Water Partnership at the requests of the US Army Corps of Engineers and the Rijkswaterstaat. The report outlines several strategies to illustrate available options for better protection of the City of New Orleans and comprehensive landscape stabilization in the region. It describes a preferred strategy involving a semi-open system with both structural and non-structural measures, i.e., restoration of wetlands, aimed at improving flood risk management in the region, and it makes recommendation for pilot/demonstration projects to implement this strategy.

"Subsidence Reversal through Marshland Restoration" is a proposed pilot/demonstration project that builds on methods of land reclamation in the Netherlands to create agricultural land; however, the goal in coastal Louisiana is to use these methods to restore freshwater organic marshes. The Dutch government provided funding and partnered with the state of Louisiana to complete Phase 1 of the project, the Definition and Conception Phase, during 2009. Stakeholders from State and Federal natural resource agencies, NGOs, and parish governments continue to work with Dutch counterparts to make the proposed project a reality.

Implications

Consensus from three workshops with stakeholders was that the proposal has promise and should be further developed and funded. Louisiana needs another tool in the toolbox for marshland restoration in addition to using dredged material and river diversions. Marsh restoration using Dutch poldering techniques could be an additional tool. The proposed pilot project could contribute data that would help keep the 150,000 hectares (370,657 acres) of organic freshwater marshland in coastal Louisiana viable and sustainable in the long term. Most of these marshes are far removed from conventional (dredging projects) and potential (river diversions) sources of sediment needed for restoration.

Dutch Lessons Learned and Eco-Engineering Protection Systems

Yvo Provoost
Rijkswaterstaat

In 1953 a disaster struck the South West of the Netherlands. Large areas were flooded and many people drowned. As soon as possible the Dutch started the Delta Works. The main item: shortening the coastline. The engineers closed several sea arms of the Southern Sea and the Eastern Scheldt. Now we know what impacts occur to a closed system like the Dutch delta: a Markermeer where nothing lives, an Eastern Scheldt with ´sand hunger´ and algae's in fresh water lakes.

In 1996 a large project was started in the South West of the Netherlands: engineers started to replace the old revetments along the dikes. According to the law, nature was important. But during the project, pilots like 'Riche Dike' and 'Building with Nature' were started. Today engineers and biologists are talking about eco-engineering while reinforcing dikes.

This project, Sea Defense, is under high pressure of time and money in a surrounding of ecosystems, environmental aspects and political issues. In spite of this difficult environment the project, over halfway done, is right on schedule. The clue: listening, looking and acting according to the environment. Safety first, but flora and fauna are right behind and where possible needs of parties interested are fulfilled.

Safety first, but many effort is put into research and innovation. Research and innovation are embedded in the project because it always offers improvements to the project whether it is on safety, nature, environment, time or even on finance. Research and innovation occurs not only on technical issues but also on ecological issues. Therefore there is a good cooperation with, for example, nature reservists. Together with engineering offices and industry the project is making the dikes as safe and eco-friendly as possible.

The Risk of Flooding in the Netherlands: In Control

Hans van der Sande
Rijkswaterstaat

In the Netherlands with a very high standard of safety against flooding caused by stormsurges (in Zeeland: resist a storm that occur 1 time each 4000 years), the focus is laying on preventing:

make sure the flood defense is strong enough to resist that storm. In order to fullfill this obligation, since 1996 there is a flood protecting law in which is arranged to report every 5 years about the strength of your flood defenses. The first time was in 2000, the second in 2005 en this year we are preparing the report for the third time.

This process of verifying has become more and more professional. In the first round there was a lack of (digital) data of strength and most of the waterboards only systematically reported on the mechanism 'wave overtopping and flooding ' and 'dune erosion'. A couple of defense were obvious to weak and measurements were prepared. During the second round the focus was laying on gathering of data (archive and field). Almost all mechanism has been analyzed and reported and again some measurements were acknowledged. But more investigations are needed in order to give a definitive answer : insufficient or good . The third time the results of the investigations will be incorporated. A Digital standard has been developed and all waterboards has to use this standard to report. It's expected that the fourth round will lead to a complete image of safety with a proposal of some measurements .

After a period of 20 years the risk of flooding is finally in control. Long but comparable with a big project such as the replacement of all the revetment in Zeeland (1997-2015).

Maintenance is the other important issue to remain the safety on the agreed level. The history tells us that not the most severe stormsurges has caused the greatest disasters but a lack of maintenance (during and after a war or recession) has been responsible for the magnitude of the disaster.

Fauna (Room C)

Moderator: Mike Carloss
Louisiana Department of Wildlife and Fisheries

Climate Change, Energy Scarcity, Fisheries Resources and Mississippi Delta restoration

James H. Cowan, Jr., *John Day and Kim De Mutsert*
Louisiana State University

The deterioration of the Mississippi delta in the 20th century is evidenced by high rates of coastal wetland loss and widespread water quality deterioration. The wetland loss was primarily the result of levees that resulted in elimination of riverine input to the delta and pervasive hydrologic alteration of the deltaic plain. These changes resulted in saltwater intrusion, reduction of sheet flow hydrology, increased flooding of wetlands, and reduction of sediment input to marshes. Fisheries have changed due to high fuel prices and cheap imports, but there is little evidence of effects of hypoxia. Climate change in coming decades will include accelerated sea level rise, more frequent drought, increased river flow, and more hurricanes. Energy will become more expensive and scarce as the world passes through peak oil production.

Implications

Recognition of the severity of the wetland loss and other problems led to a growing effort to restore the delta. Initially, restoration efforts were small and often unrelated. We now recognize that restoration must be a comprehensive and integrated, and focused on ecosystem function via massive reintroductions of river water. Reversing or slowing land loss will become more challenging due to climate change but options will be limited due to energy shortages. Hypoxia may become less severe because of increasing fertilizer costs and use of wetland buffers in the basin. Fisheries have not been strongly impacted but may cross a threshold due to habitat loss and other cumulative insults. We infer that large-scale river diversions back into degraded areas could begin the delta cycle anew and facilitate the "resetting" of prior conditions. This premise also infers that to delay restoration efforts could significantly diminish the likelihood of ecosystem recovery.

Understanding Colony Site Selection of Seabirds on Isles Dernieres Barrier Island Refuge

Cecilia Leumas[1], *Frank Rohwer[1], Aaron Pierce[2], and Edward Raynor[2]*
[1] Louisiana State University and Agricultural Center School of Renewable Natural Resources, Baton Rouge, LA
[2] Nicholls State University Department of Biological Sciences, Thibodaux, LA

Colonial nesting seabirds face a variety of threats, including habitat loss and degradation, human disturbance, and predation. Louisiana contains large breeding colonies of many of these birds, and several species of conservation concern concentrate high percentages of their total U.S. populations here. However, some restored areas with apparently suitable nesting habitat do not host colonies. We studied the assemblage of seabirds, including Royal Terns, Sandwich Terns, and Black Skimmers, nesting on Isles Dernieres barrier islands in Terrebonne Parish, Louisiana. These islands have been the focus of many expensive restoration

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Caldwell ❑ BTNEP ❑ National Wildlife Federation ❑ HNTB projects, and ideally they should be valuable for wildlife as well as for coastal protection. Two of the four islands in this chain host extensive seabird colonies and two do not. Our objective is to better understand what factors limit the use of available habitat on barrier islands.

We used an experimental approach to test two hypotheses that may explain seabird preference for one island over another. We used decoys and call broadcast to test the hypothesis that social facilitation is required for these species to form new colonies. To test the hypothesis that disturbance by potential predators prevents new colony formation, we erected fences around half of our experimental plots, and conducted predator surveys on all four islands. Only one pair of seabirds was induced to nest by our social facilitation, although behavioral observations indicate that seabirds showed more interest in decoy than in control plots, and that sound enhanced the attractiveness of the decoys. We were unable to test disturbance without nests; however, predator surveys revealed the presence of raccoons, rats, and coyotes on non-colony islands, and no mammalian predators on colony islands.

Implications

Many bird species of conservation concern in Louisiana are dependent on coastal habitats. Coastal restoration and protection efforts that are aimed at helping the human populations of south Louisiana should therefore aim to benefit wildlife as well. Seabirds, which tend to nest in very large, dense colonies, are especially vulnerable to loss of important breeding areas, and might increase reproductive output by nesting in more places. In the case of barrier islands, we had hoped that seabirds could be drawn to nest on restored areas via social facilitation, a technique that has been successful elsewhere in closely related species. We found that although seabirds were attracted to the decoys and sounds, they were not induced to nest in large numbers, suggesting that other factors prevented colony formation. Predator presence or absence seems to be important, and predator control on restored islands might benefit multiple seabird species of concern.

Can Louisiana's Oyster Industry Survive an Aggressive Coastal Rebuilding Program?

John Supan, Ph.D.[1] *and John A. Tesvich*[2]

[1]*Louisiana Sea Grant College Program, Louisiana State University, Baton Rouge, LA USA* [2]*AmeriPure Oyster Company, Franklin, LA USA*

The Louisiana oyster industry faces great challenges by coastal restoration. The heart of Louisiana's oyster industry surrounds the Mississippi River, where estuaries suffer some of the highest rates of land loss in America. Such proximity makes these estuaries prime targets for river diversions to control salinities and/or for introducing sediments, with potential over-freshening and sedimentation of highly productive oyster beds.

Analysis of Louisiana oyster production data over the past 60 years reflects changing conditions. Shifts in oyster production are resulting from the current fresh water diversions along the Mississippi River at Caernarvon and Davis Pond. The potential impacts of large-scale sediment diversions are comparable to changes experienced in the Atchafalaya Bay area after the addition of increased river flows of the Atchafalaya River and the opening of the Wax Lake Outlet.

Implications

The impacts of diversions on private oyster lease production require the ability to adapt to an uncertain environment. Off-bottom culture methods utilizing the water column, practiced for generations in other countries, can help the Louisiana oyster industry successfully produce oysters where traditional on-bottom oyster culture is not suitable. Marine enterprise zones or aquaculture parks, areas of water delineated and administered by a public authority for specific use, can provide economic development to coastal communities similar to land-based industrial parks for urban and rural areas. Statutory and regulatory changes that allow the use of such culture methods should be an integral part of the state's coastal restoration plans, so the oyster community can continue to provide cultural and employment benefits that have been a tradition in Louisiana for generations.

CONCURRENT SESSION IV

Wednesday, June 9 8:30 a.m. - 10:00 a.m.

Mississippi/Atchafalaya Rivers (Room A)

Moderator: Angelina Freeman
Environmental Defense Fund

One-Dimensional Sedimentation Modeling of the Lower Mississippi River Response to the West Bay Diversion

Ronald E. Heath[1]*, Jeremy A. Sharp*[1]*, Charles D. Little*[1] *and C. Fred Pinkard, Jr.*[2]

[1] *US Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory, Vicksburg, MS*

[2] *US Army Corps of Engineers, Vicksburg District, Vicksburg, MS*

The Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA), West Bay Sediment Diversion Project is located on the west bank of the Mississippi River, in Plaquemines Parish, Louisiana at River Mile 4.7 above Head of Passes. The project was designed to restore and maintain approximately 9,831 acres of fresh to intermediate marsh in the West Bay area by diverting fresh water and sediment from the Mississippi River over the 20-year project life. The project included the excavation of an uncontrolled diversion channel through the bank of the Mississippi River. Construction was completed in November 2003.

In theory, the diversion of water and sediment increases the potential for induced sediment deposition in the main channel downstream of the diversion unless the diverted bed material sediment load to water ratio is greater than that of the primary river. This is a critical issue on the Mississippi River where increased sediment deposition can have an adverse impact on other project purposes such as commercial navigation and flood control. Concerns about increased sediment deposition and resulting increased dredging prompted the CWPPRA Task Force to authorize a multi-faceted study to evaluate the impacts of the

West Bay Diversion on sediment deposition and dredging within the navigation channel and adjacent anchorage area. This paper addresses the 1-D modeling effort.

One-dimensional (1D) sediment routing modeling provides the opportunity of evaluating long-term channel changes and delivery of sediments at a regional spatial scale and provides boundary condition input for related multi-dimensional modeling. The HEC-6T, Sedimentation In Stream Networks, software package was used to conduct 50-year simulations with and without the West Bay Diversion to compare long term sediment deposition trends within the navigation channel and anchorage area.

Implications

Model simulations of the behavior of the West Bay Diversion and the associated response of the Lower Mississippi River will increase our understanding of critical sedimentation processes that must be considered in the design and operation of proposed future diversions. Ultimately, the results of this 1-D model investigation integrated with results from the associated field investigation, geomorphic assessment, and the multi-dimensional model investigations will provide the CWPPRA Task Force with the technical information needed to make decisions on the future operation and management of the West Bay Diversion.

Recent Progress to Quantify Nitrate and Carbon Export From the Atchafalaya River

***April BryantMason*[1]**, *Y. Jun Xu[1], and Mark Altabet[2]*

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Riverine wetlands have the capacity to reduce nutrients and organic matter through assimilation and for nitrogen, denitrification. Paired isotope technique can be more informative than examining nutrient concentration alone since isotopes lend insight into nutrient processing, source, and age. In this study, we used paired isotope technique to investigate nitrate and organic carbon transport in the Atchafalaya River. Water samples were collected biweekly-monthly at five sites along the Atchafalaya (Simmesport, Melville, Butte La Rose, and outlets, Morgan City and Wax Lake), and at two sites along the Mississippi (Angola and Baton Rouge). The samples were analyzed for nitrate, nitrite, dissolved organic and inorganic carbon concentrations, as well as isotopic changes in $\delta 15N$-NO3 and $\delta 18O$-NO3. In situ a series of water quality parameters were recorded, including temperature, dissolved oxygen, pH and specific conductivity. We found distinct seasonal trends of water temperature and dissolved oxygen and a closely reversed relationship of the parameters. Additionally, all sites had similar water temperature (about 18oC) except Morgan City that showed a significantly higher water temperature (19.3oC). Morgan City likely received backwater from riverine swamps, which may have contributed to the elevated temperatures. River waters collected from all sites showed similar δ18O (4.58o/oo-4.81o/oo) and were significantly different from rain samples (66.1o/oo), indicating that atmospheric nitrate was not a major nitrate source. Although there was little variation in δ15N-NO3 between the sites, average δ15N in the Mississippi's water at Baton Rouge (7.71o/oo) was significantly higher than the outlet of Atchafalaya River (6.99o/oo). The relatively small difference (0.72o/oo) in δ15N reflects a similar source, but may reflect a higher influence of the Red River, an agricultural tributary to the Atchafalaya River or a constant delivery of organic nitrogen and ammonium within the basin which is quickly converted to nitrate with limited fractionation, resulting in a lower δ15N signal.

Implications

This study reflects the basin may be a key role in reducing organic nitrogen. The dynamics in the basin is much more complex than originally believed. The potential importance of the backwater areas within the basin where water velocity is reduced and there is more interaction with soils may be key to denitrification. It is important that coastal planners consider the relationship with backwater areas and levee interaction flow paths. Simply increasing the amount of water diverted at the Old River Control Structure is not the solution. Further research is needed in the backwater areas as well as possible groundwater interaction. This study also demonstrates that utilizing isotopes in water quality research can supply a range of additional information otherwise unavailable in mass balance approaches.

Wetlands in the Labranche Basin and the Bonnet Carre Spillway: The Importance of Large Crevasses

*John Day[1,2], **Rachel Hunter[1,2]**, Ron Delaune[1], Richard Keim[1], Jason Day[2] and Montgomery Hunter[2]*

[1] School of the Coast and Environment, Louisiana State University, Baton Rouge, LA, 2 Comite Resources, Zachary, LA

Sediment accretion and long-term growth rates of baldcypress were compared in three wetland sites in the Labranche basin (LB) and the BC Spillway (BCS). The floodgates of the BCS have been opened nine times since 1930, approximately once every decade, with flows ranging from 3100 to 9000 m^3/s. Wetlands north of the railroad in the LB receive regular re-suspended sediments while those to the south do not. South of Airline highway, elevations in BSC reach almost 2m. In the LB elevation north of the railroad is about 30 cm and to the south elevation is near sea level. ^{137}Cs accretion in BCS, LB north of the railroad, and LB south of the railroad were 2.0, 1.0, and 0.3 cm/yr, respectively. Cypress growth rates in BCS were twice as high as those in LB. Wetland loss in LB has been caused by inadequate accretion, saltwater intrusion and hydrologic alterations that reduce sediment and freshwater input. Prolonged inundation limits cypress regeneration in the LB and leads to wetland loss.

Implications

Previous research has shown that small river diversions in coastal Louisiana can increase marsh primary production, wetland surface elevation, and vertical accretion. However, there is contention that these diversions are so small compared to the pre-levee flooding of the Mississippi River that they are not making a significant contribution to coastal restoration. Even at its lowest discharge, water flow through the Bonnet Carre Spillway is about 150 times the size of water flow from the Caernarvon or West Pointe a la Hache structures, and more than 700 times the size of water flow from the Violet siphon. These results indicate that infrequent (once a decade) large diversions can sustain wetlands, even with accelerated sea level rise.

Social and Economic Risk (Room B)

Moderator: Rex Caffey
Louisiana State University

Mapping Social Vulnerability to Climate Change in Louisiana

***Jasmine Waddell, PhD*[1]** *and Mark Hambrick*[2]

[1] *Oxfam America, Boston, MA, USA* [2] *Oxfam America, New Orleans, LA, USA*

Oxfam America worked with the Hazards and Vulnerability Research Institute at the University of South Carolina to produce a series of social vulnerability maps for thirteen states in the US South. In the Oxfam-commissioned report, *Exposed: Social Vulnerability and Climate Change in the U.S. Southeast*, 75% of the variance for social vulnerability to four hazards associated with climate change--drought, flooding, hurricane force winds, and sea level rise--was explained by eight variables: wealth, age, race, ethnicity, rural, special needs populations, gender and employment. The overlay of social vulnerability, a static demographic assessment, with the dynamic potential for hazards associated with climate change is crucial information for emergency preparedness and regional planning. The presence of 'black spots' on the overlaid maps indicates that there is a high incidence of disasters historically and that there is high social vulnerability as defined by the social vulnerability index, SoVI. The 'black spots' are concentrated on the southern coast and MS delta region of Louisiana which indicates both a high incidence of social vulnerability and climate change related hazards here. In order for effectively manage the living people resources in these geographic areas, federal state and local policies must be developed which respond to vulnerability in addition to resiliency. Vulnerability and resiliency are not two sides of the same coin, and both are critical for effective coastal policy.

Implications

The implications of this knowledge about social vulnerability to hazards associated with climate change are very practical. This information is designed to create systems which can respond to the specific needs which result from a disaster. The needs of a community with low social vulnerability are different than those for a community with high social vulnerability and the systems developed and supported by public money should reflect this. The information from this report focuses on people, and not property value; therefore, the information can be used to develop systems for people-focused emergency management in the face of climate related disaster.

The Third Element - Building a Complete System of Community Resiliency and Protection

***Brian Jackson*[1]**, *Maura Wood*[2], *Ann Yoachim*[3]

[1] *Environmental Defense Fund,* [2] *National Wildlife Federation,*

[3] *Tulane Institute on Water Resources Law and Policy*

The term "Non-structural" refers to a number of measures that help reduce risk and damage from storms and flooding - better zoning laws, land use regulations, or building codes; infrastructure improvements such as floodproofing power lines and other utilities; elevation; storm-resistant architecture or design; shuttering, reinforcement, or dryproofing of individual structures; storage or interior planning for protecting valuables; insurance; landscaping; and evacuation planning. These comprise the third set of elements that are an essential part of a complete system of protection, along with levees and restoring a robust coastal wetland buffer. Yet these measures tend to be overlooked and undervalued for their important contribution to community resiliency and cultural continuity. In this session, we will examine the role that "non-structural" elements can play in increasing community protection and resiliency. We will discuss the "How Safe, How Soon" collaboration, which provided resources to three coastal Louisiana communities to assess their level of risk and determine what measures the community as a whole could take to reduce risk. Finally, we will talk about the status and utilization of non-structural funding and policies through several state and federal agencies that can contribute to a resilient coastal Louisiana.

Implications

A complete system of community protection in coastal Louisiana must rely on many "lines of defense" to reduce risks and damage from storm surge and flooding. These include restored coastal wetlands, levees to protect densely populated areas, and non-structural measures that protect life and property - and have the advantage of rapid deployment. Without all three elements, the system of protection is not complete, and communities are less resilient in the event of hurricanes and flooding. A robust non-structural program will help reduce flood risk and protect communities far in advance of levee construction. When looked at in conjunction with levees and coastal restoration, either greater levels of protection may be achieved, or plans for levees may be adjusted, creating more opportunities for coastal restoration.

CNREP 2010 Conference Overview

***Rex H. Caffey*[1]**

[1] *LSU AgCenter and Louisiana Sea Grant College Program*

The economic importance of natural capital is now widely acknowledged, and nowhere is this more clearly demonstrated than in the coastal areas of the United States. Catastrophic damage from hurricanes, threats from sea level rise and subsidence, and the inexorable degradation associated with development and industrial activity all threaten coastal environments, but they also provide opportunities and demand for socioeconomic research. To provide a national forum for this work, the LSU Center for Natural Resource Economics & Policy (CNREP) initiated a national conference in 2004 that focuses on the status and challenges of socioeconomic research in coastal systems. A second conference was held in 2007 and attracted more than 160 researchers to Louisiana in the wake of Hurricanes Katrina and Rita. On May 26-28, 2010, more than 200 social scientists will meet in New Orleans for: *Challenges of Natural Resource Economics & Policy (CNREP 2010) the 3rd National Forum on Socioeconomic Research in Coastal Systems.* This presentation will draw on the triennial CNREP forums to describe the evolving research agenda for natural resource and environmental economics in coastal Louisiana. Primary review topics include: emerging applications of ecosystem valuation and benefit-cost analyses; indexing coastal community resiliency; and reconciling fisheries management with coastal restoration. Additional information will be provided on the status of resource damage assessments related to the Deepwater Horizon oil spill incident in the Gulf of Mexic

Innovative Tools (Room C)

Moderator: Rick Raynie
Office of Coastal Protection and Restoration

Louisiana's Coastal Wetland Forest: Ecotourism/ Recreation Magnet and Tropical Storm Protector or Disappearing Ecosystem?

Jim L. Chambers[1]*, Richard F. Keim*[1] *and John A. Nyman*[1]

[1] *School of Renewable Natural Resources, LSU AgCenter Baton Rouge, LA USA*

Coastal Louisiana was once rich with highly productive cypress-tupelo wetlands. New forests of this type were built as the major rivers changed channels. Even as some cypress-tupelo wetlands were disappearing, new ones were once being naturally created to take their place. But as levees were built areas were drained and developed, and exploration for oil and gas boomed, coastal wetland forests began to disappear. Timber harvesting, transportation, and development began to eat away at the fiber of our coastal wetlands, and storms took their toll as well. Harvesting of coastal forest was not the main cause of loss because most sites regenerated, but in certain areas harvesting worked along with other events to decrease forest area and continues to do so. Although there was some recognition of coastal forest losses by the early 20th century, only in the early 1980s were declines quantified with scientific data. In 2004 the Governor's Office of Coastal Activities created a Science Working Group (SWG) to study the coastal forest and make recommendations about policies to reverse losses and degradation. The SWG concluded that these coastal forests and especially the dominant cypress-tupelo forests are a tremendous asset to the state, but that some forests areas have disappeared and the functions and ecosystem services provided by others are threatened. The SWG made a series of recommendations to alter the demise of our coastal forest. This talk summarizes what has taken place since the SWG completed its report and what is currently being accomplished to protect our wetland forest.

Implications

Our coastal wetland forest is a large part of Louisiana's coastal wetland ecosystem that provides valuable services but has received relatively little restoration attention. New data and policies are needed to account for different threats and opportunities facing landowners and governmental agencies that own or manage coastal wetland forest. These needs extend beyond the current legally defined coastal zone.

The Use of Artificially Induced Oyster Reefs in Coastal Restoration

Mark Gagliano[1]*, Spencer Varnado* [1]*, and Cheryl Brodnax* [2]

[1] *Coastal Environments, Inc.Baton Rouge, Louisiana*

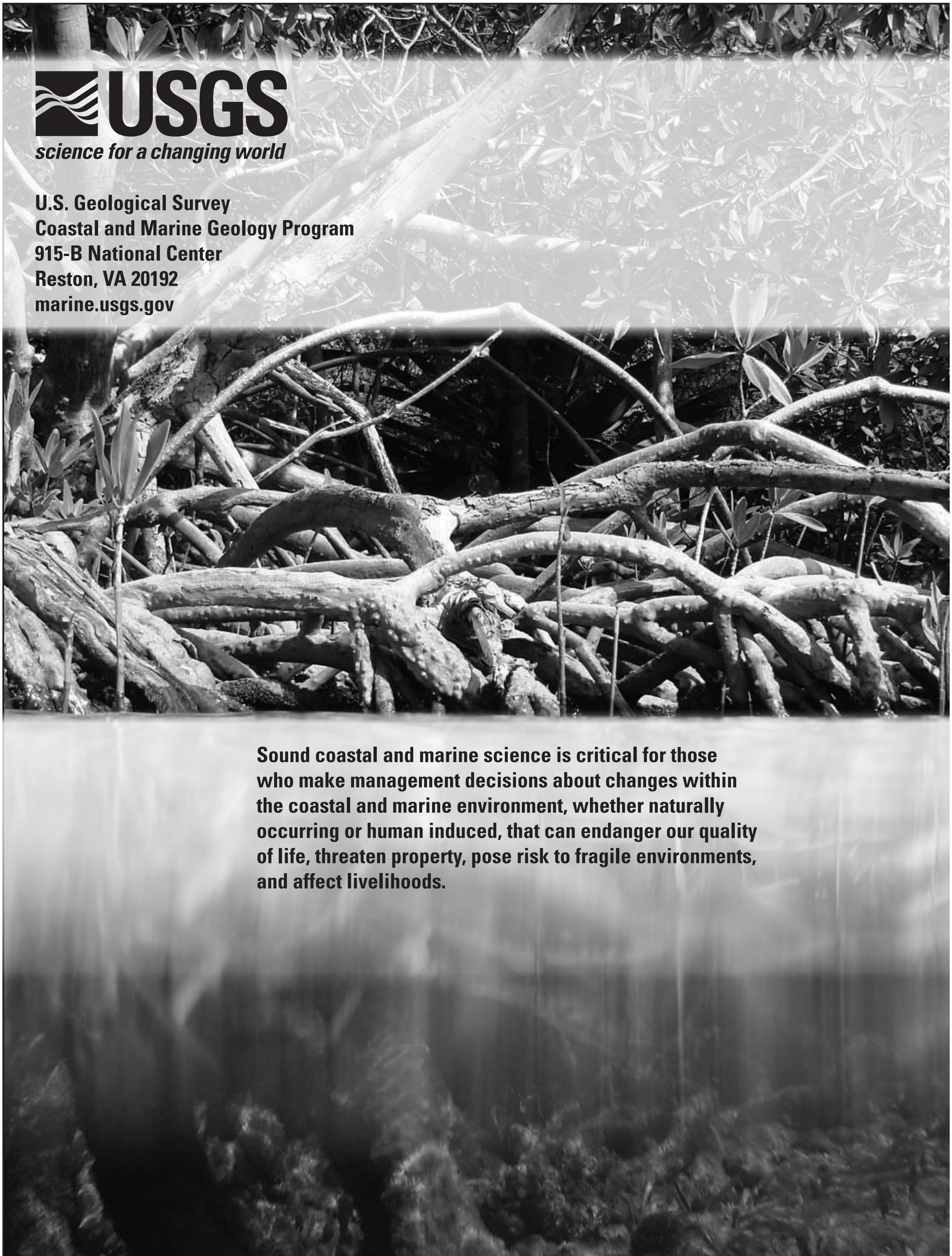
[2] *National Oceanic and Atmospheric Administration (NOAA) Baton Rouge, Louisiana*

There are approximately 30,000 miles of land-water interface within the Louisiana coastal zone that are soft, muddy, and eroding. Erosion of coastal marshes is exacerbated by lowland soils being composed largely of clays and organic peats generally devoid of beach-forming, sand-sized particles. One problem in implementing traditional coastal erosion barriers in the past has been the inability of these barriers, or breakwaters, to be installed directly adjacent to the shoreline. Traditional rip-rap rock barriers require deployment in deep water. This results in placement far from shore, or bottom dredging to allow for the navigation of barges used in installation. This increased distance from the shoreline often results in an area of water between the structure and the shoreline with turbidity and wave energy not entirely dissimilar from that outside the breakwaters.

Coastal Environments, Inc. (CEI) has developed a method of shoreline protection that can not only be implemented in water as shallow as 12 inches, but is a living, self maintaining structure. By growing oysters in an interlocked, anchored structure designed for maximum wave reduction, several projects have shown that the bio-engineered structure is an effective tool for shoreline stabilization as well as restoration. Production of calcium carbonate by shellfish is one of the few natural ways in which coarse granular material is introduced into the deltaic plain ecosystem. When CEI's reef structure is aligned with the existing shoreline the patented design reduces wave energy and allows sediment from the water column to fallout foreshore of the structure along with coarse particulate matter that naturally sloughs off the structure. The result is an area favorable for accretion of sediment. Project sponsors to date include the National Oceanic and Atmospheric Administration (NOAA), The Nature Conservancy, The Galveston Bay Foundation, and The United States Fish and Wildlife Service (USFWS).

Implications

CEI's system is deployed parallel to the existing shoreline in a configuration that maximizes wave reduction and allows for sediment fallout foreshore. The design allows for placement in shallow, remote waters where traditional shoreline stabilization methods are not practicable. Construction of all components of the system takes place on land and then transported via shallow-draft vessel to the project site. Aside from shoreline protection,



U.S. Geological Survey
Coastal and Marine Geology Program
915-B National Center
Reston, VA 20192
marine.usgs.gov

Sound coastal and marine science is critical for those who make management decisions about changes within the coastal and marine environment, whether naturally occurring or human induced, that can endanger our quality of life, threaten property, pose risk to fragile environments, and affect livelihoods.

the system provides a solid substrate suspended in the water column favorable for new oyster recruitment that is less susceptible to predation while growing oysters at a faster rate than natural reefs. Completed projects can be seen on Mad Island Nature Preserve, TX, Galveston Bay, TX, Bay Rambo in Lafourche Parish, LA and Lake Barre in Terrebonne Parish, LA. Currently projects are being constructed in Caminada Bay in Jefferson Parish, LA, Lake Fortuna in St. Benard Parish, LA, and Mobile Bay, AL.

More Submersed Aquatic Vegetation (SAV) Species Biology Needs To Be Incorporated into SAV Restoration Strategies for Different Louisiana Salinity Zones and Wetland Landscapes

Michael A. Poirrier[1], *Elizabeth A. Spalding*[2] *and Carol D. Franze*[3]

[1] *Dept of Biological Sciences and Pontchartrain Institute for Environmental Science, University of New Orleans, New Orleans, LA*

[2] *PBS&J, Metairie, LA.* [3] *LA Sea Grant and LSU Ag Center, Hammond, LA.*

Submersed aquatic vegetation (SAV) refers to rooted, flowering plants that grow underwater. Despite their food and habitat value for fish and wildlife, what little is know about Louisiana SAV biology has not been incorporated into restoration efforts. Discrete SAV associations occur in coastal salinity zones ranging from diverse freshwater species that tolerate some brackish water, to a few intermediate salinity species, to high salinity seagrasses. In addition to salinity, factors such as light, water level, nutrients, and growth form need to be considered.

Light generally begins to significantly limit growth at depths greater than one meter, and maximum depth of SAV occurrence is controlled by decreasing light with increasing depth. The minimal depth of occurrence is controlled by low water events that expose SAV to drying and damaging waves. With nutrient loading, SAV is generally replaced by algae due to shading by epiphytes and dense phytoplankton. However, particularly in freshwater habitats, the abundance of algal grazers, high growth rates, formation of persistent, near-surface canopies and the ability of exotic species to engineer a more suitable SAV habitat can negate nutrient effects. Species with high underground biomass generally have stable populations, while others have variable seasonal populations.

Implications

For sustained restoration to prosper, different monitoring, management and restoration strategies need to be developed for different salinity zones and coastal landscapes. Disregard for SAV species biology can result in SAV loss due to algal overgrowth or nuisance growth of undesirable native and exotic species resulting in negative habitat value. Using SAV cover to monitor restoration success needs to include species-specific seasonal variation. Long-term population cycles and alternate stable community states also occur and potential habitat models and dispersal from source populations need to be considered. Restoration by transplanting only works if environmental quality is restored first. Native SAV needs to be maintained and exotic species controlled to maintain long-term habitat integrity.

CONCURRENT SESSION V

Wednesday, June 9 10:30 a.m. - 12:00 p.m.

Designing Diversions (Room A)

Moderator: Barb Kleiss
US Army Corps of Engineers

Description and Analysis of Legacy Diversion Structures in Coastal Louisiana

John A. Lopez[1] *and Rebecca Green*[1]

[1] *Lake Pontchartrain Basin Foundation, Metairie, Louisiana, USA*

Legacy diversion structures are defined as: *Artificial hydrologic conveyance features which redirect river flow outside of or into its natural channel either incidentally or by intentional design, e.g. river diversions, spillways, new channel outlets, navigation channels or significant modifications to natural channels.* Approximately 24 legacy diversion structures have been identified and included in a database. The following characteristics have been catalogued for most structures: Discharge, Date of Construction, Operator, Constructor, Original Purpose, Current Purpose, Conveyance Characteristics, Operational Status, Original Construction Cost, River Source, Structure Type, Discharge Controls, Pictures, References /Web Links. Legacy structure designs have crude corollaries to natural deltaic hydrology and can be considered “artificial bayous”, “artificial crevasses” or “artificial distributary channels”. The legacy structures cumulatively represent several hundred years of operation in the Louisiana coast. Focus is currently on understanding the environmental effects of the diversions.

Implications

The concept of reintroducing Mississippi River water into the wetlands in coastal Louisiana dates back at least a century to when the problem was first created by river levees. Diversions are included in all modern coastal restoration plans for Louisiana. Nevertheless, there is great uncertainty regarding the design and impact of proposed diversions. The body of data for the legacy structures represents an untapped source of information that may be critical in predicting the response to future diversion projects. Although possibly designed for flood protection, navigation and other purposes, these structures have introduced river water into the coastal estuary and, either intentionally or not, have affected coastal wetlands, in spite of their design for other purposes. These legacy structures should be viewed critically in light of restoration needs so that they may be modified or operated more appropriately, but also as a basis for designing a new generation of structures with a new priority on re-building and sustaining coastal wetlands.

Hydrodynamics and Sediment Transport in Lower Mississippi River Meander Bends (Louisiana): Implications for Large Sediment Diversions

Ehab A. Meselhe[1], *J. Alex McCorquodale*[3] *and Ioannis Georgiou*[3]

[1] *University of Texas Institute for Geophysics, Austin, Texas, USA*

[2] *University of Louisiana, Lafayette, Louisiana, USA*

[3] *University of New Orleans, New Orleans, USA*

Field data collection and numerical modeling is being conducted in the lower Mississippi River in the region of a meander bend at Myrtle Grove, LA (river km 96 above Head of Passes) in support of a proposed large water and sediment diversion (1,130 – 2,830cms) for coastal wetland restoration. Field studies in October 2008, April and May 2009, at discharges ranging from 11,000-21,000 cms, examined the role of bend dynamics on sediment transport through this reach relative to control sites further downriver and USGS monitoring stations upriver. Suspended loads and grain size character measured by ADCP (velocities and backscatter), isokinetic point sampler (P-63), and optical sensors (LISST, OBS, transmissometer) indicate that during the rising-to-high discharge phase, sand lifting off from the downstream edge of the lateral bar upriver of the bend augments that carried from further upriver, and is entrained in the upper 10-25m of the water column. This excess suspended sand is advected around the bend before concentrations are reduced to background levels over the lateral bar downstream of the bend. Bedload transport rates measured by repeat swath bathymetric mapping of migrating dunes are comparable upstream of the bend, downstream, and in the control sites. However, no bedforms are observed in the bend thalweg (up to 60 m deep) supporting the dominance of suspended sand transport in the bend. Both 1D (HEC-RAS and HEC6-T) and 3D (Flow3D) numerical hydrodynamic and sediment transport modeling is underway to simulate this process and the large-scale eddy present in the bend that generates upriver transport along the inside of the meander bend at all observed discharges. Our preliminary results suggest that the outside of meander bends might be an appropriate site for sediment diversions that draw near-surface water from this sediment-rich layer.

Implications

This work focuses on examining the use and possible implications of sediment and water diversions in the lower Mississippi River as a tool for coastal restoration. This comes at a time when post-Katrina master plans for coastal protection and restoration have been prepared by the State and U.S. Army Corps of Engineers. Although both plans make reference to large diversions, and suggest sites for construction, no consensus has been reached on whether they should be used for coastal restoration (given complicating environmental and socio-economic factors), and where they should be located. This effort is an examination of the issues surrounding large diversions in general, as well as investigating the implications of constructing large diversion at an authorized site for a smaller diversion at Myrtle Grove. We also outline critical gaps in our understanding that need to be addressed prior to constructing large diversions.

Simulating the Change in the Sediment Carrying Capacity of a Hypothetical Diversion Under Projected Future Sea Level Rise Using ADH

Erol Karadogan[1] *and Clint Willson*[1]

[1] *Louisiana State University*

The rate of coastal land loss in Louisiana has reached catastrophic proportions. Within the last 50 years, land loss rates have exceeded 40 square miles per year, and in the 1990’s the rate has been estimated to be between 25 and 35 square miles each year. A number of freshwater diversion structures are projected to serve as the conduits for freshwater, with sediment and nutrients, to pass through river levees and into the Louisiana coastal marshes to make them vertically accrete through the accumulation of both organic matter and mineral sediment and keep pace with the relative sea level rise.

ADH (Adaptive Hydraulics) is the modern, multi-dimensional, finite element hydraulic modeling program in development by the Coastal Hydraulics Laboratory of the U.S. Army Corps of Engineers (USACE) Engineering Research and Development Center (ERDC). The 2D Shallow Water Module of ADH coupled to its Sediment Transport Module (SEDLIB) is being used to model sediment transport over a 130 mile stretch of the Mississippi River (from Carrollton to the Gulf of Mexico). The model has been calibrated and verified under several different flow and tidal conditions using stage data collected from 14 stations and recent discharge observation data obtained from USACE New Orleans District published reports and databases for the Mississippi River, distributaries and passes in the study reach. Results will be presented to demonstrate the performance of ADH in modeling a hypothetical diversion located around River Mile 70 connecting the river to the adjacent wetlands. Performance and sediment carrying capacity of the hypothetical diversion will be tested under current and several projected future sea level conditions.

Implications

Standard off-the-shelf numerical models can provide some assistance in diversion design projects. However, the dynamic and spatially variable processes associated with river flow and sediment diversions and the size of the domain require state-of-the-art computational modeling and high-performance computing. Complex and accurate numerical models with sufficient spatial and temporary resolution are necessary for design and management of the Lower Mississippi River Delta system, i.e. providing quantitative insights and details for designing future structural features, assessing their impacts on the River, and understanding the processes that influence the decay and growth of sub-deltas. Results from these tests are being used to evaluate coastal restoration scenarios and define further research questions.

Sea Level Rise (Room B)

Moderator: James Pahl
Office of Coastal Protection and Restoration

Sea Level Trends for the Gulf of Mexico, from 1854 to Present, A Look at Coastal Inundation and Future Landscape Impacts from Relative Mean Sea Level Rise

***Tim Osborn*[1] *and Jonathan Brazzell*[2]**

[1] NOAA Office of Coast Survey, 646 Cajundome Blvd, Lafayette, Louisiana 70506 [2] NOAA NWS, Lake Charles

NOAA has recently published a document reviewing the relative mean sea level trends of the United States. For coastal Louisiana, relative mean sea level rise is shown to be among the highest in North America. With 12,000 square miles of Louisiana's coastal zone having an elevation of 3 feet or less on average (over 80%) of Terrebonne Parish has elevations of 2 feet or less), these trends have very significant impacts on the coastal resources and populations and infrastructure in south Louisiana.

NOAA will review the sea levels trends report and focus the discussion on trends and sea level rise for coastal Louisiana and look at several areas of vulnerability and challenges for the coast as relative sea levels continue to rise.

Accelerated Sea-level Rise and Coastal Subsidence: A Dual Threat for Louisiana and the Adjacent US Gulf Coast

***Torbjörn E. Törnqvist*[1,2], *Shiyong Yu*[1], *Juan L. González*[3], *Ping Hu*[1]**

[1]Department of Earth and Environmental Sciences and [2]Tulane/Xavier Center for Bioenvironmental Research, Tulane University, New Orleans, Louisiana 70118, USA [3]Department of Physics and Geology, University of Texas – Pan American, Edinburg, Texas 78541, USA

Sea-level rise and subsidence combine to pose an ongoing and increasing threat for the US Gulf Coast in general, and coastal Louisiana in particular. This presentation reviews the progress that has been made over the past decade in understanding these phenomena, both in terms of processes and rates. Comparison of detailed reconstructions of Holocene relative sea-level (RSL) rise from southwest and southeast Louisiana (the Chenier Plain and the Mississippi Delta, respectively) shows differential crustal motions of Pleistocene and deeper strata of ~0.15 mm/yr. This difference can be explained by the effect of sediment accumulation in the delta and the resulting depression of the underlying lithosphere. Reconstruction of RSL rise during the past millennium yields a pre-industrial rate for the central US Gulf Coast of ~0.4 mm/yr, primarily due to glacial isostatic adjustment (forebulge collapse) associated with the melting of the Laurentide Ice Sheet that affects the entire region. RSL rise as measured from tide-gauge records for the past century shows rates of 2 mm/yr or more, indicating a dramatic increase, echoing what is observed worldwide. Tide gauges in the Mississippi Delta show rates of RSL rise on the order of 10 mm/yr and sometimes higher. Given the relatively slow subsidence rates of the deeper subsurface, this indicates that subsidence occurs primarily in the shallower and more recent deposits. Studies of the deformation of deltaic strata have confirmed that subsidence rates due to sediment compaction (primarily due to loading resulting from clastic sediment accumulation) can be as high as 5 mm/yr over millennial timescales, and likely higher over decades to centuries. Projections for the future within the context of climate change suggest that sea-level rise may progressively overtake subsidence as the main threat to coastal Louisiana.

Implications

Comparison of rates of sea-level rise over various timescales highlights the impact of global warming on the US Gulf Coast by means of a rapid acceleration, with rates of sea-level rise about five times higher during the 20th century compared to the previous (pre-industrial) millennium. This is augmented in coastal Louisiana by high subsidence rates, thus providing one of the conditions that have contributed to the rapid loss of coastal wetlands. An analysis of subsidence mechanisms and rates brings both good and bad news. Since most subsidence occurs in relatively shallow deposits (uppermost 50-100 feet), infrastructure anchored in the Pleistocene substrate is generally relatively stable. On the other hand, the high sensitivity of shallow deltaic deposits to compaction demands caution in the selection of target areas for river diversion projects. These things said, the primary threat for coastal Louisiana remains the further acceleration of sea-level rise due to climate change.

Assessing the Vulnerability of Coastal Louisiana Habitats to Accelerating Sea-level Rise

Patty Glick

National Wildlife Federation, Seattle, Washington, USA

The National Wildlife Federation (NWF) has initiated a study to identify some of the potential impacts of sea-level rise on Louisiana's already-sinking coastline. An accelerating rate of sea-level rise due to climate change is a tremendous added stressor to other factors contributing to coastal land loss. However, sea-level rise has not been factored into projected land loss trends until recently. It is critical for sea-level rise to be incorporated in the design and implementation of coastal restoration and protection strategies so our coastal investments will endure for future generations. The study will help communities and decision-makers develop the most effective coastal restoration and protection measures possible.

NWF is working with Warren Pinnacle Consulting to apply the Sea Level Affecting Marshes Model (SLAMM). SLAMM was designed to simulate the dominant processes involved in shoreline modification and the conversion of one wetland type to another under long-term sea-level rise. The SLAMM model, which has been in development for the past two decades, provides a highly accessible tool to assess how rising seas may impact coastal habitats. As with all models, SLAMM is not a crystal ball. It is not intended to forecast what will happen to the region's habitats in the future; rather, it is a tool to offer a picture of possible outcomes under a range of scenarios.

NWF's study highlights and incorporates the results of additional research and modeling through a review of the recent literature and input from a team of expert advisors. Based on the results of this assessment, we highlight how current and potential management options in the region might help safeguard coastal habitats and communities under these future scenarios of sea-level rise.

Policy and Planning (Room C)

Moderator: Karen Gautreaux
The Nature Conservancy

The West Bay Sediment Diversion on the Lower Mississippi River

Cherie Price
U.S. Army Corps of Engineers, New Orleans District
New Orleans, LA 70160

The CWPPRA West Bay Sediment Diversion project, constructed in 2003, is the largest sediment diversion in Louisiana and has afforded an extraordinary opportunity to advance the planning and design of diversions for the purpose of coastal restoration in Louisiana. The project was designed to restore and maintain approximately 9,831 acres of fresh to intermediate marsh by diverting fresh water and sediment from the Mississippi River over the 20-year project life through 2023.

As part of the project, the first phase of a work plan was completed in an effort to better determine the amount of riverine shoaling that is specifically attributable to the West Bay Diversion. The work plan included collecting extensive sediment and hydrodynamic data on the lower Mississippi River (MR), a geomorphic analysis from Belle Chasse to East Jetty, a 1D model to evaluate long term sedimentation trends, 2/3D models to analyze specific multidimensional riverine behaviors and an analysis of the bay side receiving area. The work plan is an unprecedented, comprehensive approach, which includes an examination of the historical anthropogenic modifications and natural changes to the lower Mississippi River.

Preliminary results indicate that the West Bay Diversion is inducing between 20-40% of the material that is depositing in the Pilottown Anchorage Area and the Mississippi River Navigation Channel, above and below the diversion conveyance channel. Future work will better define these percentages and determine the statistical confidence in the results. Disappointing but highly revealing is that the project influence area within the receiving area has experienced no subaerial land gain and a net loss of subaqueous land. In an effort to promote land growth, a mile-wide sediment retention island was constructed in the West Bay receiving area perpendicular to the flow entering the area to create vegetated marsh that can slow velocities and trap fine grained sediments. The island provides an exciting opportunity to monitor the effects of placing sediments on the receiving end of large scale diversions.

Implications

Restoring and protecting Louisiana's coast requires large scale solutions such as river diversions. However, the West Bay Sediment Diversion project has shown that planning effective river diversions that adequately consider potential negative impacts and benefits is an extremely complex undertaking. The Mississippi River system is very noisy with multiple anthropogenic and natural changes that make it difficult to evaluate specific effects from various individual modifications/changes and is also difficult to predict. On the receiving end, West Bay and other passes on the lower MS river are showing that building land in open water systems is not effective as a near term (10-50 years) solution without containment or retention features.

The Coastal Project Planning Process – A Difficult Path to Authorization for Dual Purpose Projects

Norwyn Johnson
Louisiana Office of Coastal Protection and Restoration

Louisiana's fight to protect and restore our rapidly disappearing coast is directly linked to the Federal government's water resources program and policies. To best leverage state funding and resources we must pursue project authorization from the U. S. Congress. Today, the authorization process involves the preparation of a feasibility report in concert with the U. S. Army Corps of Engineers. Once authorized a project cannot be constructed without additional legislative approval to appropriate funding. Implementation of large coastal projects remains dependent upon this lengthy, multi-stepped process.

The existing water resources project authorization and appropriation process does not support the immediate or long term needs of coastal Louisiana. We cannot wait 30-40 years for new projects. The Water Resources Development Act (WRDA) of 2007 was heralded as a vehicle to make the process more efficient and to bring reform of the Corps. There is little evidence things have changed to the extent anticipated in the legislation. Some changes to the study process actually lengthen study phases and increase study costs.

Will there be any new authorizations for Louisiana? Why does a feasibility report take so long to complete? What are the challenges and issues confronting a typical feasibility report? This presentation will address these questions and highlight the problems inherent in developing a dual purpose project through illustrations from the Southwest Coastal Louisiana Feasibility Study which is integrating protection and restoration measures into a comprehensive plan for Cameron, Calcasieu, and Vermilion parishes.

Quantification of Potential Carbon Sequestration Rates in Louisiana Wetlands

***Sarah K. Mack*[1]**, *John W. Day[2,3], Robert R. Lane[2,3], and Tiffany M. Potter[4]*
[1] Tierra Resources LLC, New Orleans, LA, USA
[2] Dept. of Oceanogra phy and Coastal Sciences, Louisiana State University, Baton Rouge, LA, USA [3] Comite Resources, Inc., Zachary, LA, USA [4] Streamline LLC, Washington, DC, USA

As greenhouse gas (GHG) regulatory policies and trading systems emerge, there is a need for definitive science to determine the net carbon impacts of natural wetlands. To guide future policy regimes and wetland carbon research, this paper identifies the carbon storage pools of natural wetlands and discusses the primary carbon sink mechanisms that require quantification to measure carbon sequestration by Louisiana wetlands, the timeframe over which it takes place, and the amount of carbon emitted during wetland loss. Based upon peer-reviewed literature, an analysis was conducted to quantify the rates of accretion and carbon sequestration where it is being enhanced by wetland assimilation or river diversion projects. The analysis calculated carbon sequestration as applicable towards carbon credits for three scenarios: (1) a regional wetland assimilation system planned to receive municipal effluent from the city of New Orleans; (2) the wetlands influenced by the existing Caernarvon Mississippi River diversion; and (3) the wetlands influenced by a theoretical large-scale diversion near Buras, Louisiana using the current rate of relative sea level rise and an increased rate of relative sea level rise that corresponds with climate change predictions. The analysis determined that the additional carbon sequestration of wetland assimilation systems averaged over 50 years, including reintroduced cypress and prevented wetland loss, would be approximately 54 CO2e ha/yr (22 CO2e ac/yr). The analysis further determined that the additional carbon sequestration due to river diversions averaged over 50 years, including prevented wetland loss but excluding introduced cypress, would be approximately 28 CO2e ha/yr (11 CO2e ac/yr). Wetland restoration measures designed to offset sea level rise associated with climate change will require increased vertical accretion resulting in increased carbon sequestration rates. This paper concludes with a detailed summary of the further research required to provide a scientific basis to quantify carbon sequestration and certify offsets from wetland projects.

For a variety of financial, environmental, and political reasons, substantial interest exists for carbon credits derived from terrestrial landscapes among governments, environmental organizations, private companies, and carbon funds, driven by the potential that carbon credits may obtain a premium price in the future. Monetization of these assets has important implications in coastal Louisiana. Wetland restoration will help the region adjust to climate change by enhancing carbon sequestration, preventing carbon release during wetland loss, offsetting sea level rise, and increasing the resiliency of the wetland ecosystem to drought by introducing continuous inputs of freshwater. In addition, restored wetlands dissipate surge and wave energies thereby protecting levees from breeching during the tropical storm events that are predicted to increase due to climate change. The inclusion of wetland restoration management approaches in the emerging carbon market and GHG policy regimes will facilitate rapid and effective climate change mitigation and adaptation.

LUNCH WITH KEYNOTE SPEAKER
Wednesday, June 9 12:00 p.m. - 1:50 p.m.

Policy Plenary Session I
Wednesday, June 9 1:50 p.m. - 3:10 p.m.

CEQ Interagency Working Group Panel Discussion

In this plenary session, representatives of the Interagency Working Group currently engaged in the Roadmap for Gulf Coast Ecosystem Sustainability and Resiliency will discuss elements of the Roadmap including current progress and the implications of the BP Oil Spill.

Policy Plenary Session II
Wednesday, June 9 1:50 p.m. - 3:10 p.m.

Adapting Natural and Built Environments to a Changing Climate

This plenary session will discuss projected changes in climate and sea-level and the implications for coastal Louisiana.
Invited speakers will discuss existing policies for adapting to a changing climate and also identify policy gaps or inconsistencies that should be addressed to ensure that local, state and federal climate adaptation policies are adequate to implement proactive, coordinated and flexible strategies to ensure the sustainability and resiliency of coastal economies, communities and environments.

Panel Moderator:
Margaret Davidson
National Oceanic and Atmospheric Administration

Panel Participants:
Larry Schweiger
President and Chief Executive Officer,
National Wildlife Federation
Steve Mathies
Executive Director, Louisiana Office of Coastal
Protection and Restoration
Lynne Carter
Associate Director, Southern Climate Impacts Planning Program
John Teal
Scientist Emeritus, Woods Hole Oceanographic Institution

CONCURRENT SESSION VI
Thursday, June 10 8:30 a.m. - 10:00 a.m.

Improving Risk Reduction (Room A)
Moderator: John Ettinger
Environmental Protection Agency

Morganza to the Gulf State Technical Review Panel: Final Report and Recommendations

Shirley Laska[1] *and Robert Twilley*[2]
[1] *University of New Orleans* [2]*Louisiana State University*

The Coastal Protection and Restoration Authority (CPRA) convened a panel of experts to evaluate and report their findings on the current Morganza project. The tasks of the panel were to assess existing information and decisions related to the authorized alignment as described in original and amended documents, and other relevant materials; and to hold public sessions to obtain information and inform the Panel's findings and recommendations to the CPRA and the general public. The findings of the Panel resulting from this evaluation, and recommendations to CPRA on how best to move forward in protecting the project area included three areas: Basic Assessment, Planning for Flood Risk Reduction, and Improved Tools and Analyses for Assessment of Integrated Risk Reduction Outcomes. Basic Assessment recommendations included continue work on levees, floodgates and environmental structures on the current authorized levee alignment with the goal of providing a minimum system-level of protection to the planning area; continue work on the HNC lock-floodgate structure given its vital role in the protection system and its potential to be used to benefit the ecosystem; integrate proactive wetland restoration approaches into the ongoing design and operation of the Morganza project; and finally to routinely (e.g., every 5 years), revisit the project to reassess risk to communities and the economy, evaluate ecological impacts and benefits, and revise future construction and operation plans and schedules as appropriate. Planning for Flood Risk Reduction recommendations included initiate a comprehensive, community-based planning process to identify the community and economic dynamics, along with specific infrastructure, that need to be protected for the Terrebonne communities to thrive; increase efforts to inform the business community and the general public of the level of protection and risk reduction provided, thereby encouraging them to pursue additional risk-reduction measures; implement a comprehensive flood management approach for the area that leverages existing programs for non-structural flood risk reduction, provides incentives to businesses and the general public, and provides for the safe location of future business and residential development; develop conservation easements, land-use plans and zoning ordinances to protect existing wetlands in the planning area from loss to development; initiate a public education program to communicate scientifically based assessments of risks to both rural and urban communities, and ensure that information is routinely updated as project construction and other risk reducing activities proceed and economic, community and environmental conditions change. Finally, Improved Tools and Analyses for Assessment of

Integrated Risk Reduction Outcomes included focus on continue efforts to develop a system-wide model to incorporate the effects of rainfall, pumping, lock/floodgate operations, and potential stratification on salinity and water level conditions, and ensure it is integrated with other modeling efforts. Use this system-wide model, as well as conceptual ecological models and monitoring of wetland response, to design and operate environmental structures within the levee system; and convene an independent expert panel to guide this adaptive management process; hold a workshop and/or convene a panel to consider and synthesize the state of knowledge inform evaluation of project effects on wetlands; apply planning tools that allow integrated, spatially explicit assessments of structural and non-structural measures in risk reduction and that consider a range of possible future economic, social and environment scenarios.

Donaldsonville to the Gulf Science and Engineering Review Panel: Preliminary Findings

Denise J. Reed
Pontchartrain Institute for Environmental Sciences, University of New Orleans, New Orleans, LA

This project began with a USACE Reconnaissance Study authorized in May 6, 1998 and completed and approved in October 2000. Subsequently a feasibility study was initiated to determine the feasibility of providing flood protection to the populated areas between Bayou Lafourche and the Mississippi River, from Donaldsonville to the Gulf of Mexico. The scope is to *"study various alternatives that will provide flood protection from tidal, hurricane surges, and heavy rainfall events. Determine the adequacy of the existing interior drainage systems and evaluate whether additional pumping capacity is required. Analyze recreational, cultural, and environmental needs."* The feasibility study was initiated on February 6, 2002. Five alternative levee alignments along with non-structural elements and alternatives are being considered in the feasibility study.

In July 2009 after discussion of environmental concerns regarding the narrowed range of project alignments as well as some of the planned engineering design features and project costs, the CPRA called on the Governor's Office of Coastal Activities to organize a team of experts to review and report on the Donaldsonville to the Gulf feasibility study. The DTG Science and Engineering Review Panel focuses on the study's methodological approach and technical products. The deliberations of the Panel are ongoing but their mission is to provide CPRA comments on the methods and approaches being used in the study as, to identify and assess the implications of any important assumptions or uncertainties which might influence the outcome of the study or the success of the project, and to make recommendations regarding adjustments in the planning procedures and analyses which could address likely shortcomings of the study as currently conducted. The Panel is not required to recommend specific alternative alignments or plans, but is encouraged to highlight the potential economic and ecological consequences associated with proposed alignments or plans.

This presentation will provide an overview of the Panel's work at the time of the conference and observations from the Panel Chair on the material reviewed to date.

Sand Demand at the Eastern Scheldt Storm Surge Barrier

***Leo Adriaanse*[1] *and Eric van Zanten*[1]**

[1]*Ministry of Transport, Public Works and Water Management, Rijkswaterstaat Zeeland*

After the flooding disaster of 1953 it was clear that the flood protection of the south-western delta of the Netherlands had to be improved.. The first Delta Plan consisted of blocking off most of the estuaries in the delta. In the seventies, the first dams being in place, a change in thinking occurred. The Dutch government decided to build a storm-surge barrier. This way valuable tidal nature and shellfish fisheries would be conserved. Professionals predicted, at the time, that nature would experience undisirable side-effects. Channels and tidal flats would reduce in profile. Since then the effects have become visible. The process of erosion of the intertidal areas is proceeding faster than predicted.

May 2008 the results of a first survey on the effects and possible counter measures were reported. Since the constuction of the Oosterschelde storm-surge barrier and the accompanying compartmentalization dams less water has been flowing in and out of the Oosterschelde. In effect, the tidal channels are too big for the smaller amount of water. This causes the water to flow more slowly than before and it has insufficient power to move the sediment from the channels onto the intertidal area. Sand is being moved from the intertidal area into the channels in heavy storms where it remains. The natural balance between sedimentation and erosion is disrupted. This process is known as the 'sand demand'.

The loss of tidal flats and salt marshes is disadvantageous mainly to nature on the short term On the longer term maintenance of levees will increase and the much appreciated landscape will drown.. Recreational shipping and shellfish fisheries may also be affected negatively.

The survey studied three types of measures in the Oosterschelde. Controlling the cause of the sand demand (by having more water flowing through the channels or applying more sand in the channels) and controlling the effect of the sand demand (preventing the loss of intertidal area by sand nourishments and erosion protection measures).

Pilots with sand nourishments and erosion protection measures are carried out. In 2013 the results of these pilots and of an accompanying study on the natural values that can be maintained with these measures will result in a decision how to cope with the 'sand demand'.

Hurricane Impacts (Room B)

Moderator: Scott Wilson, USGS

Observations of the Spatial and Temporal Distribution of Hurricane-induced Land Loss in Coastal Louisiana Over the Past 60 Years

John A. Barras

U.S. Army Corps of Engineers, Engineer Research and Development Center, Environmental Laboratory, Wetlands Environmental Technology Research Facility, Baton Rouge, LA, USA

A combination of historical aerial photography and Landsat Thematic Mapper (TM) satellite imagery was used to identify hurricane-induced land loss in coastal Louisiana marshes from 1956 through 2005. Hurricane magnitude, track, and landfall information obtained from the National Oceanic and Atmospheric Administration (NOAA) were used to identify candidate storms. Landfall bracketing TM imagery and photography were then examined to identify probable storm-formed or storm-expanded water bodies. Most observed loss was related to the removal or partial removal of marsh vegetation by storm surge or to shoreline erosion caused by enhanced wave action. The TM imagery was successfully used to identify loss caused by Hurricanes Andrew (Aug. 26, 1992), Lili (Oct. 3, 2002), Ivan (Sept. 16, 2004), Katrina (Aug. 29, 2005), and Rita (Sept. 4, 2005) and Tropical Strom Isadore (Sept. 26, 2002). The same techniques were applied to historical aerial photography to identify land loss caused by Hurricanes Audrey (1957), Hilda (1964), and Betsy (1965). The photography lacked the temporal and spatial coverage of the TM imagery but was adequate for identifying historical hurricane-induced land loss.

Detectable hurricane-induced land loss increased with storm magnitude. Hurricane Audrey, a category 4 storm that made landfall at Cameron Louisiana, caused probable land loss 350 km east to the Mississippi River. Category 2 or lesser storms caused detectable localized loss within 100 km east of landfall. Land loss magnitude and spatial distribution was greatest immediately east of storm landfall and then decreased eastward. Storm-induced land-loss decreased immediately to the west of storm landfall implying most identifiable land loss was caused by storm surge rather than wind. Consecutive storm landfalls caused commingled land loss patterns of varying magnitude and spatial distributions consisting of new ponds and expanded ponds, some of which have remained in place for over 60 years.

Implications

These observations suggest that hurricanes have and will continue to contribute to land loss in coastal Louisiana. Hurricane surges sculpt the coastal landscape. The decadal and greater sampling periods used to measure historical land loss lack the temporal resolution to identify hurricane surge-induced loss or to correlate loss with individual storms. Identifying past storm-induced loss may lead to enhanced coastal restoration strategies and improved coastal landscape projections.

Delta Lobe Degradation and Hurricane Impacts Governing Large Scale Coastal Behavior, South-Central Louisiana, USA

Michael D. Miner[1], Mark Kulp[1,2], Duncan M. FitzGerald[3], James Flocks[4], Ioannis Georgiou[1,2], and H. Dallon Weathers[1]

[1] Pontchartrain Institute for Environmental Sciences, University of New Orleans, New Orleans, LA, USA [2] Department of Earth and Environmental Sciences, University of New Orleans, New Orleans, LA, USA [3] Department of Earth Sciences, Boston University, Boston, MA, USA [4] U.S. Geological Survey, St. Petersburg Science Center, St. Petersburg, FL, USA

A large coastal sediment budget deficit, rapid relative sea-level rise (~0.9 cm/yr), and storm-induced erosion are forcing shoreface retreat along coastal barrier systems in Louisiana. Additionally, conversion of interior wetlands to open water has increased tidal prisms, resulting in degradation of barrier islands due to inlet widening, formation of new inlets, and sediment sequestration at ebb-tidal deltas. Bathymetric surveys along a 165 km stretch of Louisiana barrier coast, from Raccoon Point in Terrebonne Parish to Sandy Point in Plaquemines Parish, were conducted in 2006 as part of the Louisiana Barrier Island Comprehensive Monitoring Program (BICM). These data, combined with bathymetry from three time periods (dating to the 1880s) provide a series of digital elevation models used to calculate sediment volumetric changes and determine long-term erosional-depositional trends. Dominant patterns during the 125-years include: 1) erosion of ~1.6 x10^9 m^3 from the shoreface, forcing up to 3 km of shoreface retreat, 2) deposition in coastal bights and at ebb-tidal deltas, and 3) increasing combined tidal inlet cross-sectional area from 41,400 m^2 to 139,500 m^2. Bathymetric data sets, separated by shorter time periods (sub-annual), demonstrate that historical trends are primarily driven by processes associated with hurricanes; rates of shoreface erosion are an order of magnitude greater during active hurricane seasons compared to long-term trends. Numerical modeling experiments support these observations. These regional, long-term sediment distribution trends are characteristic of the destructive phase of the delta cycle and are manifested by: 1) regional coastal straightening as abandoned deltaic headlands strive to achieve equilibrium coastline configurations relative to dominant storm wave conditions and 2) barrier/inlet systems response to altered tidal hydrodynamics associated with interior wetland loss. Identification of these regional trends are important for understanding more localized, short-term coastal behavior, especially when attempting to manage sediment allocation, mitigate coastal erosion, and protect to coastal communities.

Implications

Delta plain evolution is well-studied and monitored at the surface; however, the role of seafloor sediment dynamics in long-term coastal evolution has not been properly constrained. The long-term, regional trends identified and quantified here provide unique perspectives, which should be considered when formulating management plans. For example, the relationship between interior wetland loss and barrier integrity should be considered when planning land-building projects so that they can be strategically placed to mitigate increasing tidal prism. This study also provides: 1) identification of sediment sinks for restoration, 2) demarcation of sectors of coastline as non-feasible for investing restoration funds due to widespread, long-term erosional trends, 3) updated bathymetric datasets for the development of morphodynamic models, regional sediment budgets, and storm surge and wave numerical models, 4) an understanding of the relative role of hurricane processes in regional, long-term sediment dynamics, and 5) a regional framework for predicting future coastal evolutionary trends.

Modeling of Hurricane Impacts on a Coastal Lake Bottom: South Central Louisiana

***Angelina M. Freeman*[1]**, *Felix Jose*[1], *Harry H. Roberts*[1], *and Gregory W. Stone*[1]

[1] *Coastal Studies Institute, Department of Oceanography and Coastal Sciences, Louisiana State University, Baton Rouge, Louisiana, USA*

We expand the limited understanding of sediment dynamics in Louisiana's coastal lakes through the study of hurricane-induced sediment transport processes in Sister Lake (Terrebonne Parish Louisiana), using coupled hydrodynamic models Mike 21 and Mike 3. Simulation of the complex non-linear interaction between waves and currents was incorporated through dynamic coupling of the hydrodynamic and spectral wave modules. The lake bottom was imaged both pre-and post- Hurricane Rita using high resolution acoustics. Collected bathymetric data in combination with National Geophysical Data Center bathymetry/topography data were triangulated to an unstructured grid. The Hurricane Rita hindcast was forced with blended wind data generated from high resolution H* wind (National Hurricane Center) and NOAA North American Regional Re-Analyzed wind data. The wave conditions at the southern boundary of Sister Lake were extracted from a spectral wave model implemented for the Gulf of Mexico. The Rita hindcast model was also forced with surge levels extracted at the southern boundary of Sister Lake from an ADCIRC model implemented for the Gulf. Results indicate that bed shear stresses across almost the entire model domain prior to Hurricane Rita's landfall were above the critical value causing erosion. Bed shear stresses in the western portion of Sister Lake were below the critical value causing deposition during Rita's landfall. As the storm progressed, the area of deposition increased to almost the entire Sister Lake bottom within 14 hours of landfall, indicating sedimentation over the entire lake bottom post-storm. X-ray radiographs of box cores, collected in critical areas of Sister Lake after Hurricane Rita, support the model results showing clear increments of sedimentation associated with the storm period, corroborated with radionuclide dating. Results of this analysis provide an initial understanding of how the morphology of a coastal Louisiana lake responds to major hurricane events.

Implications

With the prospect of rising sea levels and increasing storm intensities - frequencies for the future, it is especially important for environmental management purposes to be able to assess and understand change in the low-lying coastal plain habitats as a product of storm forcing. Results provide a framework and fundamental understanding of lake bottom characteristics of Louisiana's shallow water environments. Prediction and hindcast studies using numerical models are important tools for coastal management, and in this study clarify hurricane-induced sediment transport and deposition patterns in the geologically complex Sister Lake region. Increased understanding of the morphological storm response processes in coastal bays and lakes must be included as an important component of effective wetland restoration plans.

Lessons Learned II (Room C)

Moderator: Rudy Simoneaux, OCPR

A Case Study and Lessons Learned Overview on the Design and Construction of the Three Benchmark Marsh Creation Projects

Rudy Simoneaux[1], *Whitney Thompson*[1], *Dain Gillen*[1] *and Kevin Roy*[2]

[1] *Office of Coastal Protection and Restoration* [2] *United States Fish and Wildlife Service*

Over the past two years the Office of Coastal Protection and Restoration (OCPR) has been responsible for the planning, design, and construction of three benchmark marsh creation projects: Goose Point/Point Platte Marsh Creation (PO-33), Dedicated Dredging on the Barataria Landbridge (BA-36), and the Mississippi River Sediment Delivery System at Bayou Dupont (BA-39). PO-33 is located in the Lake Pontchartrain Basin along the northern shoreline of Lake Pontchartrain. The project involved the creation of over 550 acres of marsh and was constructed with approximately 3.1 million cubic yards of hydraulically dredged sediment from Lake Pontchartrain. BA-36 is located in the Barataria Basin near the confluence of Bayou Perot and Bayou Rigolettes. The project involved the creation of over 2000 acres of marsh and was constructed with approximately 9.3 million cubic yards of hydraulically dredged sediment from Bayou Rigolettes. BA-39 is located in the Barataria Basin along the lower Mississippi River. The project involved the creation of 500 acres of marsh and was constructed with approximately 3.5 million cubic yards of hydraulically dredged sediment from the Mississippi River. The restoration technique involving wetland creation via hydraulically dredged sediment has been utilized for decades. However, OCPR engineers have advanced this practice by employing advanced settlement/consolidation estimation techniques, pioneering innovative slurry transport measures, and rethinking traditional fill site dewatering methods on these three projects.

While the design aspects may tend to appear somewhat simplistic, the underlying message to be conveyed during this presentation involves the numerous logistical challenges that each project team encountered throughout the development and construction of these projects. This Case Study includes a description of the techniques utilized throughout the engineering and design process, an overview of the modeling and tests that were performed, a summary of the data collected, the steps that were taken to ensure environmental compliance, and lessons that were learned once construction was initiated. The primary focus involves the challenges of using a slurry pipeline conveyance system, the behavior of dredge material slurry during construction (containment dike configuration, dewatering scheme), and predicting the long term marsh platform elevation of a marsh creation project (self-weight consolidation, long-term settlement).

Implications

Over the past decade hydraulically dredging and pumping dredged slurry to create marsh habitat has become one of the most effective and efficient restoration techniques utilized in Coastal Louisiana. This Case Study demonstrates the different challenges faced by OCPR Project Teams throughout design and construction of three distinct marsh creation projects and the practical steps that were taken to overcome numerous setbacks. Many of the same technical, logistical, and constructability issues may be encountered on projects dealing with dredged material slurry. Therefore, the information conveyed in this Case Study may be applicable to scientists, engineers, and project managers during the planning and design of future marsh creation projects.

Do Sediment-Subsidies Restore the Ecological Structure and Function of Submerging Deltaic Wetlands?

Irv Mendelssohn[1], *Camille Stagg*[1], *Angela Schrift*[1], *Sean Graham*[1], *Michael Materne*[2], *and Matthew Slocum*[1]

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Global changes in climate, sea level, hurricane activity and land-use have the potential to substantially affect the sustainability of deltaic ecosystems and to challenge restoration attempts. We have evaluated the potential for sediment-slurry restoration to restore and rehabilitate the ecological structure and function of coastal wetlands. The sediment subsidy provided by this restoration approach increases surface elevation, a result essential for the sustainability of salt marshes during periods of sea level rise. This presentation summarizes results from a series of individual studies at multiple sites that assessed plant ecological and soil physico-chemical responses to different intensities of sediment subsidy in salt marshes experiencing high rates of relative sea level rise. Sediments were hydraulically dredged with a high fluid to solids ratio and dispersed into coastal marshes. Sediment

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subsidies increased soil mineral matter, and, in turn, soil fertility and marsh elevation, and thereby reduced nutrient deficiency, flooding, and interstitial sulfide stresses. Positive effects of the sediment subsidy were still quantifiable at one restored marsh 15 years after sediment-addition. Evidence is provided that sediment subsidies promote the ecological integrity and longer-term sustainability of tidal wetlands via evaluations of system metabolism, organization, and resilience (the capacity of the system to recover from disturbance). Relative to system resilience, we found that sediment-slurry enrichment, not only increased salt marsh resilience in the near-term (8-years post sediment-addition), but that the positive effect of sediment-addition was still evident after 15 years. Salt marshes that received moderate intensities of sediment-slurry addition with elevations within the mid to high intertidal zone were more resilient than natural marshes in this submerging delta. Our research indicates that the ecological structure, function and resilience of deltaic wetlands are enhanced by appropriate intensities of sediment subsidy to subsiding deltaic wetlands, thereby, promoting their sustainability.

The Hammond Assimilation Wetlands: What Went Wrong and How to Fix It

***Gary P. Shaffer*[1], *William B. Wood*[1], *John W. Day Jr.*[2], *and Christopher J. Lundberg*[2]**

[1]Southeastern Louisiana University, [2]Louisiana State University

Outfall of secondarily-treated wastewater into Four-Mile Marsh began fall, 2006. During the 2007 growing season, both herbaceous vegetation and baldcypress seedlings produced significantly greater aboveground biomass at the effluent site than in a nearby control marsh. Furthermore, the highest rates of production were proximal to the outfall area and vegetative production decreased linearly with distance from outfall. Nutria (*Myocaster coypus*), which are known to be attracted to high-quality vegetation, recruited to the area *en masse* and quickly devoured most of the vegetation. By spring 2008, much of the marsh had been converted to open water and the most extensive damage occurred closest to the outfall area. Despite killing over 2,000 nutria to date, much of the area remains as open water. However, mature baldcypress adjacent to the outfall are growing about 15 mm in diameter per year compared to 1-2 mm in the rest of the Maurepas swamp. Additionally, waterfowl use of Four-Mile Marsh has greatly increased.

To restore Four-Mile Marsh, a second outfall area needs to be established in the forests of Joyce Wildlife Management Area to the south, or a closer baldcypress – water tupelo forest to the east of the current outfall site. This would enable pulsing of the treated wastewater and periodic drawdown, which should enable reestablishment of a healthy herbaceous marsh and will greatly improve ecosystem function of the receiving forest. Adequate management of nutria populations will remain a challenge.

CONCURRENT SESSION VII

Thursday, June 10 10:30 a.m. - 12:00 p.m.

Structural Protection II (Room A)

Moderator: John Headland

A Unified Approach For Design of Overtopped Coastal Levees

John R. Headland

Moffatt & Nichol, New York, New York, USA

This paper extends design methods for overtopped coastal structures including levees. Rather than relying on the nebulous descriptions for allowable overtopping discharges (e.g., “well-protected” crest and rear slope) cited in most references (e.g., EurOTop (2007)), mechanistic/quantitative design methods are advanced. The approach here is to compute the wave overtopping velocities and flow depths over the seaward face, crest, and rear slope (Shuttrumpf et al 2002, Van Gent 2002, Bosman et al, 2008). Probability distributions for the various velocities are developed using methods described in Van den Bos (2006.) Using formulae for critical velocities and scour behaviour of soil/grass/stone (Hoffmans and Verheij, 1998), the soil/stone performance can be evaluated quantitatively. Similarly, rock stability formulae for crest and rear slopes of overtopped structures can be used to size rock for armouring purposes. This treatment can serve to promote further research regarding design of overtopped surfaces such that design procedures reach a level of maturity comparable to that currently associated with armour stone sizing and wave runup/overtopping. This paper presents example applications for several case histories including: (1) wave overtopping field tests in the Netherlands (Van der Meer, 2008), (2) damage experienced during Hurricane Isabel in the Chesapeake Bay (Headland et al, 208), and (3) levee performance (both failure and survival) during Hurricane Katrina (IPET, 2007.)

Use of Soil Mixing to Raise Levees

***Thomas L Cooling** and Bruce R. Lelong*
URS Corporation

The levee ring protecting New Orleans East includes five miles of earthen levee known as LPV 111, which borders the Bayou Sauvage National Wildlife Refuge along the Gulf Intracoastal Waterway. As part of the post-Katrina improvements to the New Orleans Area's levees, the LPV 111 levee presently is being raised 10 feet and the soft, underlying native soils are being strengthened by a ground improvement process called the Deep Mixing Method (DMM). The DMM operations in LPV 111 are one of the largest DMM projects ever undertaken in North America.

DMM was selected to improve the underlying ground to meet considerable design challenges: soft, underlying soils; the magnitude of the levee raise and the short time to accomplish it; and the need to reduce environmental impacts to the wildlife refuge. This technique involves mixing the native soil with cement in the ground to form "soil-crete" in a panel arrangement to strengthen the underlying soils against stability failures beneath the levee embankment. DMM elements also are being installed at transitions between floodwalls and earthen levee to reduce differential settlement and eliminate downdrag on the supporting pilings.

One critical quality issue is verifying the *in-situ* strength of the soil-crete elements meets the specified strength. The strength is measured during construction by core samples obtained from representative DMM elements. To have high confidence that the design strength is achieved during construction, statistically based specifications were developed considering typical variations in soil-crete strength, sample frequency, and core recovery during sampling of the DMM elements.

This presentation will describe the methodologies for designing the DMM panels, construction sequencing considerations, differential settlement considerations between the levee and the panels and at levee/floodwall transitions, and the statistical sampling techniques for verifying the *in-situ* strengths of the DMM elements.

Implications

The use of the DMM permits the strengthening of soft soils so that levees or levee raises of any significance can be completed within months or years instead of decades. The method also results in a much smaller levee footprint than a levee that does not use the DMM. The use of DMM at transitions and floodwalls and earthen levees results in reducing settlement, reducing long term maintenance issues, and reduces issues associated with the piles of the floodwalls.

Steel Swing Barge Gate for the Houma Navigational Canal, Terrebonne Parish, Houma, Louisiana

Oscar Pena
Shaw Coastal

In 2009 the Terrebonne Levee & Conservation District (TL&CD) implemented the Terrebonne Interim Flood Risk Reduction Program (T.I.F.R.R.P.) along the Morganza to the Gulf Hurricane Protection System Alignment. As part of this program, a floodwall and gate structure is proposed in the Houma Navigation Canal (HNC) that can be closed to stop the storm surge that travels northward from the Gulf of Mexico up the HNC. A Steel Swing Barge Gate (SBG) is being designed for installation in the HNC for the TL&CD near Houma, LA.

The project's goal is to construct a structure across the HNC that will control the storm surge and resulting crest in the HNC in concert with the levees on both sides thereby minimizing storm induced flooding in Terrebonne Parish. During normal HNC water levels, the gate will be open allowing canal traffic and water flow to pass through the opening. At the threat of impending weather, the swing barge gate will be dewatered to a floating position, winched into position across the HNC, and ballasted into a close position against two (2) receiving structures. This project will result in the design of the gate, receiving structures, floodwalls, pumps, winches, and pull structure necessary for the operation with the structural integrity needed to withstand the forces that will occur in a storm event.

Implications

Although this type of structure has been used in smaller waterways, it is thought that it could be utilized more in hurricane protection systems. This could reduce the overall initial cost thereby allowing more protection to be constructed. The HNC SBG will be the largest gate of this type constructed in Louisiana.

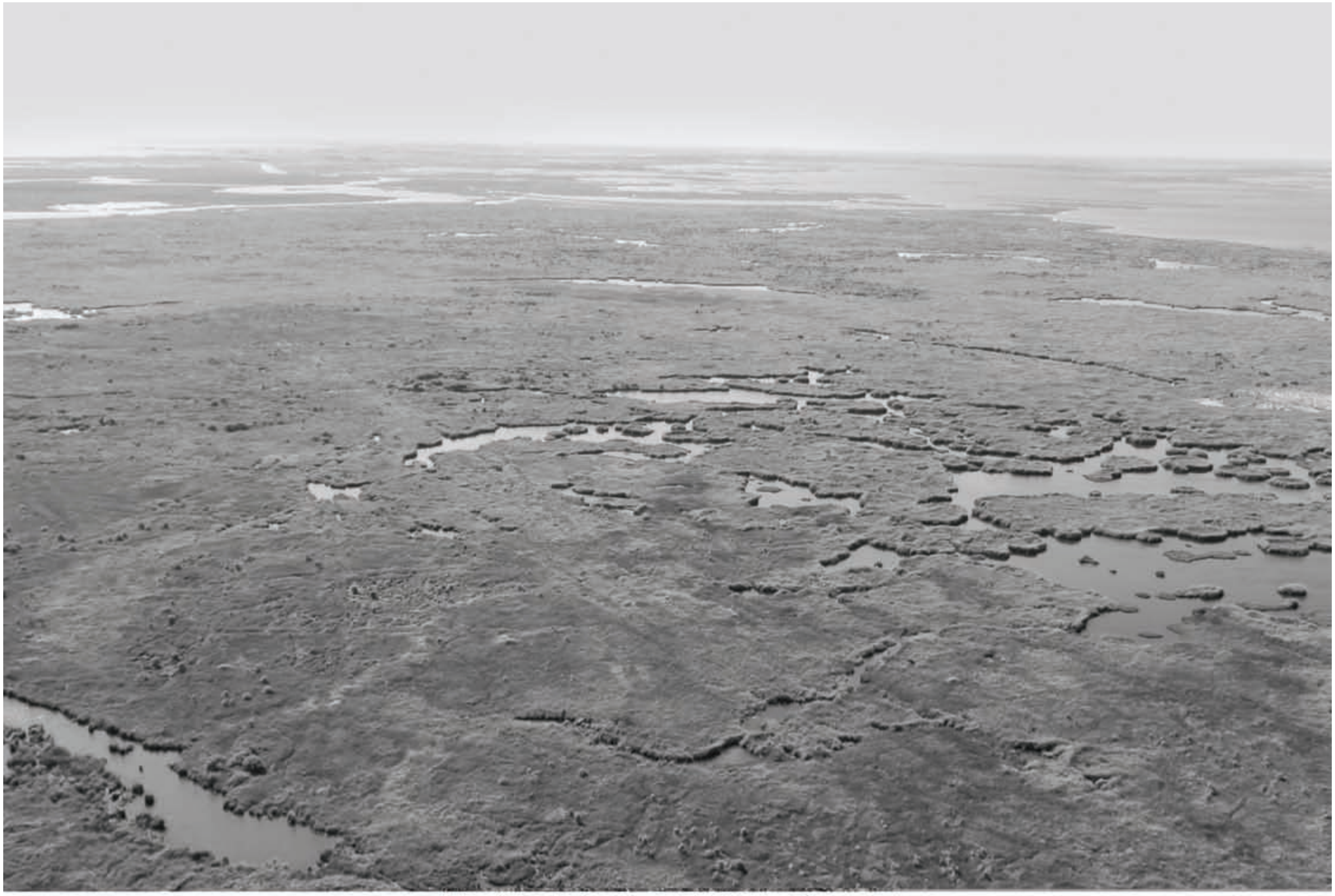
Sediment Management II (Room B)

Moderator: Syed Khalil, OCPR

Sediment Inventory for Federal Navigation Channel Maintenance in Louisiana: A Resource Tool for Coastal Planners

Jeff Corbino
US Army Corps of Engineers, New Orleans District

The U.S. Army Engineer District, New Orleans (MVN), maintains over 2,800 miles of waterways in Louisiana, and implements the largest maintenance dredging program in the nation. An average of 67 million cubic yards (mcy) of dredged material are removed annually from 11 major navigation channels extending across the coast from Texas to Mississippi, and as far north as Simmesport. Funding allocated to maintenance allows for the average annual beneficial use of about 16.5 mcy of dredged



Supporting habitat restoration and coastal resiliency in Louisiana and the Gulf Coast

NOAA Fisheries Service - Southeast Region
NOAA Fisheries Service - Restoration Center
NOAA National Ocean Service - Coastal Services Center

material for marsh creation, beach nourishment, barrier island restoration, and construction of "bird islands". To date, over 39 square miles of these coastal habitats have been created during routine channel maintenance. Additional beneficial use opportunities are limited by dredged material suitability, availability of sites for inland and ocean channel reaches, and other operational constraints. A dredged material inventory for MVN has been compiled from dredging records over the last decade that includes dredging quantities and frequencies, general sediment quality, and current placement practices for each channel reach. This inventory will help coastal restoration planners locate potential sediment resources near project sites, develop engineering solutions for transporting dredged material to project sites, generate cost estimates for placement alternatives, and identify obstacles to transport or placement of material based on current land-use and infrastructure within the project area.

Implications:

The utilization of sediments removed during annual maintenance dredging of Federal navigation channels for coastal restoration has lately become a topic of increased focus. This presentation seeks to correct misinformation that has been circulated in the press regarding dredging and disposal practices, and promote partnerships with coastal restoration groups to increase beneficial use of this resource. An inventory of sediments proposed for removal during future maintenance events will provide coastal planners an opportunity to identify sediment sources for restoration projects or find new applications for dredged material that will help achieve restoration goals.

Simulation and Analysis of Sediment Transport in Calcasieu Ship Channel and Surrounding Wetlands

Ning Zhang, *Saikiran Yadagiri*

Department of Engineering, McNeese State University, Lake Charles, LA 70609, USA

Calcasieu Lake is one of the major watersheds in the Chenier Plain. The Calcasieu Ship Channel passes through the Calcasieu Lake and connects the port of Lake Charles to the Gulf of Mexico. The ship channel is getting deeper and wider and thus altered the circulation of the lake water significantly, thus causes some problems. One of the problems is the excessive sedimentation found in the ship channel. Millions of dollars have to be spent each year to remove the unwanted sediments. It is very important to identify the source in order to prevent and reduce the sediments in the future. The numerical simulations were conducted to study the sediment transport in the entire system, including the watersheds and wetlands. The area of the interests includes the entire Calcasieu Lake, the Calcasieu Ship Channel, the Calcasieu River, and parts of the Intra-Coastal Canal connected to the ship channel. Particle tracking technologies will be applied in addition to the hydrodynamic simulations results to show the path of sediment particles. Mineralogical analysis of some collected samples was also conducted to assist the simulations by providing required data, as well as serving as validations. The study provides a better understanding of the entire dynamic system, therefore, make it possible to predict the sources of the sediments in the ship channel.

A National Sediment and Water-Quality Monitoring Network

Jim Stafanov

US Geological Survey

A National Sediment and Water-Quality Monitoring Network, composed of some 400 to 450 sites is proposed for implementation at an annual estimated cost of $75-$90 million. This level of funding will generate a nationally consistent data set that will help address the environmental, engineering, and socioeconomic impacts associated with sediments, nutrients, and sediment-associated chemical constituents. While the cost of this program is not minor, it can be shown to amount to <1% of the current annual estimated costs for dealing with ongoing sediment and water-quality issues. The proposed monitoring program will not only establish a long-term historic record, but will improve the science surrounding sediment and water-quality monitoring, as well management capabilities for maintaining sustainable national water resources. This monitoring program will build on, fill in the gaps, and provide a nationally consistent framework for existing and future programs, and permit the tracking of sediments, nutrients, sediment-associated chemicals, and water quality from headwater streams Hydrologic Benchmark Network, through medium-sized river basins National Water Quality Assessment Program, through major river basins National Stream Quality Accounting Network, and ultimately to coastal outlets.

This presentation describes the need for a national network, but focuses on the thrusts and requirements for initiation of a Mississippi River Basin (MRB) Pilot Program. The MRB Program includes some 68 monitoring sites, at a cost of $18 million in the first year, and about $14 million per annum in subsequent years and is proposed until it is subsumed by initiation of the National Network.

Ecosystem Modeling (Room C)

Moderator: Greg Stone, LSU

Hydrodynamic and Water Quality Modeling for the Convey Atchafalaya River Water to Northern Terrebonne Marshes Study

***Mark A. Hammons*[1] *and Donald L. Duncan*[2]**

[1] FTN Associates, Ltd. 2U.S. Army Corps of Engineers – St. Louis District

The Convey Atchafalaya River Water to Northern Terrebonne Marshes study is a Louisiana Coastal Area (LCA) project to investigate the potential of increasing existing Atchafalaya River fresh water influence to reduce the rate of loss in degrading central (Lake Boudreaux) and eastern (Grand Bayou) Northern Terrebonne marshes via the Gulf Intracoastal Waterway (GIWW). Potential project features include diverting additional Atchafalaya River water into the GIWW, improving conveyance by repairing banks and enlarging constrictions in the GIWW, improving water distribution within the marsh, and implementing outfall management measures. The project area extends from the Lower Atchafalaya River on the west to the Barataria Basin on the east.

A two-dimensional finite element hydrodynamic and water quality model of the project area was developed and calibrated to provide a basis for evaluating the proposed project alternatives. The model was developed using RMA2 (hydrodynamic modeling) and RMA11 (water quality modeling) software from Resource Modelling Associates of Sydney, Australia. The model incorporated finite element representations of portions of the project area originally developed for previous coastal restoration and hurricane protection projects. These finite element meshes were edited and expanded for this modeling project. Despite the large size and complexity of the model, the simulations were executed on high-end personal computers running 64-bit operating systems, with very manageable runtimes. This presentation will describe the development and calibration of the model.

Implications

Coastal restoration and hurricane protection projects often require modeling of large areas with sufficient resolution to evaluate the impact of proposed project features. In the past, such modeling has required access to computer resources available only to those supported by major research funding, thereby limiting the accessibility to and increasing the cost of modeling. Thanks to advances in computer technology and matrix solution techniques, even large and complex finite element models can have reasonable runtimes on inexpensive personal computers. Future coastal restoration projects could benefit from the type of modeling developed for this project, which demonstrates the feasibility, affordability, and accessibility of two-dimensional hydrodynamic and water quality modeling for coastal restoration projects.

A Method for Estimating the Benefits of Freshwater Introduction Into Coastal Wetland Ecosystems in Louisiana: Nutrient and Sediment Analyses

R.G. Boustany

Natural Resources Conservation Service. Lafayette, LA

A desktop numeric model (NSED) was developed to estimate the potential benefits of nutrients and sediments introduced into coastal marshes in Louisiana from freshwater diversions and to improve the predictability of coastal restoration alternatives. Nutrient benefits are based on the cumulative volume of water introduced by an average annual flow rate (cubic feet per second, cfs), the average total nitrogen and phosphorus concentration of the source water (mg l^{-1}), the nutrient requirements of the plants based upon the annual plant production rate per unit area (g m^{-2} y^{-1}), and proportion of nutrients retained in the system. Sediment benefits are based upon the cumulative volume of water introduced by the average annual flow, total suspended solid concentration (mg l^{-1}), bulk density of the receiving marsh area (g cm^{-3}), average depth of the receiver area (ft), and the retention of material introduced into the system. The sum of nutrient and sediment benefits represents a gross change that is then applied to adjust the annual land change rate. Model validation was performed on the three longest operating diversions in Louisiana–Caernarvon, Naomi Siphon, and West Pointe a la Hache Siphon. For the period of observation, the model output differed from observed land changes by -1.8%, 1.8, and 4.9% for each of the diversions, respectively. Model applications indicate that volume, concentration and retention of materials tend to be the most important controlling factors in determining the efficiency of marsh building. The model has proven to be a very useful tool for rapid assessment of benefits ranging from large scale diversions to small flow restoration projects.

Using Coastwide Reference Monitoring System (CRMS) Data to Refine Existing Habitat Switching Algorithms

Gregg A. Snedden[1], Gregory D. Steyer[1], and Jenneke Visser[2]

[1] *U.S. Geological Survey, National Wetlands Research Center*

[2] *Department of Renewable Resources, University of Louisiana at Lafayette*

Climate change and ecosystem restoration measures can result in altered hydroperiods and salinity regimes in coastal regions. Using models to predict shifts in floral community composition in response to these changes is an increasingly important task for coastal resource managers. Accurate determination of community response along environmental gradients is critical to enhancing performance of these models. To date, many predictive models are based on relatively little field data. Louisiana's Coastwide Reference Monitoring System (CRMS) provides data related to vegetation community composition, soil characteristics, and hydrology at over 300 coastal marsh locations in Louisiana, and CRMS provides an opportunity to empirically refine algorithms that feed community models. Two-Way Indicator Species Analysis (TWINSPAN) was used to determine commonly occurring vegetation assemblages at 173 CRMS sites. Canonical correspondence analysis (CCA) identified salinity and tidal amplitude as the hydrologic variables that most strongly correlated with community composition. Polytomous logistic regressions were used to parameterize community response curves and estimate the realized environmental niche of each community type. These findings can be readily integrated into existing vegetation community change models to increase reliability of future projections.

Implications

Most restoration efforts in coastal Louisiana alter the hydrology in the vicinity of the project area (e.g., altered salinity, changes in flooding duration, altered tidal exchange). Effective evaluation of restoration alternatives is important to maximize ecological benefits from a finite pool of restoration resources. Predicting changes in ecosystem structure that result from hydrologic perturbations is an important part of this evaluation, and the reliability of these predictions is limited by the accuracy of algorithms that drive ecosystem response models. Data collected under CRMS are currently providing robust datasets to 1) determine which aspects of hydrology are most important in governing vegetation communities and 2) provide statistically robust coefficients for algorithms used in ecosystem models.

LUNCH WITH KEYNOTE SPEAKER

Thursday, June 10 12:00 p.m. - 1:50 p.m.

Nancy Sutley

Council on Environmental Quality

Cafe' and Beignets Plenary Session

Thursday, June 10 1:50 p.m. -3:00 p.m.

Five Years After the Storms – Are we on the right path?

The Louisiana coastal crisis was brought to the national forefront after the storms of 2005. In response, changes were made in the way government is organized to deal with Louisiana's coastal crisis and substantial additional public funds were allocated.
Five years later, we must ask whether the changes, on top of all the efforts of the previous two decades, have resulted in a more sustainable coast and if not, are we at least on the right course. Discussion by the panel and audience will be focused on several aspects of this issue:

- ❑ Are our efforts on planning and implementing restoration and protection projects translating into discernible gains from a landscape perspective?
- ❑ Is more money the only thing we need to make a measurable difference on the ground in terms of coastal sustainability?
- ❑ What kind of changes need to be made in government, business and social systems to achieve a sustainable Louisiana coast?

"You can get so confused that you'll start in
to race down long wiggled roads at a break-necking pace
and grind on for miles across weirdish wild space,
headed, I fear, toward a most useless place."
– Dr. Seuss, Oh! The Places You'll Go!

Panel Moderator

Denise Reed
University of New Orleans

Panel Members

Gerald Galloway
University of Maryland, A. James Clark School of Engineering

Margaret Davidson
National Oceanic and Atmospheric Administration

Brigadier General Michael Walsh
Mississippi Valley Division, US Army Corps of Engineers (Invited)

Garret Graves
Governor's Office of Coastal Activities

Jim Tripp
Environmental Defense Fund

Special Oil Spill Session

Thursday, June 10 3:50 p.m. – 5:20 p.m.

The Louisiana coast is now faced with uncertain changes and impacts from the BP Oil Spill. Despite the current uncertainties surrounding the extent, duration and impact of the BP Oil Spill, we do know that those working to protect and restore the coast and its communities will be facing new challenges in the future.

As we wait to understand the extent of this event, there are numerous questions being asked. What are the real impacts of the BP Oil Spill? What remediation/restoration will be required? Will current restoration and protection efforts need to be modified? What occurs if a tropical storm or hurricane hits the region? Ultimately, everyone wants to know what the BP Oil Spill means to the sustainability and resilience of Louisiana's coast and communities.

In order to answer these questions, we need to have a clear understanding of what we know. In this session, we will gather experts to have a science-based, informative and interactive discussion between the panel members and the audience about the BP Oil Spill and its potential impacts on the Louisiana coast.

Panel Moderator

Donald Davis
Director Emeritus of Oral History and former Administrator of the Louisiana Applied and Educational Oil Spill Research and Development Program, Louisiana State University

Panel Members

David Kennedy
Director of NOAA's Office of Ocean and Coastal Resource Management

Irving Mendelssohn
Professor, Department of Oceanography and Coastal Sciences, Louisiana State University

Rex Caffey
Director, LSU Center for Natural Resource Economics & Policy

Edward Overton
Professor Emeritus, School of the Coast and Environment, Louisiana State University

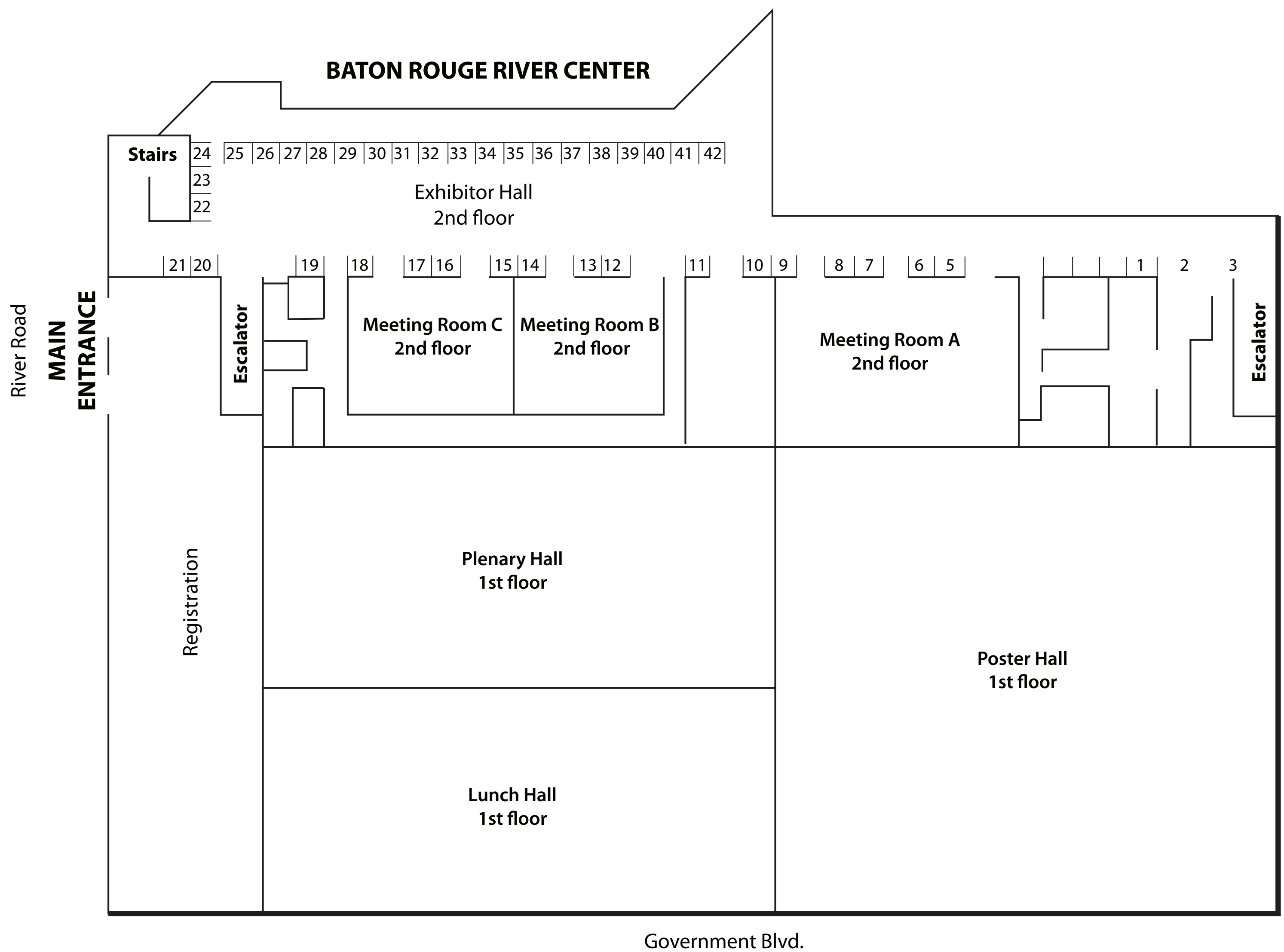
Felicia Coleman
Director, Florida State University's Coastal and Marine Lab

NOTES


RIVER ROAD
Lafayette St.
FLORIDA BLVD.
Hilton
Baton Rouge Capitol Center
Convention St.
North Blvd.
110
RIVERCENTER
BATON ROUGE
St. Louis St.
St. Ferdinand St.
GOVERNMENT STREET
France St.
BELLE OF BATON ROUGE CASINO & HOTEL
St. Phillip St.
10
Mississipi River
HIGHLAND ROAD
10
NICHOLSON DRIVE
N
Half Mile

Exhibitors Booth Locations

1. Restore America's Esturaries
2. Arcadis
3. USGS –National Wetlands Research Center
4. CWPPRA –The Coastal Wetlands Planning, Protection and Restoration Act Outreach Committee
5. BTNEP –Barataria-Terrebonne National Estuary Program
6. T. Baker Smith
7. Moffatt & Nichol
8. Shaw Environmental & Infrastructure
9. NOAA
10. CRCL
11. CPRA – Coastal Protection and Restoration Authority
12. NRCS
13. EPA –Region 6
14. CH2M Hill
15. Brown & Caldwell
16. Fenstermaker & Associates
17. HNTB
18. Coast Builders Coalition
19. Dynamic Solutions
20. Shallow Draft Workboats
21. Conoco Phillips
22. Floating Island Environmental Solutions
23. CDM
24. Louisiana Department of Natural Resources/Office of Coastal Management
25. Big Vision Media/ Matthew White Photography
26. LSU AgCenter
27. Restore or Retreat
28. Lonnie Harper, Inc.
29. Athena Technologies
30. CSA International, Inc.
31. PBS&J
32. GeoEngineers, Inc.
33. NWF
34. HDR
35. USACE –Mississippi Valley Division
36. USACE , ERDC – Flood Risk Management in the Corps of Engineers
37. USACE, ERDC - Coastal and Riverine Modeling in the Lower Mississippi River and Gulf of Mexico
38. USACE, ERDC - Estuarine Restoration in the Corps of Engineers
39. Burk Kleinpeter
40. URS
41. Louisiana Sea Grant
42. GEC, Inc.



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2. Arcadis
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3. USGS –National Wetlands Research Center
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4. CWPPRA –The Coastal Wetlands Planning, Protection and Restoration Act Outreach Committee
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5. BTNEP –Barataria-Terrebonne National Estuary Program
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6. T. Baker Smith
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7. Moffatt & Nichol
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10. CRCL
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11. CPRA – Coastal Protection and Restoration Authority
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12. NRCS
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13. EPA –Region 6
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14. CH2M Hill
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15. Brown & Caldwell
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17. HNTB
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18. Coast Builders Coalition
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20. Shallow Draft Workboats
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21. Conoco Phillips
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22. Floating Island Environmental Solutions
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23. CDM
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24. Louisiana Department of Natural Resources/Office of Coastal Management
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25. Big Vision Media/ Matthew White Photography
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26. LSU AgCenter
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27. Restore or Retreat
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28. Lonnie Harper, Inc.
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29. Athena Technologies
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30. CSA International, Inc.
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31. PBS&J
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32. GeoEngineers, Inc.
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33. NWF

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34. HDR

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35. USACE –Mississippi Valley Division

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36. USACE , ERDC – Flood Risk Management in the Corps of Engineers

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37. USACE, ERDC - Coastal and Riverine Modeling in the Lower Mississippi River and Gulf of Mexico

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38. USACE, ERDC - Estuarine Restoration in the Corps of Engineers

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40.URS

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41.Louisiana Sea Grant

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42. GEC, Inc.

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Thanks to our State of the Coast Committee Members

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- ❑ Denise Reed, University of New Orleans
- ❑ Chuck Wilson, Louisiana State University
- ❑ Barb Kleiss, U.S. Army Corps of Engineers/ LCA S&T
- ❑ Rick Raynie, Louisiana Office of Coastal Protection and Restoration/ LACES
- ❑ Scott Wilson, U.S. Geological Survey
- ❑ John Lopez, Lake Pontchartrain Basin Foundation
- ❑ Steven Peyronnin, Coalition To Restore Coastal Louisiana
- ❑ Andy Nyman, Louisiana State University
- ❑ Jeffrey Duplantis, ASCE Baton Rouge Chapter President

Program Committee

- ❑ Jim Pahl, Louisiana Office of Coastal Protection and Restoration
- ❑ Andy Nyman, Louisiana State University
- ❑ Ehab Meselhe, University of Louisiana at Lafayette
- ❑ Rex Caffey, Louisiana State University
- ❑ John Ettinger, Environmental Protection Agency
- ❑ Doug Daigle, CREST
- ❑ Rudy Simoneaux, Office of Coastal Protection and Restoration
- ❑ Mike Carloss, Louisiana Department of Wildlife and Fisheries
- ❑ Troy Constance, U.S. Army Corps of Engineers
- ❑ Tom Doyle, U.S. Geological Survey
- ❑ Joan Exnicios, U.S. Army Corps of Engineers
- ❑ Jonathan Brazzell, National Oceanic and Atmospheric Administration
- ❑ Natalie Snider, Coalition to Restore Coastal Louisiana

Café and Beignets Session Sub-Committee

- ❑ Denise Reed, University of New Orleans
- ❑ Barbara Keeler, Environmetal Protection Agency
- ❑ Ed Theriot, Malcolm Pirnie
- ❑ Cynthia Duet, Governor's Office on Coastal Activities
- ❑ Bob Thomas, Loyola University
- ❑ Karen Gautreaux, The Nature Conservancy
- ❑ Michaele Deshotels, Office of Coastal Protection and Restoration
- ❑ Greg Steyer, US Geological Service
- ❑ Robert Twilley, Louisiana State University
- ❑ Patricia Strayer, Brown and Caldwell
- ❑ Natalie Snider, Coalition to Restore Coastal Louisiana

Policy Plenary Sub-Committee

- ❑ Denise Reed, University of New Orleans
- ❑ Gerry Galloway, University of Maryland
- ❑ Jennifer Grand, Ducks Unlimited
- ❑ Sidney Coffee, America's Wetland
- ❑ Mark Davis, Tulane University
- ❑ David Jenkins, U.S. Army Corps of Engineers
- ❑ Karen Gautreaux, The Nature Conservancy
- ❑ Kyle Graham, Louisiana Governor's Office of Coastal Activites
- ❑ Steven Peyronnin, Coalition to Restore Coastal Louisiana
- ❑ Paul Harrison, Environmental Defense Fund
- ❑ Jim Wilkins, Louisiana State University
- ❑ Barbara Keeler, Environmental Protection Agency

Sponsorship Committee

- ❑ Betsy Brien, Conoco Phillips
- ❑ Jonathan Hird, Moffatt Nichol
- ❑ Gerry Duszynski, Fenstermaker & Associates
- ❑ PJ Hahn, Plaquemines Parish
- ❑ Patricia Strayer, Dynamic Solutions
- ❑ Linda Mathies, DHV
- ❑ Lance LaPlace, LaPlace Consulting Services
- ❑ Scott Kirkpatrick, Coast Builders Coalition
- ❑ Carolyn Woosley
- ❑ Stevie Smith, Morganza Action Coalition
- ❑ Oneil Malbrough, Shaw E&I
- ❑ Amy Tyrrell, Coalition To Restore Coastal Louisiana

STATE OF THE COAST

IMPLEMENTING A SUSTAINABLE COAST FOR LOUISIANA

CPRA
Coastal Protection and
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June 8-10, 2010 ❑ Baton Rouge River Center ❑ Baton Rouge, Louisiana