CNREP 2019

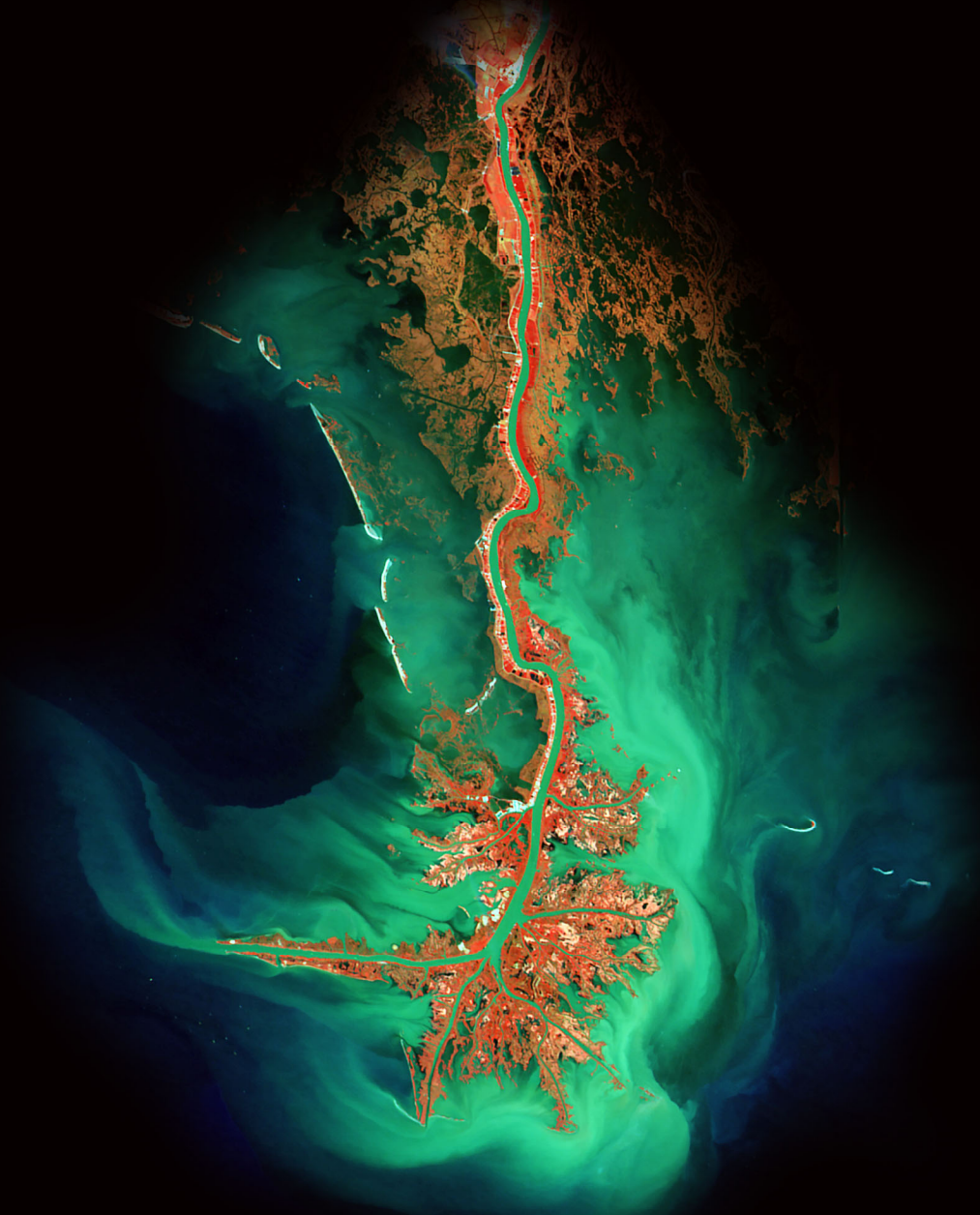## Challenges of Natural Resource Economics & Policy

6th National Forum on Socioeconomic Research in Coastal Systems

May 19-21   **New Orleans**

Program Contents

Welcome!

On behalf of the program committee, I welcome you to New Orleans and sincerely thank you for joining us for *CNREP 2019: Challenges of Natural Resource Economics and Policy.* We're always happy to greet old friends and make new acquaintances as we convene every three years in the city known as the "Big Easy". Since our first gathering in 2004, we've strived to create a unique atmosphere with this conference – a meeting that is not only timely, relevant and informative, but also casual, eclectic, and fun. Our sixth national forum will be no different.

The 2019 program features 162 presentations from attendees representing 65 public and private institutions located in 22 U.S. states and five countries. A quick "ctrl-f" of the program depicts topics that have always been a mainstay of our forum. The word *coast* appears 345 times, followed by other frequent flyers like *water* (324), *economic* (299) and *resource* (172). A similar search reveals a more recent focus on issues of increasing importance since our last gathering, such as *flood* (147), *risk* (120), and *insurance* (48). Moreover, a range of emerging topics signal some of latest frontiers in coastal socioeconomic research – including words like *access* (37), *health* (23) and *avulsion* (17).

As always, we try to balance this content with numerous opportunities for professional networking and socializing. Thanks in part to the generous support of our sponsors, we're once again able to offer an amenity-rich event with 12 hours of catered receptions, meals and breaks. We encourage you to take full advantage of the content and context of our forum. Our sincere hope is that you will find CNREP 2019 to be a rewarding experience, will come away with new and renewed friendships and have a better understanding of the important socioeconomic challenges facing coastal communities.

Once again, we welcome you to New Orleans and we extend to you our best wishes for a productive and enjoyable conference.

Sincerely,

Rex H. Caffey
CNREP 2019 Conference Chairman

Program Committee

Naveen Adusumilli, Assistant Professor, Department of Agricultural Economics and Agribusiness, Louisiana State University Agricultural Center

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Special Thanks

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Rogers Leonard, Associate Vice President and Program Leader, Louisiana State University Agricultural Center

Phillip Elzer, Executive Associate Dean, Louisiana State University College of Agriculture

Robert Twilley, Executive Director, Louisiana Sea Grant College Program and Professor, Department of Oceanography and Coastal Sciences, Louisiana State University

Mike Salassi, Professor and Head, Louisiana State University Department of Agricultural Economics and Agribusiness

Chuck Wilson, Chief Science Officer, Gulf of Mexico Research Initiative, Gulf of Mexico Alliance

Burt Singer, Board of Directors, Gulf of Mexico Research Initiative

Scott Wilson, Branch Chief, Wetland and Wildlife Conservation Branch, United State Geological Survey Wetland and Aquatic Research Center

David Yoskowitz, Associate Director for Research, Policy and Development; Endowed Chair for Socio-Economics, Harte Research Institute, Texas A&M University-Corpus Christi

Jason Shackelford, Coastal Resource Sciences Manager, Freese and Nichols, Inc.

Mike Miner, Director of Applied Geosciences, The Water Institute of the Gulf

Mark Davis, Director, Tulane Institute on Water Resources Law and Policy; Director, Tulane ByWater Institute, Director, Tulane Center for Environmental Law

Jonathan Hird, Business Unit Leader and Associate Vice President, Moffatt & Nichol

William Norman, Coastal Business Development Manager, SWCA

Steve Ashby, Co-Director, Northern Gulf Institute

Charles Colgan, Research Director, Center for the Blue Economy, Middlebury Institute of International Studies

Robert Ray, Art Director, Louisiana Sea Grant College Program

Jody K. Bissett, Administrative Coordinator, Department of Agriculture Economics and Agribusiness, Louisiana State University Agricultural Center

Lindsay Rushing, Accounting Coordinator, Louisiana Sea Grant College Program

Judith P. Johnson, Coordinator, Louisiana Sea Grant College Program

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Sapana Bastola	Michael Heaton
Dependra Bhatta	Patrice Lazard
Daniel Bosch	Ran Li
Vikash Dangal	Jessica Parfait
Conner Fagan	Santosh Pathak
Tej Gautam	Zhaoyi Li
Ana Gutierrez Castillo	Zhaohui Yang

About the Center

The Center for Natural Resource Economics & Policy (CNREP) originated in 1999 with a small working group of faculty in the Department of Agricultural Economics at Louisiana State University. The center was formally recognized in 2003 by the LSU Board of Supervisors and the Louisiana Board of Regents.

The center serves as a cooperative for environmental economists and legal scholars engaged in research and extension programs that contribute to the management and sustainability of natural resources. Center cooperators maintain active projects in six primary focus areas, including the bioeconomics of energy use, wetland valuation and economic linkages, economic management of fisheries, human dimensions of wildlife habitat conservation, economics of forest management and product development, and socioeconomics of land and water policy.

The mission of the center is to foster the interaction of socioeconomic professionals to address natural resource and environmental challenges in coastal regions of the United States and abroad. A primary function of the center is coordinating the triennial research forum: *Challenges of Natural Resource Economics & Policy*. The 2019 forum marks the sixth national CNREP conference, with previous forums convened in 2004, 2007, 2010, 2013 and 2016.

To learn more about CNREP, visit: *www.cnrep.lsu.edu*

Conference Support

Partners

Louisiana State University Agricultural Center
www.lsuagcenter.com

Louisiana Sea Grant College Program
www.laseagrant.org

Gulf of Mexico Research Initiative
http://gulfresearchinitiative.org

Coastal Wetlands Planning, Protection and Restoration Act
http://lacoast.gov/new/default.aspx

Sponsors

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www.swca.com

Keynote Speakers

Roy E. Wright
"Science Driving Resilience: Stronger Homes, Business and Communities"
Monday, May 20, 2019 8:30 am

Roy Wright joined the Insurance Institute for Business & Home Safety (IBHS) in 2018 with more than 20 years of experience in insurance, risk management, mitigation and resilience planning. Convinced that the continuing cycle of human suffering that strikes families and communities in the wake of severe weather can be broken, Wright leads a team of scientists and risk communicators who deliver strategies to build safer and stronger homes and businesses. IBHS' real-world impact enables the insurance industry and affected property owners to prevent avoidable losses. Wright joined IBHS from the Federal Emergency Management Agency (FEMA) where he served as the Chief Executive of the National Flood Insurance Program, led the agency's Federal Insurance and Mitigation Administration and directed the resilience programs addressing earthquake, fire, flood and wind risks. In these roles, he guided several programs that promote a risk-conscious culture, enable faster disaster recovery and address long-term vulnerabilities to life, property and well-being in communities across the United States. Prior to joining FEMA in 2007, Wright worked in public and private sector roles with Coray Gurnitz Strategy Consulting and the U.S. Department of the Interior. A native of California, Wright earned a bachelor's degree in political science from Azusa Pacific University and a Master of Public Administration from the George Washington University.

Pawan G. Patil
"Toward a Blue Economy: Nourishing Nations and Stimulating Sustainable Growth"
Monday, May 20, 2019 12:00 pm

Pawan G. Patil, PhD, is a development banker, Harvard, Oxford and London School of Economics trained economist and serial social entrepreneur. With more than 19 years at the World Bank, he has followed his twin passions, co-developing the institution's multi-billion-dollar portfolio on Oceans and the Blue Economy, and co-creating social enterprises and initiatives in support of adolescent girls and young people. His work has been featured in dozens of peer reviewed journals and newspapers, including *The Economist*, *Financial Times*, *New York Times*, *Huffington Post* and *Nature*. Patil is the recipient of several innovation awards in support of ocean-facing developing countries. He was selected as a World Economic Forum (WEF) Young Global Leader and served as a member of WEF's Global Agenda Council for Oceans and the founding boards of Nike Foundation, Youth2Youth, Mobile Movement and Mapping Ocean Wealth – which was awarded the 2017 Tourism for Tomorrow Innovation Award and World Travel and Tourism Council's annual Global Tourism Summit in Bangkok He currently lives in the Washington, DC area with his wife of more than 20 years and two children.
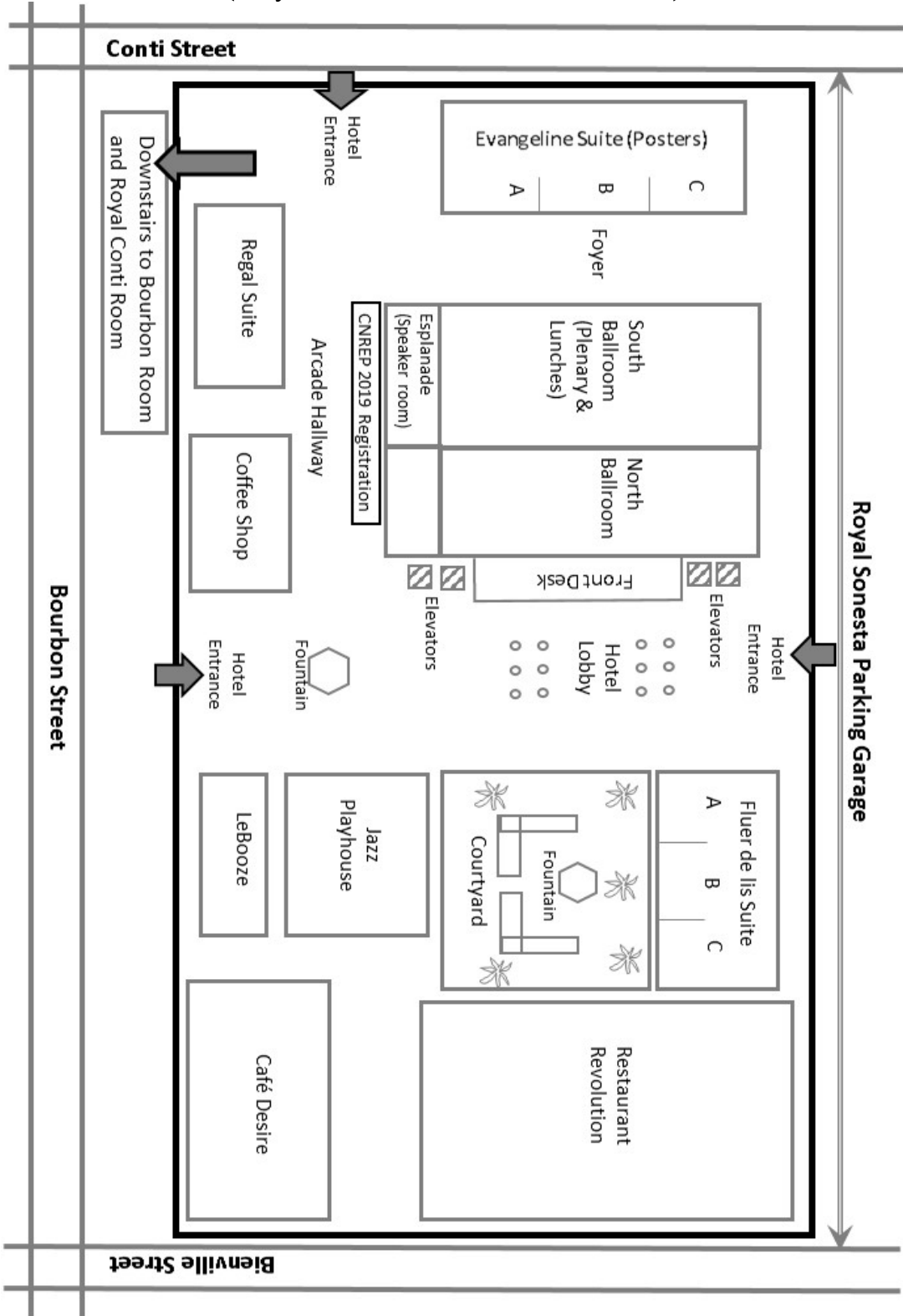
James Barnett
"The Mississippi: A River of Change"
Tuesday, May 21, 2019 12:00 pm

Jim Barnett is the retired Director of the Historic Properties Division with the Mississippi Department of Archives and History. He has written three books and numerous articles for history and archaeology journals. His latest book is *Beyond Control: The Mississippi River's New Channel to the Gulf of Mexico*. Barnett describes the Mississippi as a waterway of change, unnaturally confined by ever-larger levees and control structures. During the great flood of 1973, the river nearly changed its course for a shorter and steeper path to the sea. *Beyond Control* traces the history of this phenomenon, beginning with a major channel shift around 3,000 years ago. Told against the backdrop of the Lower Mississippi River's impending diversion, the book's chapters chronicle historic floods, rising flood crests, a changing strategy for flood protection and competing interests in the management of the Old River outlet. *Beyond Control* is both a history and a close look at an inexorable, living process happening now in the 21st Century.

Meeting Space
(Royal Sonesta Hotel - First Floor)

Conti Street

Bourbon Street

Bienville Street

Royal Sonesta Parking Garage

Hotel Entrance

Downstairs to Bourbon Room and Royal Conti Room

Regal Suite

Coffee Shop

Arcade Hallway

CNREP 2019 Registration

Evangeline Suite (Posters)

A | B | C

Foyer

Esplanade (Speaker room)

South Ballroom (Plenary & Lunches)

North Ballroom

Front Desk

Elevators

Elevators

Hotel Entrance

Hotel Lobby

Hotel Entrance

Fountain

Hotel Entrance

LeBooze

Jazz Playhouse

Courtyard

Fountain

Fluer de lis Suite

A | B | C

Café Desire

Restaurant Revolution

Conference Agenda

	Sunday, May 19, 2019
2:00 pm to 5:00 pm Arcade Hallway	**Registration Desk Open**
2:00 pm to 5:00 pm Esplanade	**Speaker Resource Room Open**
2:00 pm to 5:00 pm Evangeline Suite	**Poster Set-Up**
6:30 pm to 9:00 pm Bourbon Balcony Suite Room 2110	**CNREP 2019 Opening Reception and Conference Social** Join us on Sunday evening, May 19th for the CNREP 2019 Welcome Reception. This event will be an opportunity to socialize with other participants while enjoying a variety of hors d'oeuvres and beverages. The reception will take place in the Royal Sonesta's premier balcony suite overlooking Bourbon Street. This reception is sponsored by the LSU Center for Natural Resource Economics & Policy.
	Monday, May 20, 2019
7:00 am to 5:00 pm Arcade Hallway	**Registration Desk Open**
7:00 am to 5:00 pm Esplanade	**Speaker Resource Room Open**
7:00 am to 3:30 pm Evangeline Suite	**Poster Set-Up**
7:00 am to 8:30 am Foyer	**Continental Breakfast**
8:30 am to 10:00 am South Ballroom	**CNREP 2019 Plenary Session** **8:30 Welcome and Opening Announcements** Rex Caffey, Director, LSU CNREP, Professor, LSU AgCenter and Louisiana Sea Grant College Program Michael Salassi, Department Head and Professor, LSU Dept. of Agricultural Economics & Agribusiness Robert Twilley, Executive Director, Louisiana Sea Grant College Program **9:00 Keynote Presentation:** **Science Driving Resilience: Stronger Homes, Business and Communities** Roy E. Wright President & Chief Executive Officer, Insurance Institute for Business & Home Safety

10:00 am to 10:30 am Foyer	**Morning Break**

Monday, May 20, 2019 **10:30 am to 12:00 noon** Regal Room **Moderator:** Jonathan Lee East Carolina University	**Coastal Hazards and Insurance Challenges** **Prepare to Prevent: Reducing Losses with the National Flood Insurance program and the Community Rating System** Jennifer Argote (Louisiana State University) **Does the Community Rating System Work? Evidence from Two Gulf Coast States** Eugene Frimpong (East Carolina University), Daniel Petrolia and Ardian Harri (Mississippi State University) **Hurricanes and U.S. County-to-County Migration** Danae Hernández Cortés (University of California-Santa Barbara) and Margaret Walls (Resources for the Future) **Distributional Impacts of Flood Hazards and Insurance** Okmyung Bin, John Bishop, Jonathan Lee and Lester Zeagler (East Carolina University)
Monday, May 20, 2019 **10:30 am to 12:00 noon** Royal Conti Room **Moderator:** Seong Yun, Mississippi State University	**Valuation Efforts in Coastal Ecosystems: Current Applications and Future Directions** **Optimal Portfolio Design to Manage Oyster Resources** Frederick Nyanzu, Daniel Petrolia, Ardian Harri and Seong Yun (Mississippi State University), William Walton (Auburn University) and Just Cebrian (Dauphin Island Sea Lab) **Accounting for Attribute Non-Attendance in Three Previously-Published Choice Studies of Coastal and Marine Resources** Daniel Petrolia (Mississippi State University) and Joonghyun Hwang (Florida Fish & Wildlife Conservation Commission) **Measuring Risk Preferences in the Field** Craig Landry and Dylan Turner (University of Georgia) **Capital Asset Pricing for Nature (capn): Deterministic vs. Stochastic Approaches** Seong Yun (Mississippi State University), Joshua Abbott (Arizona State University) and Eli Fenichel (Yale University)
Monday, May 20, 2019 **10:30 am to 12:00 noon** Bourbon Room **Moderator:** David M. Cochran University of Southern Mississippi Sponsored by: Gulf of Mexico Research Initiative	**Coupled Human Environmental Systems** **Improving Community Preparedness for Oil spills: A Multi-Regional Approach** Melissa Partyka (Mississippi-Alabama Sea Grant), Christine Hale (Texas Sea Grant), Emily Maung-Douglass (Louisiana Sea Grant), Stephen Sempier, Tara Skelton and LaDon Swann (Mississippi-Alabama Sea Grant), Monica Wilson (Florida Sea Grant) **Tapping a Research Resource: Rich Datasets of Coastal Information for the Gulf of Mexico, US and Beyond** Emily Maung-Douglass (Louisiana Sea Grant), Christine Hale (Texas Sea Grant), Kirsten Larsen, Sharon Mesick, Angela Sallis (NOAA), Missy Partyka (Mississippi-Alabama Sea Grant), (NOAA), Stephen Sempier (Mississippi-Alabama Sea Grant), Tara Skelton (Mississippi-Alabama Sea Grant), LaDon Swann (Mississippi-Alabama Sea Grant), Monica Wilson (Florida Sea Grant) **Understanding the Socio-Spatial Variation of Perception of Resilience Among the Mississippi Gulf Coast Communities** Bandana Kar (Oak Ridge National Laboratories), David M. Cochran Jr. (University of Southern Mississippi),Xiaohui Liu (Dalhousie University), Joslyn Zale (National Consortium for Spectator Sports Safety and Security), Nicole Callais (University of Tennessee) **Unique Challenges and Adaptive Solution to Climate Science Communication:** **Case Study from Mississippi** Dominika Parry (2oC Mississippi)

	Community Engagement through Regional 'Surge Consortiums' to Reduce Risk and Enhance Resiliency in Southeast Louisiana Michael Hopkins and John Lopez (Lake Pontchartrain Basin Foundation)
Monday, May 20, 2019 **10:30 am to 12:00 noon** Fluer de lis Room A **Moderator:** Gregory Upton Louisiana State University	**Perspectives on Conventional and Alternative Energy** **Estimating the Economic Impacts of Oil and Gas Activities in the Gulf of Mexico** Mark Jensen (Bureau of Ocean Energy Management) **Community Preferences for Tidal Energy: A Choice Experiment in Puget Sound Washington** Keila Meginnis (University of Glasgow), Dan Rigby (University of Manchester), Michael Burton (University of Western Australia) **Powering Tourism: Wind Energy and Its Impact on Rural Tourism in Ilocos Norte, Philippines** Mishael Barrera (Mariano Marcos State University) **Assessing the Effectiveness of Feed-in-Tariffs and Renewable Portfolio Standards: An Analysis of Global Renewable Energy Policy** Gregory B. Upton (LSU Center for Energy Studies), Sanya Carley (Indiana University Bloomington)
Monday, May 20, 2019 **12:00 noon to 1:30 pm** South Ballroom	**Lunch** Keynote Presentation **Toward A Blue Economy: Nourishing Nations; Stimulating Sustainable Growth** Pawan Patil Senior Economist for the Environment, World Bank
Monday, May 20, 2019 **1:30 pm to 3:00 pm** Regal Room **Moderator:** David Yoskowitz Harte Research Institute Texas A & M University Sponsored by: Harte Research Institute	**Managing Water for the Extremes** **Managing Water for the Extremes** David Yoskowitz (Texas A & M University) **Development and Transfer of a Predictive Water Pricing Model from Australia to Texas** Quinn McColly (Harte Research Institute, Texas A&M University-Corpus Christi) **Factors Affecting Water Usage from Texas' Colorado River** Rosa Marie Garcia (Texas A&M University) **The Price of Water: From Economics to Equity** Margaret Schneemann (Illinois Indiana Sea Grant), Nora Beck (Chicago Metropolitan Agency for Planning), Danielle Gallet (Chicago Metropolitan Planning Council)
Monday, May 20, 2019 **1:30 pm to 3:00 pm** Royal Conti Room **Moderator:** Charles Colgan Middlebury Institute of International Studies	**Assessing the Value of Ocean Observing Systems** (Brief Presentations and Panel Discussion) **Estimating Benefits from Public Investments in Operational Oceanography** Hauke Kite-Powell (Woods Hole Marine Policy Center) and Charles Colgan (Middlebury Institute of International Studies) **The Consortium for the Valuation of Applications Benefits Linked with Earth Science (VALUABLES)** Yusuke Kuwayama and Bethany Mabee (Resources for the Future) **Public Opinion of a Gulf-Wide Beach Conditions Reporting System** Daniel Petrolia (Mississippi State University), Jerrod Penn (Louisiana State University), Rex Caffey and Matthew Fannin (Louisiana State University)

	Preferences and Values for the Gulf Coast Ocean Observing System Rex Caffey, Cody Plummer, Hua Wang (Louisiana State University) and Dan Petrolia (Mississippi State University)
Monday, May 20, 2019 **1:30 pm to 3:00 pm** Bourbon Room **Moderator:** David M. Cochran University of Southern Mississippi Sponsored by: Gulf of Mexico Research Initiative	**Coupled Human Environmental Systems** (Discussion Panel) How can scientific research be translated so that policy makers, local leaders and the lay public better understand the need to alter contemporary human-environment interactions and to create a more sustainable and resilient Gulf of Mexico? Who are the partners that might create effective linkages between scientific research and local communities of the Gulf Coast? This panel session focuses on the opportunities and challenges of translating science into public knowledge with the goal of creating positive social and ecological change in the Gulf of Mexico. Drawing together a team of researchers and practitioners, this panel will examine strategies about how to transform scientific data into actionable knowledge that can help policy makers and local stakeholders better understand the need to alter contemporary human activities as part of a broader strategy to create a more sustainable and resilient Gulf of Mexico. **Michael Hopkins** Lake Pontchartrain Basin Foundation **Dominika Parry** 2oC Mississippi **Melissa Partyka** Mississippi-Alabama Sea Grant **Denis Wiesenburg** University of Southern Mississippi
Monday, May 20, 2019 **1:30 pm to 3:00 pm** Fluer de lis Room A **Moderator:** Mark Davis Tulane Institute on Water Resources Law and Policy	**Tipping Points:** **Finding and Funding the Capacity for Coastal Communities to Extend their Lifespan** **Finding Capacity to Extend Community Lifespan** Mark Davis (Tulane Institute on Water Resources Law and Policy) **Investment in Coastal Communities: Financing Options for Coastal Protection and Restoration** Kristen Hilferty (Tulane Institute on Water Resources Law and Policy) **GOMESA and the Future of Coastal Restoration and Protection Funding** Stephen Barnes (Louisiana State University) **Louisiana's Seafood Future: An Industry Adapts to Coastal Change** Patrick Banks (Louisiana Dept. of Wildlife & Fisheries), Brian Lezina (Louisiana Coastal Protection and Restoration Authority) and Robert Twilley (Louisiana Sea Grant College Program)
3:00 pm to 3:30 pm Foyer	**Afternoon Break**
Monday, May 20, 2019 **3:30 pm to 5:00 pm** Regal Room **Moderator:**	**Coastal Hazard Response, Mitigation and Resilience** (Brief Presentations and Discussion Panel) **Measuring Wellbeing, Resilience and Recovery as a Guide for Community Development** Traci Birch (Louisiana State University Coastal Sustainability Studio)

Melissa Daigle Louisiana Sea Grant Law and Policy Program	**The Eclipse of Risk Memory in the Amite River Basin** Craig Colten (Louisiana State University) **Measuring Individual Community Capacity, Resilience and Recovery in Three Louisiana Coastal Parishes** Aimee Moles (Louisiana State University) **Where will the Water Go?** Melissa Daigle and Niki Pace (Louisiana Sea Grant Law & Policy Program)
Monday, May 20, 2019 **3:30 pm to 5:00 pm** Royal Conti Room **Moderator:** Lisa Wainger University of Maryland Center for Environmental Science	**Policy-Relevant Valuation of Restoration in Large Water Bodies** **The Value of Water Quality to Coastal Recreation in New England** Marisa Mazzotta, Nathaniel Merrill, Kate Mulvaney (U.S. EPA Office of Research and Development, Atlantic Ecology Division) and Sarina Atkinson **Planning for Unpredictability: The Value of Invasive Species Research** Matthew A. Weber, Lisa A. Wainger (Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science): Nathan E. Harms (Engineer Research and Development Center, US Army Corps of Engineers): Geneviève M. Nesslage (Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science) **Economic Benefits of Protecting a Shared Marine Area - Knowledge Accumulated on the Baltic Sea in Northern Europe** Heini Ahtiainen (Natural Resources Institute Finland & Baltic Marine Environment Protection Commission), Christine Bertram (Kiel Institute for the World Economy), Tuija Lankia (Natural Resources Institute Finland), Jürgen Meyerhoff (Technische Universität, Germany), Eija Pouta (Natural Resources Institute Finland), Kristine Pakalniete (AktiiVS Ltd, Riga, Latvia), Katrin Rehdanz (Kiel University, Germany) and Janne Artell (Natural Resources Institute Finland) **Evaluating the Social Efficiency of Chesapeake Bay Restoration: Implications for Measuring and Maximizing Net Benefits of Water Quality Programs** Lisa Wainger (Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science)
Monday, May 20, 2019 **3:30 pm to 5:00 pm** Fluer de lis Room A **Moderator:** Jack Isaacs Louisiana Department of Wildlife and Fisheries	**Economic Value and Trends of Commercial Fisheries** **Derelict Pot Impacts on Commercial Blue Crab Harvest and Collaborating with Crabbers to Address the Problem** James DelBene, Andrew M Scheld and Donna M Bilkovic (Virginia Institute of Marine Science at William & Mary) **The Impact of the Deepwater Horizon Spill on Commercial Blue Crab Landings** Jacqueline Fiore (Tulane University), Shanthi Nataraj and Craig Bond (RAND Corporation) **Economic Recovery Paths of Mississippi Oyster Harvesting** Benedict C. Posadas (Mississippi State University, Mississippi-Alabama Sea Grant Extension Program) **Understanding Louisiana's Freshwater Commercial Fishery** Lauren E. Bonatakis and Julie A. Lively (Louisiana State University) **Entry, Exit and Continuous Participation in Louisiana's Fisheries Markets among Licensed Seafood Dealers** Jack C. Isaacs (Louisiana Department of Wildlife and Fisheries)

Monday, May 20, 2019 **3:30 pm to 5:00 pm** South Ballroom **Moderator:** Shaun Tanger Louisiana State University	**Lightning Round** Three-minute presentations in rapid-fire succession. • **NOAA's Blue Economy Priorities** Chris Hayes (NOAA Office of Legislative and Intergovernmental Affairs) • **Estimating the Impact of Hurricanes and Harmful Algae Blooms on the Tourism Economy** Sergio Alvarez (University of Central Florida) • **Northern Gulf of Mexico Sentinel Site Cooperative** Renee Collini (Mississippi State University/Mississippi-Alabama Sea Grant) • **Sea-level Rise in Planning: Resources for "What is Sea-level Rise" through "What Scenario Should I Use?"** Renee Collini (Northern Gulf of Mexico Sentinel Site Cooperative) • **The Costs of Climate Justice: What is the Value of a Village and Who Should Pay to Move It?** E. Barrett Ristroph, (Ristroph Law, Planning, and Research) • **Gulf TREE: A Resource for Finding Climate Resilience Tools** Mikaela Heming and Renee Collini (Northern Gulf of Mexico Sentinel Site Cooperative, Mississippi State University/Mississippi-Alabama Sea Grant) • **Changing Behavior for Public Good: Social Marketing 101 and the Outreach Program Audit Tool** Jennifer Dindinger and Amanda Rockler (University of Maryland Sea Grant) • **Watershed Stewards Academy: A Community Engagement Model for Meeting Chesapeake Bay Restoration Goals** Amanda Rockler and Jennifer Dindinger (University of Maryland Sea Grant) • **Valuation of Wetland Restoration Program in Arkansas: A Difference-in-Difference Approach Based on Machine Learning Method** Matthew Richardson, Pengfei Liu, Michael Eggleton (University of Arkansas Pine Bluff) • **How to Build Resilience in Our Coastal Communities, Our Businesses and Our Lives** Scott Thomas (Stetson Engineers & Desert Research Institute) • **Forced Relocation Because of a Natural Resource-based Industry: Vulnerability Assessment of the Displaced People** Siyu He, Krishna Paudel, Weizhong Zen and Dongmei Li (Louisiana State University) • **Factors Affecting Groundwater Use in Coastal Louisiana Agriculture** Dependra Bhatta and Krishna P. Paudel (Louisiana State University) • **Galveston Bay Foundation's Oyster Shell Recycling Program and Volunteer-Based Oyster Gardening Program** Michael Niebuhr (Galveston Bay Foundation) • **Characterizing the Southern Flounder Fishery in Louisiana** Dave Smith and Steve Midway (Louisiana State University), Jack Isaacs (Louisiana Department of Wildlife and Fisheries) • **Perceptions of Hurricane Irma among Recreational Lobster Fishers in Key West, Florida** Elizabeth Conley, Kelsi Furman, Steven Scyphers (Northeastern University Marine Science Center) • **Sustainable Seafood Certification: The End or Just the Beginning?** Damon C. Morris, former Program Director, Sustainable Fisheries and Seafood, Louisiana Department of Wildlife and Fisheries • **The Ecosystem Value Toolkit** David Batker (Earth Economics)

Monday, May 20, 2019 **5:00 pm to 6:30 pm** Evangeline Suite	**Poster Viewing/Social** Enjoy a complimentary beverage while viewing the CNREP 2019 posters during the manned poster session. • **Factors Affecting Groundwater Use in Coastal Louisiana Agriculture** Dependra Bhatta and Krishna P. Paudel (Louisiana State University) • **Northern Gulf of Mexico Sentinel Site Cooperative** Renee Collini (Mississippi State University/Mississippi-Alabama Sea Grant) • **Sea-level Rise in Planning: Resources for "What is Sea-level Rise" through "What Scenario Should I Use?** Renee Collini (Northern Gulf of Mexico Sentinel Site Cooperative) • **Gulf TREE: A Resource for Finding Climate Resilience Tools** Mikaela Heming and Renee Collini (Northern Gulf of Mexico Sentinel Site Cooperative, Mississippi State University/Mississippi-Alabama Sea Grant) • **Changing Geographies of Flood Mitigation Policies: A Case Study of Central, LA** Ria Mukerji (Louisiana State University) • **A Critical Source Approach to Control Water Pollution Using Best Management Practices** Bijay K Pokhrel, Krishna P. Paudel and Huizhen Niu (Louisiana State University) • **Identifying the Optimal Locations for Poultry Litter based Electric Reactors using Multi-Criteria Evaluations in GIS** Huizhen Niu and Krishna P. Paudel (Louisiana State University and LSU AgCenter) and Qiuzhuo Ma (Guangdong University of Foreign Studies; Doleswar Bhandari, New Mexico State University) • **Valuation of Wetland Restoration Program in Arkansas: A Difference-in-Difference Approach based on Machine Learning Method** Matthew Richardson, Pengfei Liu, Michael Eggleton (University of Arkansas Pine Bluff) • **Compounding Disruptions and Cascading Failures: A Framework for Assessing and Enhancing Resilience** Scott Thomas (Stetson Engineering) and Dave Kerner (LMI) • **Forced Relocation Because of a Natural Resource-based Industry: A Vulnerability Assessment of Displaced People** Siyu He, Krishna Paudel, Weizhong Zen and Dongmei Li (Louisiana State University) • **Galveston Bay Foundation's Oyster Shell Recycling Program and Volunteer-Based Oyster Gardening Program** Michael Niebuhr (Galveston Bay Foundation) • **Perceptions of Hurricane Irma among Recreational Lobster Fishers in Key West, Florida** Elizabeth Conley, Kelsi Furman, Steven Scyphers (Northeastern University Marine Science Center) • **Staying Afloat: The Legal Issues Related to Maintaining a Vessel-Based Grocery Store** Daniel Bosch (Louisiana Sea Grant Law & Policy Program) • **Increasing Capacity for Local Communities to Respond to Climate Change** Tracie Sempier (Mississippi-Alabama Sea Grant Consortium and Gulf of Mexico Alliance), Melissa Daigle and Katie Lea (Louisiana Sea Grant College Program), Renee Collini and Amy Gohres (Northern Gulf of Mexico Sentinel Site Cooperative and Mississippi State University) • **Impacts of Hurricane Irma on People and the Built Environment in the Florida Keys: A Survey of Coastal Residents** Kiera O'Donnell, Sharon Harlan, Tori Tomiczek and Steven Scyphers (Northeastern University Marine Science Center) • **The Local and Basin-wide Impact of Baton Rouge Stormwater Laws** Conner Fagan, Louisiana Sea Grant Law & Policy Program • **Changes for Gulf Red Snapper Management** Michael Heaton (Louisiana Sea Grant Law & Policy Program)

	- **Current status and trends of Soft Shell Blue Crab Production and Producers in Louisiana, Maryland and Virginia** Julie A. Lively (Louisiana Sea Grant and Louisiana State University Agricultural Center), Eric J. Schott (University of Maryland) and Hamash J. Small (Virginia Institute of Marine Science, College of William & Mary) - **Winning Ugly: The Potential for Converting Ugly Food to a Horizontally Differentiated Product** Ran Li, Danyi Qi and Jerrod Penn (Louisiana State University), Brian Roe (Ohio State University) - **Social Media Users Food Safety Risk Information Seeking Behavioral Intention in the Impact of Food Safety Incidents in China: Multi-Group Analysis Based** - **on Consumer Characteristics** Zhaohui Yang (Louisiana State University) - **Coastal Wetland Planning Protection and Restoration Act (CWPRA) Preserving Wetlands Since 1990** Jennifer Ritter Guidry, Kacie M. Wright, Scott A. Wilson (USGS/Wetland & Aquatic Research Center) - **Economic Comparison of OCS Sand vs. Nearshore Sand for Coastal Restoration Projects** Hua Wang and Rex Caffey (Louisiana State University), Daniel Petrolia (Mississippi State University), Ioannis Georgiou (University of New Orleans) and Mike Miner (Water Institute of the Gulf) - **Willingness to Pay to Support Honey Bee Pollinator Conservation** Alexander Hildreth and Jerrod Penn (Louisiana State University), Macy Hagan (University of Kentucky) and Wuyang Hu (Ohio State University) - **Risk Information Seeking Behavioral Intention of Online Food Purchasers in China** Zhaohui Yang (South China Agricultural University), Krishna Paudel (Louisiana State University), Xiaowei Wen and Yong Wang (South China Agricultural University)
Monday Evening May 20, 2019	**Dinner on your own**

Tuesday, May 21, 2019

7:00 am to 3:00 pm Arcade Hallway	**Registration Desk Open**
7:00 am to 3:00 pm Esplanade	**Speaker Resource Room Open**
7:00 am to 8:30 am Foyer	**Continental Breakfast**
Tuesday, May 21, 2019 **8:30 am to 10:00 am** Regal Room **Moderator:** Philip G. King San Francisco State University	**Coastal Community Adaptation and Retreat** **The Costs of Climate Justice: What is the Value of a Village and Who Should Pay to Move It?** E. Barrett Ristroph, (Ristroph Law, Planning and Research) **Multidisciplinary Knowledge Integration to Support Louisiana Coastal Indigenous Communities' Response to Natural and Technological Disasters and Adaptation to Climate Change** Tara Lambeth (University of New Orleans) and Matthew Bethel (Louisiana Sea Grant College Program) **The Political Economy of "Managed" Retreat: A Case Study of Pacifica, CA** Philip G. King (San Francisco State University), Jeff Gilliam (George Mason University) James Jackson, Bob Battalio (Environmental Science Associates) **Integrating Sea Level Rise and Cost Benefit Models for Evaluation of Adaptation Options** Charles S. Colgan (Center for the Blue Economy), Fernando DePaolis (Middlebury Institute of International Studies), Philip G. King (San Francisco State University), Brian Free (Middlebury Institute of International Studies) **Government Acquisition of Homes to Reduce Flood Risk, Household Willingness to Participate and Implications for Acquisition Policy** Eugene Frimpong, Jamie Kruse, Gregory Howard (East Carolina University)
Tuesday, May 21, 2019 **8:30 am to 10:00 am** Royal Conti Room **Moderator:** Jay Shimshack University of Virginia	**Market and Nonmarket Impacts of Natural and Manmade Disasters** **Impacts of Hurricane Irma on People and the Built Environment in the Florida Keys: a Survey of Coastal Residents** Kiera O'Donnell, Sharon Harlan, Tori Tomiczek and Steven Scyphers (Northeastern University Marine Science Center) **Business Disruption Associated with Extreme Events and Pathways to Planning for more Robust Recovery** Jennifer Helgeson (National Institute of Standards and Technology), Kirstin Dow (University of South Carolina), Eleanor Davis (Carolinas Integrated Sciences and Assessments) and Claudia Nierenberg (NOAA) **Return on Investment for Wind Mitigation** Shea Gould, Dan Petrolia (Mississippi State University), Hank Hodde (Smart Home America) **Natural Disasters and Price Gouging: Evidence from Gasoline Sales Before and After U.S. Hurricanes** Jay Shimshack (University of Virginia), Timothy Beatty (University of California at Davis), Gabe Lade (Iowa State University)

Tuesday, May 21, 2019 **8:30 am to 10:00 am** Bourbon Room **Moderator:** Matthew Fannin Louisiana State University	**Perspectives on Community Planning and Resilience** **Integrated Planning to Evaluate Coastal Resilience Investments in Jamaica Bay, New York** Jordan R. Fischbach and Debra Knopman (RAND Corporation) **Comprehensive Plans: Tools for Coastal Community Resilience** Marina Cucuzza, Joshua Stoll, Heather Leslie (University of Maine) **Lessons from Ecology: Building Resilience into Coastal Systems** Scott Thomas (Stetson Engineers & Desert Research Institute) and Dave Kerner (LMI) **Watershed Stewards Academy: A Community Engagement Model for Meeting Chesapeake Bay Restoration Goals** Amanda Rockler and Jennifer Dindinger (University of Maryland Sea Grant Extension) **Is the Gulf Coast Region a Great Place to Raise a Child? An Evaluation of the Upward Economic Mobility of Children Raised along the Gulf Coast of the United States** J. Matthew Fannin and Vikash Dangal (Louisiana State University)
Tuesday, May 21, 2019 **8:30 am to 10:00 am** Fluer de lis Room A **Moderator:** Andrew Ropicki Texas A&M University	**Economic Trends and Value of Recreational Fisheries** **Spatial and Temporal Dimensions to the Value of Recreational Fishing in U.S. Waters** Alexandra Naumenko and Roger von Haefen (North Carolina State University) **Economic Evaluation of Fishing Tournaments in Florida: A Case Study for Lake Okeechobee** Edward Camp (University of Florida), Nia Morales, Lee Grove, Joonghyun Hwang (Florida Fish and Wildlife Conservation Commission) **Trends in Specialty Recreational Fishing License Sales: Potential Impacts Associated with Increases in the Issuance of Discounted Multiple-Privileged Licenses** Jack C. Isaacs (Louisiana Department of Wildlife and Fisheries) **Evaluation the Economic Feasibility of Pigfish (*Orthopristis chrysoptera*) Aquaculture for the Texas Baitfish Market** Andrew J. Ropicki (Texas A&M University), Cynthia K. Faulk, Jeffrey B. Kaiser, Kathryn L. Thompson, Lee A. Fuiman (University of Texas at Austin)
10:00 am to 10:30 am Foyer, Evangeline Suite	**Morning Break** (Final removal of posters)
Tuesday, May 21, 2019 **10:30 am to 12 pm** Regal Room **Moderator:** Jennifer Meredith Colby College	**Property Rights and Resource Access** **Value of Proximity and Access to Public Trust Resources on the Coast** Paul R. Hindsley (Eckerd College), Craig E. Landry (University of Georgia), Jesse Sherry (Eckerd College) **Legal and Economic Options for Incentivizing Recreational Fishing Access in Coastal Louisiana** Jim Wilkins, Niki Pace, Melissa Daigle (Louisiana Sea Grant Law & Policy Program), Rex Caffey (LSU Center for Natural Resource Economics & Policy), Michael Heaton, Morgan Ducote, Kameron Whitmeyer (Louisiana Sea Grant Law & Policy Program) **Fish or Flight: The Impact of Transferable Access Rights on Rural Alaskan Salmon Harvesters** Jennifer Meredith (Colby College) **Influence of Land Titling Policy on Land Abandonment in China** Kai Liu, Krishna Paudel and Menzhong Lou (Louisiana State University)

Tuesday, May 21, 2019 **10:30 am to 12 pm** Royal Conti Room **Moderator:** Jerrod Penn Louisiana State University	**Methodological Approaches to Ecosystem Valuation** **Combining Aggregate and Individual-level Data to Estimate a Repeated Choice Recreation Demand Model** Stephen C. Newbold (University of Wyoming), D. Matthew Massey (U.S. Environmental Protection Agency), John Whitehead (Appalachian State University) **A Zonal Travel Cost Approach to Estimating Recreational Damages from the Deepwater Horizon Oil Spill** Roger H. von Haefen (North Carolina State University), Eric English (Bear Peak Economics), Joseph Herriges (Michigan State University), Frank Lupi (Michigan State University) and Kenneth McConnell (University of Maryland) **Implicit Value of Wetland Proximity: A Meta-Analysis of Hedonic Property Value Studies** Sapana Bastola and Jerrod Penn (Louisiana State University) **Consumer Preferences for Post-storm Coastal Adaptation: An Application of Choice Experiments** Craig E. Landry (University of Georgia), Andrew Keeler (University of North Carolina), Steven B. Scyphers (Northeastern University)
Tuesday, May 21, 2019 **10:30 am to 12 pm** Bourbon Room **Moderator:** Naveen Adusumilli Louisiana State University	**Economics and Policy of Ground Water Resources** **Casing out Contaminants: Avoidance Behavior along the Hydrogeologic Gradient** Jacob Hochard, Randall Etheridge, Maria Gomez, Ariane Peralta (East Carolina University), Charles Sims (University of Tennessee Knoxville), Tom Vogel (East Carolina University) **Well Water and Welfare: Behavioral Responses to Potential Groundwater Contamination** Thomas J. Vogel, Jacob Hochard, Randall Etheridge, Maria Gomez, Ariane Peralta (East Carolina University), Charles Sims (University of Tennessee Knoxville) **Economic Impacts of Groundwater Salinity in Louisiana** Rajan Dhakal and Krishna P. Paudel (Louisiana State University) **Groundwater over Extraction and Energy Cost** Frank Tsai (LA Water Resources Research Institute), Krishna Paudel, Tej Gautam (Louisiana State University
Tuesday, May 21, 2019 **12:00 noon to 1:30 pm** South Ballroom	**Lunch** Keynote Presentation **The Mississippi: A River of Change** James Barnett Mississippi Department of Archives and History (retired)
Tuesday, May 21, 2019 **1:30 pm to 3 pm** Regal Room **Moderator:** Lynn Kennedy Louisiana State University	**Conceptualizing the Economic Impacts of a Mississippi River Avulsion** (Discussion Panel) **Patrice Lazard** Louisiana State University **James Barnett** Mississippi Department of Archives and History (retired) **Chris Mclindon** New Orleans Geological Society **Michael Miner** The Water Institute of the Gulf

	Bruce Lambert Metro Analytics **Sean Duffy** Big River Coalition
Tuesday, May 21, 2019 **1:30 pm to 3 pm** Royal Conti Room **Moderator:** Niki Pace Louisiana Sea Grant College Program	**Challenges of Shoreline Protection and Management** **Louisiana's Living Shoreline Reference Guide** Niki Pace (Louisiana Sea Grant Law & Policy Program) **Unpacking Property Owners' Shoreline Modification Decisions: Survey Evidence from Coastal Virginia** Sarah Stafford (College of William and Mary) and Amanda Guthrie (Virginia Institute of Marine Science) **Assessing Social-Ecological Systems Following Disasters: A Case Study using Fuzzy-Cognitive Mapping Post-Hurricane Irma in Key West, Florida** Kelsi L. Furman (Northeastern University), Steven A. Gray (Michigan State University), Steven B. Scyphers (Northeastern University) **Can Mangroves Shelter Coastal Economic Activity from More Frequent Storm Damages? A Spatial Economic Analysis** Jacob Hochard (East Carolina University), Edward B. Barbier (Colorado State University), and Stuart E. Hamilton (Salisbury University)
Tuesday, May 21, 2019 **1:30 pm to 3 pm** Bourbon Room **Moderator:** James Henderson Mississippi State University	**Economic Development and Impact Assessments** **Transient Boaters Potential for Economic Development on Communities that are Proximate to the Atlantic ICW** Hans Vogelsong (East Carolina University) **Potential Changes to Louisiana Hardwood Timber Industry Economic Contributions Following Emerald Ash Borer Invasion: An Input-Output Approach** T. Eric McConnell, Curtis L. VanderSchaaf (Louisiana Tech University) and Shaun M. Tanger (Louisiana State University) **Economic Contribution of Coastal Fisheries Harvesting and Processing Industries along the Mississippi Gulf Coast by County** James E. Henderson and Benedict C. Posadas (Mississippi State University) **Analyzing the Effect of Exposure to Natural Disaster Risk in Population, Employment and Home Price Growth in Coastal Counties of the United States** Vikash Dangal and James M. Fannin (Louisiana State University Agricultural Center)
Tuesday, May 21, 2019 **1:30 pm to 3 pm** Fluer de lis Room A **Moderator:** Kate Quigley NOAA, NOS, Office for Coastal Management	**Identifying Socioeconomic Information Needs for Gulf of Mexico Coastal Communities to Inform Future Projects** (Panel Discussion) **Stephen Sempier** Mississippi Alabama Sea Grant College program **Michael Jepson** Southeast Regional Office NOAA Fisheries **Chris Ellis** NOAA, NOS, Office for Coastal Management

	Kate Quigley NOAA, NOS, Office for Coastal Management
3:00pm to 3:30pm Foyer	**Afternoon Break**
Tuesday, May 21, 2019 **3:30 pm to 5 pm** Regal Room **Moderator:** Don Blancher Moffatt & Nichol	**Economic Assessments of Coastal Ecosystem Restoration** **A Geo-economic Framework for Examining the Benefits and Costs of Coastal Dredging Projects** Rex Caffey, Hua Wang (Louisiana State University), Daniel Petrolia (Mississippi State University), Ioannis Georgiou (University of New Orleans) and Mike Miner (Water Institute of the Gulf) **Reversing Wetland Death from 35,000 Cuts: Opportunities to Restore Louisiana's Dredged Canals** R. Eugene Turner (Louisiana State University), Giovanna McClenachan (University of Central Florida) **Coastal Dynamics and Adaptation to Uncertain Sea Level Rise: Optimal Portfolios for Salt Marsh Migration** Anke D. Leroux (Monash Business School), Orencio Duran (Texas A&M University), Robert J. Johnston (Clark University), Matthew L. Kirwan (Virginia Institute of Marine Sciences), Vance L. Martin (University of Melbourne) **What is the Value of Restored Habitats and Ecological Resources? Lessons Learned from the Deepwater Horizon Natural Resource Damage Assessment Process** Don Blancher, Meg Goecker, Justin Blancher and Jonathan Hird (Moffatt & Nichol)
Tuesday, May 21, 2019 **3:30 pm to 5 pm** Royal Conti Room **Moderator:** Lawson Connor Louisiana State University	**Agriculture and the Environment** **Economic Impact of Flood in Rice Farming Communities of Eastern Nepal** Santosh Pathak (Louisiana State University), H. K. Panta, T. Bhandari (Tribhuvan University) A. KC3 (International Maize and Wheat Improvement Center, India) **Factors Affecting Farmers' Risk Perceptions Towards Feral Hogs as Disease Vectors** Hua Wang, Shaun Tanger, Naveen Adusumilli, Mike Kaller (Louisiana State University) **Effect of Crop Insurance on Cover Crop Adoption** Lawson Connor (Louisiana State University) **Impacts of Climate Change on U.S. Peanut and Peanut Butter Prices** Trang Le (Auburn University)
Tuesday, May 21, 2019 **3:30 pm to 5 pm** Bourbon Room **Moderator:** Tej Gautam Louisiana State University	**Economics and Policy of Surface Water Resources** **Estimating the Impact of Hurricanes and Harmful Algae Blooms on the Tourism Economy** Sergio Alvarez (University of Central Florida) **Nutrient Management and Recreational Fishing: Modeling On-Water Decisions in New York Coastal Waters in Response to Hypoxic Conditions and Supply Chain Connections** Anthony Dvarskas (Stony Brook University) **SERA-46: Overview and Future Directions of a Multi-state Research and Extension Project Addressing Hypoxia in the Gulf of Mexico** Naveen Adusumilli (Louisiana State University) and John Westra (University of Nebraska–Lincoln)

	Factors Influencing the Choice of Irrigation Technologies and Acreage Allocation in Louisiana Crop Production Tej Gautam and Krishna P. Paudel (Louisiana State University)
Tuesday, May 21, 2019 **3:30 pm to 5 pm** Fluer de lis Room A **Moderator:** Chris Hayes University of Maryland	**Current and Future Directions of Fisheries Management** **Including Stakeholder Preferences in Fisheries Management Decisions Using Multi-Criteria Decision Analysis** Chris Hayes and Lisa Wainger (University of Maryland) **Focus Groups and Automated Data Collection: Testing New Avenues for Informing Fisheries Management in the Southeast** Michael Jepson (Southeast Regional Office, NOAA Fisheries) and Matt McPherson (Southeast Fisheries Science Center, NOAA Fisheries) **Quantifying the Impact of Different Management Regimes on Two Otherwise Similar Fisheries** Christopher Liese and Scott Crosson (Southeast Fisheries Science Center, NOAA Fisheries) **Incorporating the Human Dimension into the Ecosystem Approach to Fisheries Management** David Rudders and John Ward (Virginia Institute of Marine Science
Tuesday, May 21, 2019 **3:30 pm to 5 pm** Bacchus Room **Moderator:** Jennifer Dindinger and Amanda Rockler University of Maryland Sea Grant Extension	**Workshop: Changing Behavior for Public Good: Social Marketing 101** Jennifer Dindinger and Amanda Rockler (University of Maryland Sea Grant Extension)
Tuesday, May 21, 2019 **6:30 pm to 9:30 pm** Bourbon Balcony Suite Room 2110	**CNREP 2019 Closing Reception**

ABSTRACTS

Adusumilli, Naveen
Louisiana State University
Center for Natural Resource
Economics & Policy

John Westra
University of Nebraska–Lincoln

SERA-46: Overview and Future Directions of a Multi-state Research and Extension Project Addressing Hypoxia in the Gulf of Mexico.

As mitigation of nonpoint source pollution from agricultural lands takes precedence among national conservation goals, nutrient management in working lands gains priority. Although the use of sustainable management practices is something not unusual for producers, selection of management actions not just accounting for the ease of implementation but accounting for the adequate mitigation of a resource concern(s) is warranted. Runoff losses due to the inefficient selection of management practices not only exacerbates soil and nutrient runoff losses to the bodies of water but puts the agricultural producer on the inefficiency frontier of the production enterprise. Education and outreach to identify not just economical but environmentally sustainable practices is an unmet need and warrants collaboration with the team of experts, around the nation, already investing time and effort towards these objectives. One such group is the SERA-46, a national consortium of scientists from the US land-grant universities, primarily working in the area of nutrient management and water quality protection, collaborating to address hypoxia zone in the Gulf. The primary goal of the SERA-46 group is promoting effective implementation of science-based approaches to nutrient management/conservation and reducing nutrient losses to the environment. Research and extension faculty at land-grant universities located within the Mississippi river basin, one of the largest river basins in the world, can participate and contribute to the goals of the group. An interdisciplinary approach provides opportunities for identifying and validating best management actions as well as opportunities for evaluating conservation programs. In addition, the approach enables outreach for promoting practices and keeping funding to nutrient mitigation programs at a level for continuing implementation without compromising profitability and providing environmental protection. The presentation covers the current actions and future projects undertaken within the state of Louisiana, situated at the tail end of the river basin, that align with the national objectives of the SERA-46 members and member states for protecting the water resources within the Mississippi river basin and the Gulf.

Ahtiainen, Heini
Natural Resources Institute
Finland & Baltic Marine
Environment Protection
Commission

Christine Bertram
Kiel Institute for the World
Economy

Tuija Lankia
Natural Resources Institute
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Jürgen Meyerhoff
Technische Universität
Berlin, Germany

Eija Pouta
Natural Resources Institute
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Kristine Pakalniete
AktiiVS Ltd
Riga, Latvia

Katrin Rehdanz
Kiel University, Germany

Janne Artell
Natural Resources Institute
Finland

Economic Benefits of Protecting a Shared Marine Area - Knowledge Accumulated on the Baltic Sea in Northern Europe

The Baltic Sea, located in Northern Europe, is one of the world's largest brackish water areas. It is surrounded by nine coastal countries that differ in socio-demographic, geographical and cultural characteristics. The most important pressures resulting from human activities in the Baltic Sea include eutrophication, contamination, marine litter, non-indigenous species, underwater sound, fishing, as well as habitat loss and disturbance. The objective of the European Union marine policy is to achieve a good environmental status of marine waters by 2020, with requirements to assess the costs and benefits of new measures to protect the marine environment. Thus far, information on the economic benefits from an improved provision of ecosystem services to support policy-making has been limited. We examine how the state of the Baltic Sea marine environment affects human well-being using results from two international stated preference valuation studies, with identical valuation surveys conducted in several littoral countries. The studies apply the contingent valuation, choice experiment and contingent behavior method to estimate the economic value of changes in the marine environment and the provision of ecosystem services. We address the main pressures to the Baltic Sea environment, including eutrophication, biodiversity-related aspects and marine litter, and assess the importance of cultural ecosystem services, with focus on recreation. We provide information on the spatial distribution of ecosystem service benefits. The results show that the state of the marine environment affects the use and non-use values people derive from the Baltic Sea. The largest benefits accrue from the reduction of eutrophication, but for the other pressures, there are country-wise differences in the importance. Larger changes in the marine environment lead to higher welfare impacts, but the marginal benefits are decreasing. Environmental conditions are a significant determinant of the number of recreation visits to the sea, thus affecting the recreation values. Consistent with the theory of loss aversion, deterioration of water quality below the reference (current) quality leads to larger changes in recreation values than an improvement. The benefits per capita differ substantially between countries, with the income level differences driving the results, together with use-related and attitudinal factors. Of cultural ecosystem services, people consider recreation, habitats and landscapes as the most important, with some country-wise differences in the importance of habitats as a source of nonuse values. Altogether, the results imply that measures to improve the Baltic Sea environment bring about benefits that depend on the current level of environmental quality, the environmental problem and the country in question. The findings can be utilized to assess the benefits from achieving the policy objective of good environmental status of the marine environment and in cost-benefit analyses to evaluate the effectiveness of measures and policies.

Alvarez, Sergio
National Center for Integrated
Coastal Research
University of Central Florida

Estimating the Impact of Hurricanes and Harmful Algae Blooms on the Tourism Economy

Hazards affect the tourism economy in multiple ways. During hazards such as hurricanes, tourists already in the area can be expected to evacuate, while tourists planning to visit may cancel or postpone their trips. In addition, businesses may close to prepare for the hazard's onset, and businesses that suffer heavy impacts to their infrastructure will close or operate well-below capacity in the aftermath. In disasters such as harmful algae blooms, tourists in the area may end their trips early or decide to visit other locations. In addition, media coverage of hazards may dissuade tourists who were planning to visit the destination. In either case, the reduction in tourist arrivals induced by the onset of a hazard event would result in lower business revenues for multiple sectors of the local economy. The state of Florida, which relies heavily on tourism as an economic driver, has experienced an unprecedented number of these hazards in the last three years, including three major hurricanes (Matthew in 2016; Irma in 2017; Michael in 2018), and annual harmful algae blooms of red tide and blue-green algae. In this paper, the impact of past hazards is quantified using a panel data analysis of monthly economic sales data obtained from the Florida Department of Revenue. The data provides monthly sales by county for nearly 80 business sectors, includes all of Florida's 67 counties, and extends from July 1995 to the present. Given the wide coverage and monthly availability of the data, it can provide valuable insights into seasonality, overall growth and trends, and impacts of external shocks such as previous hazard events. We will use these data to develop a panel-data regression model with the objective of relating changes in sales from tourism sectors in different counties to location-specific variables while controlling for seasonality and growth trends. Such location-specific variables will provide information on the economic environment (e.g., time and county varying unemployment rate), external shocks (e.g., indicators for geopolitical events such as the terrorist attacks of September 11, 2001), and previous hazards (e.g., hurricane Irma in 2017). The results of this approach will be used to gain a better understanding of how different types of hazards affect the tourism economy, including a comparison of the impact of hurricanes of different strength to harmful algae blooms or other disasters. This presentation will focus on hazards that have taken place since 2015 throughout the state of Florida and will include four hurricanes and multiple harmful algal blooms.

Argote, Jennifer
College of the Coast and
Environment, Louisiana State
University

Prepare to Prevent - Reducing Losses with the National Flood Insurance Program and the Community Rating System

Coastal Louisiana is incredibly vulnerable to flooding. In the aftermath of flood events, parishes have been left with millions of dollars in property damage, as well as lost economic opportunities. One way to reduce these physical and financial damages is to better prepare communities for flood risks before flooding occurs – a principle of hazard mitigation. Many coastal communities have extensive hazard preparedness programs and physical infrastructure to reduce their risks from flooding and storm damage. One such preparedness program is the National Flood Insurance Program's (NFIP) Community Rating System (CRS), which encourages communities to reduce flood risk through 19 hazard-mitigating and risk-reducing activities. Eligible activities include actions to increase public education, improve mapping and regulations, reduce flood damages, and improve warning and response systems. Participating communities receive points for each completed activity, and a score from 1-10 is assigned to each community. Scores of 9 or lower receive discounts on their NFIP premiums, ranging from 5% to 45% discounts. Only 5% of NFIP communities participate in the CRS, and many still have high scores and low discounts. In 2015, I co-authored a paper, led by Dr. Margaret Reams and Dr. Nina Lam of LSU, which focused on CRS-participating communities in Louisiana. My dissertation research, which my talk will draw from heavily, focuses on coastal communities from Texas to Florida to determine which factors influence how likely a community is to have a lower CRS score and be better protected from flooding and generally more hazard-resistant. Contributing factors that affect CRS scores, and subsequently their level or risk) include a community's socioeconomic makeup, level of education, exposure to storms, population, and number of years in the CRS program. Of the US 52 counties bordering the Gulf of Mexico, nearly half of them are not participating in the NFIP. While participation is not a requirement, the CRS provides financial benefits to homeowners and it has the potential to provide many financial and environmental benefits to larger scale communities. My dissertation research is looking into why more of these counties are not participating in the CRS, and what factors influence the scores of participating communities. A better understanding these scores will yield a better understanding of what drives adaptive planning and mitigation activities for flooding and other hazards, subsequently helping policymakers target and improve poorly performing communities.

Barnes, Stephen
Department of Economics
Louisiana State University

GOMESA and the Future of Coastal Restoration and Protection Funding

This study provides a detailed review of the major provisions of the Gulf of Mexico Energy Security Act (GOMESA) and forecasts the revenue shared under Phase II of GOMESA for the next 20 years. Under GOMESA, the federal government shares 50% of revenues from select federal offshore oil and gas activities with the Gulf Producing States (GPS), their Coastal Political Subdivisions (CPS) and the Land & Water Conservation Fund. These revenues include bonus bids, rents and royalties and are subject to a revenue sharing cap of $500 million, which limits how much can be shared in Phase II such that no more than $300 million can be shared

with the GPSs and $75 million shared with CPSs. Since the passage of GOMESA, expectations have been high that revenues would be near or above the cap and states and coastal communities would have a large new source of revenue to invest in coastal protection and restoration projects. While early Phase II revenue sharing is well below this level, this research suggests that those revenues are expected to grow fairly quickly and will soon hit or exceed the revenue sharing cap leading to the maximum level of revenue sharing for GPSs and CPSs.

Barnett, James F.
Mississippi Department of Archives and History (retired)

The Mississippi: A River of Change

Jim Barnett is retired Director of the Historic Properties Division with the Mississippi Department of Archives and History. He has written three books and numerous articles for history and archaeology journals. His latest book is "Beyond Control: The Mississippi River's New Channel to the Gulf of Mexico". Barnett describes the Mississippi as a waterway of change, unnaturally confined by ever-larger levees and control structures. During the great flood of 1973, the River nearly changed its course for a shorter and steeper path to the sea. Beyond Control traces the history of this phenomenon, beginning with a major channel shift around 3,000 years ago. Told against the backdrop of the Lower Mississippi River's impending diversion, the book's chapters chronicle historic floods, rising flood crests, a changing strategy for flood protection, and competing interests in the management of the Old River outlet. Beyond Control is both a history and a close look at an inexorable, living process happening now in the twenty-first century.

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Powering Tourism: Wind Energy and Its Impact on Rural Tourism in Ilocos Norte, Philippines

This study provides a formal attempt to empirically quantify the impact of wind farm development projects to the local tourism industry. Specifically, it provides a framework that assumes the presence of wind mills in the community can decrease the value of the landscape. The Contingent Valuation Method (CVM) assessed the change in value of the landscape by examining the change in willingness-to-pay (WTP) of tourists assuming that individuals value the scenery and the introduction of 'industrial infrastructure, be it wind turbines or other metal structures, may decrease its value. A survey conducted via the internet was designed to explore the scenic value lost to the public when a wind farm like the one in Bangui, Ilocos Norte is established. Contrary to the findings of studies abroad, results show that tourists are willing to pay an additional amount in order to upgrade to a room with the view of wind mills. The data sets demonstrate that under standard assumptions, the wind farm provides a positive value based on the point of view of potential tourists. The positive valuation of individuals to wind farm facilities can be potentially translated as increase in tourist arrivals in the area, which would mean additional revenues through employment generation, tourist expenditures, accommodation and transportation, among others. Hence, additional revenues increase the benefits over time that may further improve the local community welfare. This implies that wind farms are potential tourist destinations sites on which careful planning and monitoring of tourism activities must be undertaken in order to provide a sustainable tourism development plan that would trickle-down benefits to the local residents of the community.

Bastola, Sapana
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Implicit Value of Wetland Proximity: A Meta-Analysis of Hedonic Property Value Studies

Wetlands provide numerous ecosystem service benefits, which include groundwater recharge and purification, a buffer against flood, nutrient retention, habitat availability, and aesthetic appeal. Increased acknowledgment among residents towards wetland benefits has generated a corresponding increase in willing to pay/property value to gain wetland benefits. Though the wetland services are not directly traded in the market, the implicit value to property owners can be estimated using the hedonic property price method. The aim of this paper is to present a meta-analysis of hedonic property value studies that have estimated the relationship between wetland proximity and residential property value. To our knowledge, this is the first meta-analysis of wetland composed exclusively of hedonics analyses. This study includes 22 such articles based on an initial screening of roughly 2500 articles. A corresponding dataset has been developed and we will use common meta-regression techniques in economics to examine the effect of wetland proximity on housing price. The findings will have policy implications on wetland conservation, restoration and management near residential areas.

Bhatta, Dependra
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Factors Affecting Groundwater Use in Coastal Louisiana Agriculture

In this study, we use the groundwater pumping rate from 2004 to 2016 in the agriculture sector of the coastal parishes of Louisiana to understand how commodity price fluctuations have impacted groundwater extraction. To understand this relationship, we use a panel fixed and random effects model. Our preliminary result shows that the increasing price of agricultural commodities increases the pumping rate. We also find that the

expanding crop area generates increased economic activities; however; it may adversely affect the aquifer and degrade the water quality with saline water intrusion. Groundwater salinity poses a threat to agriculture sustainability, thus, impacting the social, economic and environmental values. Proper agricultural conservation measures help to improve water quality and reduce water extraction.

Bin, Okmyung
John A. Bishop
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Distributional Impacts of Flood Hazards and Insurance

Panel data on US county-level flood damages, insurance premiums and payouts are merged with Census data measuring annual payroll, employment, and establishment counts in order to quantify the impact of flood disasters on economic activity. Intuitively one would expect economic activity to decrease in the aftermath of a flood, and on average our results support this hypothesis. Specifically, we find a 0.0003% ($0.3 million) reduction in average annual payroll and a 0.0002% (6.5 employee) reduction in average county employment for each 1% increase in flood damages. These average effects, however, mask important heterogeneity in the distributional impacts of flood risks. Specifically, we find no significant impact of flood damages on median payroll and employment. Counties in the lowest payroll quartile experience an average reduction of $0.2 million in annual payroll and 2.5 employee losses per 1% increase in flood damages. Alternatively, counties in the top quartile experience a $1.0 million increase in average payroll and the addition of 36.4 employees for a 1% increase in flood damage. Results suggest that flood disasters hamper economic activity in poorer counties but create an economic boon in richer counties.

Birch, Traci
College of Art & Design
Louisiana State University

Measuring Wellbeing, Resilience and Recovery as a Guide for Community Development

Louisiana's coastal communities face tremendous challenges related to severe weather events, threatened ecosystems, Inundation, rising sea levels, hazardous spills, and land subsidence. The physical safety as well as the livelihoods of coastal citizens are being severely impacted. While the challenges to both rural and urban areas of the Louisiana coast are similar, these communities are not homogeneous in their strengths and struggles. Additionally, there needs to be a better understanding of what "recovery" looks like for each community through comparison of pre and post disaster capacities. As part of a large, transdisciplinary research project focused on solutions to this coastal crisis, a wellness index was developed to measure the variations and capacity gaps among three coastal Louisiana Parishes both prior to and after the south Louisiana flooding event of August 2016. Adopting the methods of Burton (2015) and Cutter et al. (2010), we collected over 100 variables relating to local well-being at the census-tract level in East Baton Rouge, Ascension, and Livingston parishes. The variables were categorized into public health and safety, community identity, economic stability, natural environment, and built environment to capture dimensions of well-being and to better understand how each community could be aided in developing a plan for future resilience.

Blancher, Don
Meg Goecker
Justin Blancher
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What is the Value of Restored Habitats and Ecological Resources? Lessons Learned from the Deepwater Horizon Natural Resource Damage Assessment Process

The Natural Resource Damage Assessment (NRDA) process, mandated by the Oil Pollution Act of 1990, requires that the responsible party (RP) who impacted the natural resources must make the public whole. Typically, this is accomplished by paying for the total costs of lost/injured resources through ecological restoration, and the RP bears the full costs of the ecological restoration project(s) which attempt to restore either habitat or ecological resources. The emphasis is usually on the cost of the restoration necessary to offset the injury and does not necessarily set a value for the injured resource. The Deepwater Horizon (DWH) incident and in particular, the Early Restoration agreement between the Federal and State Trustees (the "Trustees") and RP (BP Oil) presents a unique case where the two parties negotiated both the ecological benefits (services restored) of restoration projects, and costs the RP was willing to pay for those benefits. While not without some biases in terms of perhaps "overbuild" issues, and a conservative view of project success, it does provide a number of examples where the price was intensively negotiated on what the RP was willing to pay for various ecological services. In this paper we compare the benefits negotiated by the Trustees, through Phases I – IV of the DWH Early Restoration process, for the ecological services restored for a given set of resource and habitat projects and the monetary values negotiated for the costs of these services. These values have been documented in several published Environmental Impact Statements (EIS) and various phases of Early Restoration Plans publicly provided by the Trustees. In addition, we compare these monetary values derived to alternate monetary values of several habitats and ecological resources (e.g. productivity) which have been derived through emergy methodology. The values from the NRDA negotiation are compared to corresponding published Emdollar evaluations for like resources in an effort to elucidate a consistent trend in the data. Finally, we present an example of how the values derived for the Early Restoration program can be used to evaluate cost-benefit for future restoration projects which are funded through various oil spill funded sources, such as DWH-NRDA, NFWF-GEBF and RESTORE.

Bonatakis, Lauren E.
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Understanding Louisiana's Freshwater Commercial Fishery

As an important contributor to Louisiana's economy, the commercial freshwater fishery has been the subject of growing attention in recent years by resource managers. Compared to the marine sector, little is known about the freshwater fishery. Anecdotally, the fishery appears to be on the brink of collapse. Fewer young fishermen are entering the field, fish buyers and processors are closing, and market prices remain stagnant. Because of this, the fishery may lack the resources needed to perpetuate the success and sustainability for future generations. To better understand this fishery, we conducted a two-part study to characterize the commercial freshwater fishery in Louisiana. First, we completed in-person surveys to collect data about the fishermen, including target species, gear type, and number of trips. We also assessed their opinions and attitudes about the way certain ecological factors, commercial regulations, and human interference are affecting their fishing success, as well as their interest in learning new techniques to improve the quality of their product. Preliminary results suggest that the closing of fish houses has created a bottleneck effect for fishermen who are looking for places to sell their catch. This could increase competition between fishermen, flood the market, and cost the fishermen time and money. Additionally, results show there is an overpopulation of Asian carp and alligators, which can hinder the number of landings brought in. Catfish and buffalo appear to be the most sought-after finfish; however, this does slightly differ by region. For part two of the study, we used spatial analysis to understand trends of historical landings data and fishing effort from the years 2000-2016. This data was provided by the Trip Ticket Program, curated by Louisiana Department of Wildlife and Fisheries. We mapped freshwater commercial fish landings, the monetary value of those landings, and locations of fish houses and processors across the 12 river basins in Louisiana. In 2016, results have shown that the highest value of freshwater fish landings came from the Atchafalaya, Terrebonne, and Mississippi River basins, while Calcasieu basin produced the lowest value. Similarly, the majority of freshwater fish dealer license holders were located in central and southeastern Louisiana, while few were located in the western and northern regions. In addition, wild crawfish from the Atchafalaya basin accounted for over $10 million in landings value, almost 50% of the total state value, while wild catfish landings were valued at over $700,000. As a valuable contributor to Louisiana's economy, it is important to identify problems and hardships within the commercial freshwater fishery to inform future workshops, educational material, and policy actions aimed to improve the livelihood of the fishermen and success of the fishery.

Bosch, Daniel
Louisiana Sea Grant Law & Policy Program

Staying Afloat: The Legal Issues Related to Maintaining a Vessel-Based Grocery Store

As coastal erosion and rising sea levels impact roadways along coastal Louisiana, residents have found it difficult to travel to their local grocery stores. Even when they do, the selection of fresh produce and other necessities can be sparse. In order to improve adaptation to changing conditions and increase the socio-ecological resiliency of the Louisiana coast, the idea of creating a 'floating grocery store,' or one which can be transported on a water vessel from dock to dock in coastal communities, has emerged. As a vessel operating on the navigable waters of the United States, maintaining such an operation necessarily involves questions both of maritime and admiralty law, as well as state regulations regarding grocery stores. Terrebonne Parish has been working with the Louisiana Sea Grant to research the legal issues related to a floating grocery store and to compile this information into a format that can be used by the community to educate investors on the potential benefits and risks. This poster will address several issues, including: (1) maritime jurisdiction and tort liability, (2) Coast Guard regulation of inspected vessels, (3) applicable Occupational and Safety & Health Administration employment standards, and (4) regulations by the Division of Administration for grocery stores in Louisiana.

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Hua Wang
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Daniel Petrolia
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Mike Miner
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A Geo-economic Framework for Examining the Benefits and Costs of Coastal Dredging Projects

Demand for dedicated dredging in U.S. waters has more than doubled in the past decade, with particular growth in coastal Louisiana, where an estimated 90 million yd3 of sediment will be needed for barrier shoreline and wetland restoration over the next 50 years. Sediment acquisition for these projects is typically restricted to two primary sources: near shore (NS) materials of limited quantity and quality, and outer continental shelf (OCS) inputs of potentially higher quality and costs. Economic trade-offs between these source types have yet to be systematically analyzed but are expected to be project- and location-specific; and influenced by a wide range of constraints. In October 2015, BOEM initiated a three-year, cooperative marine institute (CMI) study to characterize these constraints and integrate them into a comparative, geo-economic framework useful for estimating the costs incurred, and the ecosystem services derived, from projects relying on these two source materials. This presentation provides an overview of the geomorphological and economic sub models of the CMI project, with a particular emphasis on data sources, descriptive statistics, and statistical development of generic costs models for projects using NS and OCS sediments. The overview provides a mechanical description of how geophysical trajectories and project cost data are coupled into a decision support tool for examining a wide range of economic trade-offs related to sediment characteristics, technological limitations, sediment transport distance, project scale (spatial and temporal) seasonal risks, and environmental policy.

Camp, Edward
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Nia Morales
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Florida Fish and Wildlife
Conservation Commission

Economic Evaluation of Fishing Tournaments in Florida: A Case Study for Lake Okeechobee

Within Florida's many thousands of lakes, miles of canals, and miles of river are productive freshwater fisheries that attract anglers from all over the world for the opportunity to target one of the most popular sportfish in the country, Largemouth Bass (*Micropterus salmoides*). Florida is not just a popular destination for recreational anglers and trophy hunters, but also a prime destination for tournament anglers. The state hosted roughly 3500 tournaments in the 2016 – 2017 fiscal year alone. The tournaments cover a broad range of sizes and skill levels (amateur tournaments, amateur trails, semi-professional tournaments, semi-professional tournaments trails, opens, and elite professional tournaments). The ultimate goal is to evaluate economic expenditures and angler value of bass fishing tournament anglers across the state of Florida but Lake Okeechobee has been selected as the first resource to be evaluated by this study because of the number of tournaments hosted there each year, the relatively few connected water bodies, and the national reputation as a top bass lake. Tournament participant survey will be distributed to directors of each tournament and redistributed to participants. Detailed participant-specific information including hours spent, expenditures, distance traveled, and other demographics will be collected from the survey. Also, tournament-specific information such as date, time, skill level, etc. will be collected from the tournament directors. Using this information, a travel cost method will be used to estimate the economic value of the tournaments. In addition, an input-output analysis will be performed to understand economic impacts of the tournaments to the region.

Cochran, David
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Coupled Human Environmental Systems (Panel)

This panel session focuses on the opportunities and challenges of translating scientific research into public knowledge that can be used to create positive social and ecological change in the Gulf of Mexico. Drawing together a team of researchers and practitioners, this panel will examine strategies about how to transform scientific data into actionable knowledge that can help policy makers, local leaders, and the lay public better understand the need to alter contemporary human activities as part of a broader strategy to create a more sustainable and resilient Gulf of Mexico.

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Center for the Blue Economy,
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Middlebury Institute of
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Integrating Sea Level Rise and Cost Benefit Models for Evaluation of Adaptation Options

The threat of coastal flooding exacerbated by sea level rise due to climate change is now widely appreciated and has been the subject of extensive research to develop models capable of estimating the possible extent of flooding throughout coastal regions. While important in identifying vulnerabilities to socio-ecological systems, these models provide only part of the information needed to formulate and execute plans to adapt to the increased risks of flooding. Also required are processes to measure the costs and benefits of different options for adaptation to flooding. The project discussed in this paper created a model that links estimates of sea level rise, extreme weather, events, vulnerability of property value losses, and the economic benefits and costs associated with user-specified adaptation options. The model is fully specified using a Monte Carlo framework designed to highlight the elements of risk and probabilities the communities face. The model was tested in Monterey, California with different types of shoreline and adaptation responses and was found to be highly useful by City officials.

Collini, Renee
Northern Gulf of Mexico
Sentinel Site
Cooperative/Mississippi State
University/Mississippi-Alabama
Sea Grant

Northern Gulf of Mexico Sentinel Site Cooperative

Sea-level rise will have significant impacts on coastal communities in the northern Gulf of Mexico across multiple economic, cultural, and environmental sectors. It can often be daunting to consider addressing sea-level rise; however, planning for it will be critical to sustainable ecosystems, economies, and communities. The Northern Gulf of Mexico Sentinel Site Cooperative (Cooperative) is a partnership of federal and state agencies, researchers, non-profits, extension and outreach professionals, and others working to transition and translate sea-level rise science and observations in to coastal decision-making. The efforts of the Cooperative partners have expanded our understanding of how sea-level rise can impact the Gulf Coast and resulted in the development of multiple avenues to communicate that understanding. This lightening presentation will focus on the types of efforts the Cooperative partners undertake together, benefits of the partnership, and how to engage with the Cooperative moving forward.

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Northern Gulf of Mexico
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Sea Grant

Sea-level Rise in Planning: Resources for "What is Sea-level Rise" through "What Scenario Should I Use?

Negatively impacting cultures, economies, and ecosystems, sea-level rise will impact quality of life across the coast. Sea-level rise is steadily gaining more attention in the media, community planning discussions, and in natural resource decision-making. Along a separate, but parallel track, available observations and research around sea level and effects of sea-level rise are increasing at an almost overwhelming rate. Recent advancements include regionally-specific sea-level rise projections, probabilities of different sea-level rise scenarios, multiple models addressing the fate of marshes under sea-level rise, predictions of future high-tide flooding frequencies, and models demonstrating changes is the magnitude of storm surge with an sea-level rise altered-shoreline. All of this information is publically available to be integrated into natural resource management and coastal community planning; however, many are unsure of where to start, where or what the best available science is, and how to apply the information once it has been obtained. This presentation will focus on identifying available resources to acquire and utilize sea-level rise information and how they can be used as a suite of resources to assist decision-making processes at any stage. Specific tools will include: newly available short educational videos on sea-level rise basics; customizable two-pagers for regional sea-level rise scenarios and projections of future high-tide flooding; the NOAA Sea-Level Rise Viewer; story maps depicting future storm surge under various sea-level rise scenarios; sea-level rise scenario selection utilizing a combination of aforementioned tools; and soon-to-be released marsh model comparison information. In addition to a quick overview of the available tools, an example will be stepped through to demonstrate when and how these tools can be applied.

Colten, Craig E.
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The Eclipse of Risk Memory in the Amite River Basin

Floods washed across the Amite River basin in southeastern Louisiana in 1983. Despite a tradition of avoiding floodplains, residential sprawl had propelled development across former open land since the 1960s. Following the 1983 catastrophe, public actions to mitigate future floods became a short-term priority. Proposals for flood mitigation programs including reservoirs, a diversion canal, and a river basin authority gained public support. The clear memory of the devastation and efforts to enhance resilience were short lived, however. Public policies promoted suburban development, new roads and infrastructure, and mitigation failed to gain lasting support. The sense of urgency and the specter of future floods faded from the public imaginary. Expanding the parish tax bases received priority in policy, not public safety. A more dramatic flood in 2016 caused even more widespread devastation and exposed three decades of expanding urbanization that had eclipsed flood memories. A series of focus groups and scenario building workshops with local officials and residents conducted in 2018 and 2019 reveal the deterioration of public memory of the 1983 flood and the erosion of resilience since the preceding tragedy. And, post-flood policy has continued to prioritize development over safety. Few local officials were mindful of the impacts of the 1983 event and basin-wide considerations have given way to parish-level concerns. Although disaster risk reduction has become a prominent part of hazards management, over the thirty-three-year interval between tragic floods, local experts reveal that officials failed to perpetuate risk memory and prepared for development rather than disaster.

Conley, Elizabeth
Kelsi Furman
Steven Scyphers
Northeastern University Marine
Science Center

Perceptions of Hurricane Irma among Recreational Lobster Fishers in Key West, Florida

In efforts to promote community resiliency, understanding the social and ecological impacts of natural disasters is a vitally critical topic for coastal societies. This study investigated recreational lobster fishers' perceptions of the current lobster fishing conditions in Key West, Florida one year after Hurricane Irma. Key West heavily relies on the recreational fishing of lobster (*Panulirus argus*) as a main part of their economy, culture, and

2018 "mini-season", we tested hypotheses that Hurricane Irma would be associated with negative perceptions of current fishing conditions, including direct and indirect impacts on lobster populations, essential fish habitats, fishing gear and infrastructure. Our survey questionnaire also documented fishing behaviors, including geospatial dimensions, local ecological knowledge, and observed or experienced impacts of the storm. Overall, and counter to initial hypotheses, our results indicated broadly positive perceptions of lobster populations and fisheries one year after Hurricane Irma. Through our analyses, we also identified several individual-level characteristics and beliefs associated with the overall positivity. For instance, longevity of participation in the mini-lobster season was a significant predictor of increasingly positive perceptions of lobster abundance and size, as well as increasing overall fishing satisfaction after compared to before the storm. Additionally, believing that lobsters are habitat generalists, as opposed to heavily reliant on a single habitat type, was associated with increasing positive perceptions. The most common negative perceptions of the involved storm impacts on commercial fishing gear and traps, infrastructure, and operations. However, these sentiments often co-occurred with overall positivity towards lobster populations and recreational fishing opportunities, highlighting a potential area of stakeholder conflict. In summary, the results from this study indicated that recreational lobster anglers perceived lobster populations as resilient to Hurricane Irma, and that the disruption of commercial fishing

positively impacted fishing opportunities and outcomes. Considering the economic and cultural importance of fisheries in many coastal communities like Key West, as well as their exposure to coastal hazards, understanding diverse stakeholder perceptions of impact and recovery are important for resilience.

Connor, Lawson
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Effect of Crop Insurance on Cover Crop Adoption

Cover crops and several other sustainable practices have been gaining policy attention as ways to reduce environmental impacts of agriculture in the US. Cover crops have been shown to improve soil longevity in various ways. Many cover crops add nutrients, particularly nitrogen, thus improving soil fertility (Nord et al. 2011). Cover crops also lead to reduced erosion (Snapp et al. 2005) and increased water retention (Blanco-Canqui et al. 2011). This implies that farmland stays useable for a longer period as the soil retains nutrients and moisture better over time. These benefits combined suggest that cover crops can maintain yields and guard against downside yield deviations in the long run. The potential benefits only become more important as the effects of climate change continue to increase in importance. However, despite their benefits, cover crops can be costly, in terms of time and money, to incorporate into modern farm practices. Cover crop usage remains low in many areas as a result. Nevertheless, the external benefits of cover crops (runoff in the Chesapeake basin has been an area of significant discussion) implies that policy intervention can play a role in encouraging their use. To this end, several policies have been put in place, with payments in Iowa, and Maryland and payments from the NRCS being among them. The Federal Crop Insurance Program (FCIP) is one public program that may also play a role in encouraging cover crop usage, given cover crops' likely impact on yield risk. This project investigates the link between crop insurance and cover crops. To the extent that farmers trade current protection (from the FCIP) for long term reductions in yield variance (from cover crops) then crop insurance use may discourage further cover crop adoption. Additionally, several rules exist for cover crop usage by the RMA as well, which could further discourage their use for farmers using crop insurance. Initial findings suggest a link exists between crop insurance use and cover crop adoption. It shows that the use of crop insurance plays a small role in reducing the rate of cover crop adoption. Additionally, it suggests that crop insurance has a role to play in encouraging the use of cover crops. Effects of cover crops on long term yield variability can be accounted for in premium ratings, making crop insurance coverage cheaper for adopters. Given the extent to which crop insurance is used (above 90% coverage among corn and soybean farmers) crop insurance can potentially have a significant effect in cover crop adoption rates. The environmental and government policy implications would be significant points of discussion for this project.

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Comprehensive Plans: Tools for Coastal Community Resilience

Coastal communities around the world are increasingly recognized as vulnerable places, particularly in the context of climate change. In Maine, USA, changing ocean conditions, declines in key fisheries, and the loss of working waterfront infrastructure are among the many compounding stressors that threaten the resilience of coastal communities. Planning for social-ecological resilience is critical to ensuring the longevity of coastal communities. In this context, resilience is defined as the ability of coastal communities to withstand disturbances without fundamentally changing their essential identity, structure, and functions. Resilience planning emphasizes anticipating and preparing for crises under uncertainty and increasing adaptive capacity by reducing individuals and communities' vulnerabilities to potential disturbances. Challenges such as coastal flooding, population decline, and economic strain are felt at local scales where people are closely linked to coastal and marine systems. Ultimately, many decisions and policies about how to adapt and remain resilient in the face of environmental and economic change will need to be made at the community level. Comprehensive plans are documents written by communities that are designed to guide the future actions and direction of the community. These plans were originally required of municipalities in Maine to address issues of developmental sprawl over thirty years ago, yet this is not the primary challenge facing these coastal communities today. We report on the results of an assessment of comprehensive plans from coastal Maine communities based on the degree to which they actively incorporated principles of social-ecological resilience. We draw on insights gained from participating in town-level planning activities to discuss the role that comprehensive plans play in mobilizing communities to implement strategies that build adaptive capacity as they face unprecedented challenges and plan for a changing world.

Daigle, Melissa
Niki Pace
Louisiana Sea Grant Law & Policy Program

Where Will the Water Go?

As part of the Inland from the Coast project, the Louisiana Sea Grant Law & Policy Program is providing legal and policy research on local government authority and responsibility to respond to floodwaters. Local governments have to balance economic concerns, National Flood Insurance Program participation requirements, and the safety of their residents when determining their stormwater management strategies. They must also take into consideration new state requirements to plan on a watershed basis. This presentation

will explore the legal authority for local government stormwater regulations and explore potential liability for failure to act.

Dangal, Vikash
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Agricultural Center

Analyzing the Effect of Exposure to Natural Disaster Risk in Population, Employment and Home Price Growth in Coastal Counties of the United States

The ambiguity in the empirical evidence of whether 'people follow jobs' or 'jobs follow people' has long been one of the basic questions in regional economics and policy. The regional adjustment model, a two-equation migration model, examines the interactions between population and employment growth and can reveal whether or not population and employment are endogenously determined. It is developed within a partial adjustment model framework which assumes population and employment levels adjust toward a certain spatial equilibrium. Housing markets are also considered to affect the relationship between regional population and employment but there has been no study on growth of housing prices especially under a regional adjustment model framework. Furthermore, along with natural and built environment, exposure to natural disaster risks suck as floods, hurricane, drought or wildfire might play a role in regional growth. This study analyzes effect of natural disaster risk in population, employment and home price growth particularly in coastal counties of the United States from 2011 to 2016 employing regional adjustment model. Specifically, effect of natural disaster risks on simultaneous determination of population, employment and home price growth will be analyzed using seemingly unrelated regression (SUR) and two stage least squares (2SLS) regression models. This study is expected to serve as a useful extension of regional adjustment model in understanding regional growth of coastal America. Furthermore, the findings from this study might also help policy makers in formulating and targeting policies to enhance growth in coastal counties.

Davis, Mark
Tulane Institute on Water Resources Law and Policy
Director, Tulane ByWater Institute

Tipping Points: Finding and Funding the Capacity for Coastal Communities to Extend their Lifespan

Louisiana's 2017 Master Plan for Coastal Protection and Restoration recognizes that a changing coast will not only impact the ecology of the coast but the economic viability of coastal parishes, communities, and businesses. We have worked with the State to recognize that the tax bases of communities and the financeability and insurability of governments and business will be dramatically affected by whatever is or isn't done. In short, those communities and businesses are reaching "tipping points" that need to be understood and planned for. The critical need to understand those tipping points is underscored by the fact that Master Plan relegates most of the "nonstructural" responses to coastal change to local governments to figure out and fund. For much of our coast this is the only option available and the costs will be counted in the billions of dollars, dollars few? if any? local governments have the present ability to raise. This session will address the challenges facing coastal communities sorts of financing and decision support that will be needed to give them and plans and programs being developed a chance.

DelBene, James A
Virginia Institute of Marine Science at William & Mary

Andrew M Scheld
Donna M Bilkovic
Virginia Institute of Marine Science at William & Mary

Derelict Pot Impacts on Commercial Blue Crab Harvest and Collaborating with Crabbers to Address the Problem

The Chesapeake Bay blue crab (Callinectes sapidus) fishery is responsible for 30-40% of U.S. blue crab commercial harvests valued at over $85 million in 2015. Crab pots are the primary commercial fishing gear used to harvest blue crabs, and it is estimated that 12-20% of all pots licensed in the Chesapeake become derelict each year (approximately 145,000 derelict pots are predicted to be present at any given time). Ghost fishing impacts on valued bycatch species are well documented, yet there is a need for further analysis of derelict pot impacts on blue crab harvest and information on effective, stakeholder supported management actions to combat these problems. Previous analysis evaluating the 2008-2012 Marine Debris Location and Removal Program that employed commercial crabbers to remove derelict pots in the Chesapeake found removal of 34,408 derelict pots increased harvests by 30 million pounds over the course of the program. Results from a field experiment evaluating derelict pot impacts and preliminary results from a stated preference survey focused on identifying commercial crabber preferences for derelict pot mitigation strategies will be presented. We simulated the presence of derelict pots near actively fished pots in seasonal field experiments located in the Mobjack Bay, VA, to quantify the effect derelict pots have on blue crab harvest. Derelict pots reduced harvests by 30% during the summer, but not during the fall. Female blue crab capture rates were consistently lower when derelict pots were present; while capture rates of the less abundant males were not affected by derelict pots. Variable responses to derelict pots may be due to seasonal differences in female and male blue crab behavior and movements. Our findings support the claim that derelict pots can create an uncontrolled inefficiency in the blue crab fishery that decreases the harvest of blue crabs, requiring a larger investment of time and resources from commercial crabbers to reach harvest limits. To combat negative impacts caused by derelict pots, successful and long-term mitigation strategies require behavioral changes by commercial crabbers, thus it is essential to include them in developing effective management practices that

address the issue of derelict pots. We conducted stated preference surveys using discrete choice experiments to evaluate commercial crabber decision-making and willingness to accept/participate in derelict crab pot mitigation and management strategies. Working collaboratively with commercial crabbers and Virginia marine resource managers, we aim to gather information and evaluate management preferences to develop sustainable, stakeholder driven solutions to prevent reduced harvests, among other negative ecological and economic impacts, caused by derelict pots.

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Department of Agricultural Economics and Agribusiness, Louisiana State University

Economic Impacts of Groundwater Salinity in Louisiana

In the United States, nearly 60 million acres of land is affected by water and soil salinity problems that pose a serious threat to the long-term economic and environmental viability of the agricultural sector. Understanding the economic impacts of soil salinity in agricultural lands is essential for planning farming practices in several salinity affected regions. This study utilizes a two-stage approach to assess the economic damage to crop production from salinity in two major aquifers (Chicot and Mississippi River Alluvial Aquifer) in Louisiana. In the first stage, looking at the trend of rise in salt content within these aquifers, we predict the future level of salinity by assuming three different scenarios. The three scenarios involve increase in water salinity level within the two aquifers at low, medium and high rate. In the second stage, we use the IMPLAN software to estimate the potential economic impact from the increasing level of salinity with and without using adaptive measures. In order to assess the potential economic damage to economy in future, we set a baseline economic scenario and compare the economic contribution of crop production in future under increased salinity conditions with the baseline scenario. The baseline scenario in this study is the current total economic contribution of major irrigated crop production on the economy of the study region. The study region is the 17 parishes overlying the Mississippi River Alluvial Aquifer and Chicot aquifer. If the damage is assessed 30 years from now, the results show that increased salinity can result in loss of more than $500 million in total output in the current value term. Furthermore, we estimate the economic impacts of adopting alternative cropping systems in the study region to prevent salinity-induced crop yield loss and directly compare the impact results with the status quo scenario. We find that adaptive measure using alternative cropping practices should be able to prevent a majority of this loss.

Dindinger, Jennifer
Watershed Restoration
University of Maryland Sea Grant Extension

Amanda Rockler
University of Maryland Sea Grant Extension

Changing Behavior for Public Good: Social Marketing 101 and the Outreach Program Audit Tool

Being knowledgeable and/or concerned about environmental issues does not always lead to action. (Kollmus, A. & Agyeman, J. 2002). Social marketing is "a process that applies marketing principles and techniques to influence target audience behaviors that benefit society as well as the target audience," (Lee and Kotler, 4th ed.). University of Maryland Sea Grant Extension agents with experience in evaluating programs for increased effectiveness will lead this 90-minute session in which participants are introduced to the theory of social marketing (behavior change campaigns for public good). The focus will be on learning the "101" of social marketing and the social science framework behind the technique. Participants will learn the steps for creating robust behavior change campaigns and work in groups to build campaigns around mock case studies. In the latter half of the workshop, participants will run a mock outreach program through a rapid assessment called the Outreach Program Audit Tool (developed in partnership with Chesapeake Bay Trust) to identify elements of the program that align with social marketing principles and elements that could be modified to better achieve behavior change objectives. The experts will also assist participants in identifying appropriate ways to evaluate education programs to ensure they can demonstrate success, even if behavioral objectives are not desired or feasible. For example, is there justification for establishing a foundation of awareness or should the program just focus on behavior change? Is there a need for education, or behavior change, or both? Is it just that a policy needs to be in place to achieve implementation? The concluding discussion and "office hours" format following the audit exercise will help participants understand how to modify their outreach programs if desired.

Dvarskas, Anthony
School of Marine and Atmospheric Sciences, Stony Brook University

Nutrient Management and Recreational Fishing: Modeling On-Water Decisions in New York Coastal Waters in Response to Hypoxic Conditions and Supply Chain Connections

Recreational fishing represents a driver of economic activity in many parts of the United States with access to inland or coastal aquatic resources, supporting businesses ranging from bait and tackle shops to boat building and repair shops; the coastal waters of New York are no exception to this general rule. New York's coastal waters, while enjoying a long tradition of recreational fishing, have also faced ongoing challenges from nutrient runoff, associated algal blooms, and hypoxic conditions. As a result, efforts are underway to manage the flows of nitrogen from terrestrial sources through proposed septic upgrades. Determining the relationship between "on water" environmental conditions and recreational fishing activity can inform decisions being made related to nitrogen management. Data collected from the Marine Recreational Information Program of the National Oceanic and Atmospheric Administration can provide information on intensity of use at launch locations, but is

less useful for evaluating changes in on-water locations of recreational fishing activity and, consequently, the impact of spatial variations in water quality (e.g., hypoxic areas, temperature gradients). This research project explores the use of mobile app-based recreational fishing data in estimation of on-water recreational fishing activity and its relationship to monitored environmental conditions. A key goal of the study is to evaluate how alternative nutrient management scenarios and changing water temperatures may impact future recreational fishing activity in New York. As part of this project, we therefore develop a dynamic model linking on-water recreational fishing activity to both environmental conditions and land-based supply chain industries, classified by North American Industrial Classification Standard (NAICS) codes. Results from the pilot development of this approach to data collection and modeling will be presented for Long Island Sound and the South Shore Bays of Long Island.

Ellis, Chris
Kate Quigley
NOAA, NOS, Office for Coastal Management

Identifying Socioeconomic Information Needs for Gulf of Mexico Coastal Communities to Inform Future Projects

The Office for Coastal Management in NOAA provides coastal managers, planners, educators, decision-makers, and interested citizens with trainings and tools to help in: coastal resilience; ecosystem services projects; green infrastructure; risk communication; social science basics; facilitation; estimating the economic contribution of local marine economies; and, adaptation planning, among other topics through Digital Coast. This session includes brief presentations from three professionals that will highlight their social and economic programs, examples of how research transforms into application, and present categories (social and economic data, tools, trainings, and research) that needs for Gulf coastal communities might fall into. The session will continue with an open discussion and solicitation of social and economic information needs for coastal communities. The presentations and discussion will better inform potential research and project funders about future projects for consideration. Participants in discussion panel:

Ellis, Chris
NOAA, NOS, Office for Coastal Management

Chris Ellis, Social Scientist, Office for Coastal Management, National Ocean Service, NOAA. Chris Ellis is a social scientist with NOAA's Office for Coastal Management. His training is in environmental sociology, survey design and implementation, recreation and tourism choice behavior, organizational behavioral networks, and social-psychological interaction with the coast. He has extensive experience in working with state and local municipalities to build capacity in coastal conservation, and community resilience. He also has a growing portfolio of projects that lend technical assistance to the National Weather Service to build social science capacity within the Office. Working currently for NOAA, and formerly for both the U.S. Fish & Wildlife Service and the National Park Service, he has gained unique perspectives of how the public and institutions understand, perceive, and use natural resources, particularly in coastal areas. Chris completed his PhD in 2005 at East Carolina University.

Fagan, G. Connor
Louisiana Sea Grant Law & Policy Program

The Local and Basin-wide Impact of Baton Rouge Stormwater Laws

Louisiana faces the triple threat of 1) climate change-induced sea rise 2) subsidence and erosion 3) more frequent and severe storms and hurricanes. As shown by the 2016 floods, Louisiana has struggled to combat these severe threats. A lack of enforceable, regional agreements among local, state, and federal actors is at the crux of the problem. And further, localities are not incentivized to go beyond federal standards for flood mitigation because the federal government has historically intervened after major disasters. While there are intergovernmental agreements among parishes, municipalities, and other political subdivisions, regional coordination among local, state, and federal actors is necessary to prevent future disasters. Louisiana does not have an enforceable, basin-wide stormwater pollution. This presentation first establishes that parish-to-parish and regional governance is essential to mitigate future severe flooding events. Second, study recommends innovative, enforceable land use controls as an effective and necessary means to manage storm water on a regional level.

Fannin, J. Matthew
Analytic and Academic Programs, Rural Policy Research Institute, Dept. of Ag. Economics and Agribusiness, LSU AgCenter

Vikash Dangal

Is the Gulf Coast Region a Great Place to Raise a Child? An Evaluation of the Upward Economic Mobility of Children Raised along the Gulf Coast of the United States

The Gulf Coast of the United States is a region with many natural and man amenities that intersect to create a heterogenous economic structure that runs from the energy sector to fishing to tourism. Much socio-economic and human systems research along the Gulf Coast focuses on either structure or success of the place or the economic condition and change in that condition of the people that live in these regions. However, to the best of our knowledge, no research has addressed the intergenerational economic mobility of the Gulf Coast region.

Dept. of Ag. Economics and Agribusiness, LSU AgCenter

We propose to use newly available data from Raj Chetty, IRS, and the Census Bureau to look at the upward mobility in income rank of children that grew up in Gulf Coast counties compared to the income rank of their parents. We will condition this analysis on low, middle, and high starting income ranks of their parents. We will further evaluate the differences in the upward mobility of children that stayed in the same region where they were raised as compared to those that migrated out of the region. That is, we will evaluate how much of an income rank penalty is observed for those children that stay in Gulf Coast communities and what factors are most correlated to variation of this mobility from community to community along the Gulf Coast.

Fiore, Jacqueline
Tulane University

Shanthi Nataraj
RAND Corporation

Craig Bond
RAND Corporation

The Impact of the Deepwater Horizon Spill on Commercial Blue Crab Landings

We examine the effects of the Deepwater Horizon oil spill on landings, revenues, and effort in the commercial blue crab fishery. A key contribution of our work is that it goes beyond simple pre-post analysis and uses a difference-in-differences method to identify the causal effects of the spill. We compare affected areas to two different counterfactuals - Atlantic states, as well as Louisiana basins that were less exposed to the spill - which essentially provides upper and lower bounds on the magnitude of the impact. When using the Atlantic as a counterfactual for the Gulf states, we find that the spill resulted in a 75-85% decrease in landings in the months immediately following the spill, followed by a relatively swift recovery. While there is some evidence of potential longer-term impacts, we cannot estimate these effects precisely. Because of the potential for substitution between Gulf and Atlantic crab, we view these results as an upper bound on the true impact. When comparing Louisiana basins that were more versus less affected by the spill, we identify a 50% drop in crabbing trips in basins that were more affected following the spill; however, we find little impact on landings, likely because the spill and the resulting closures changed the relationship between effort (trips) and landings. Overall, our findings suggest that the Deepwater spill did result in substantial, short-term losses to the blue crab fishery due to policy responses, but that the fishery also exhibited a high degree of resilience and recovered quickly as soon as the closures were ended.

Fischbach, Jordan R.
RAND Corporation

Debra Knopman
RAND Corporation

Integrated Planning to Evaluate Coastal Resilience Investments in Jamaica Bay, New York

Jamaica Bay, located at the southeastern end of the boroughs of Queens and Brooklyn, is a valuable resource for the City of New York and the surrounding metropolitan region. It was one of the region's most heavily flooded areas during Hurricane Sandy in 2012 and is also highly vulnerable to forces affecting the coast, including sea level rise, storm surge, and wetland degradation. In the years following Sandy, many ideas have been proposed to reduce the bay's vulnerabilities to these forces. But the region has lacked an analytical framework for evaluating the efficacy of these various proposals and comparing their merits across the goals of flood risk reduction, improved water quality, and ecosystem restoration. Some proposed interventions have the potential to achieve benefits toward one goal but not necessarily the others, with the potential for significant tradeoffs between them. Without the appropriate tools of analyses, these kinds of assessments and comparisons are far less credible. In this talk, we describe a participatory research study that explored current and future resilience-related concepts in Jamaica Bay in close partnership with key local decision makers and stakeholders. Conducted in partnership with the Science and Resilience Institute at Jamaica Bay, the study includes new integrated systems modeling designed to explore the future impacts of sea level rise and other key climate drivers in a future without action. We also consider baywide concepts that could reduce future flood risk exposure while also improving water quality, restoring habitat in and around the bay, and more generally improving resilience to extreme weather events. The analysis compares conditions in and around Jamaica Bay in the present and 25 and 50 years in the future. Study results show that climate change will have a significant impact on natural and human systems in and around Jamaica Bay if no further major investments are made. The conceptual resilience investments evaluated could modestly reduce tidal flooding and improve water quality. A restoration-focused concept could also yield substantial new marsh habitat, but these benefits would largely disappear with a sufficiently high rate of sea level rise by year 50.

Frimpong, Eugene
Coastal Resources Management Program, East Carolina University

Jamie Kruse
Center for Natural Hazards Research
Department of Economics East Carolina University

Government Acquisition of Homes to Reduce Flood Risk, Household Willingness to Participate and Implications for Acquisition Policy

Any entity offering flood insurance, whether it is private or government-administered such as the National Flood Insurance Program (NFIP), faces the challenge of solvency. This is especially true for the NFIP, where homeowner affordability criteria limit the opportunity to charge fully risk-based premiums. One solution is to remove the highest flood risk properties from the insurer's book of business. Acquisition (buyout) of floodprone structures is a potentially permanent solution that eliminates the highest risk properties while providing homeowners with financial assistance to relocate in a less risky location. To encourage participation, homeowners are offered a pre-flood fair market value of their damaged (or at-risk of damage) structures. Although many factors have been shown to affect a homeowner's decision to accept an acquisition offer, very

Gregory Howard
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little research has been devoted to the influence of acquisition program attributes, including price or monetary incentive offered on homeowners' willingness to participate in acquisition programs. Using data from a discrete choice survey of homeowners in coastal U.S., we examine the factors that influence homeowners' willingness to accept an acquisition offer, including future insurance pricing and contract options that include property pricing, retained ownership of the deed-restricted lot, timing of the transaction, home elevation subsidies, demographic characteristics of the property owner, and geospatial characteristics of the property location. Results should give insight on the attributes of buyout contracts that are most attractive to homeowner and thus most cost effective in retiring vulnerable structures.

Frimpong, Eugene
Coastal Resources
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Daniel Petrolia
Department of Agricultural
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Does the Community Rating System Work? Evidence from Two Gulf Coast States

The Community Rating System (CRS) was introduced by the Federal Insurance Administration (FIA) as a way of engaging communities to undertake additional flood mitigation actions beyond the National Flood Insurance Program's (NFIP) minimum requirements. In exchange for specific mitigation actions, individual households in CRS participating communities receive premium discounts on their flood policies based on their community's CRS score. Although it is expected that this reward will motivate communities to participate in the CRS, it is not clear how additional mitigation and premium discounts will affect NFIP participation (i.e. policies-in-force) and insured damage claims. Recent papers that have shed light on this issue have focused only on counties in Florida, and to lesser extent Texas. This is not surprising, given that Florida leads the nation in the number of NFIP policies and in CRS participation. However, it does sow some doubt as to whether the results found for Florida (and Texas) carry over to other states, particularly to states that have relatively lower NFIP and CRS participation rates. Using community-level panel data on number of NFIP policies-in-force; magnitude of claims; CRS participation and CRS classes for the period (1998-2014) for the states of Alabama and Mississippi, this paper examines jointly, the effect of CRS participation on NFIP participation and damage claims payment. We do so while controlling for key geospatial and socioeconomic characteristics. We expect to explain in detail, the extent to which participating in CRS mitigation activities affects NFIP participation and insured damage claims payment.

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Assessing Social-Ecological Systems Following Disasters: A Case Study using Fuzzy-Cognitive Mapping Post-Hurricane Irma in Key West, Florida

In the aftermath of major disasters, assessing the complex landscape of damage to human and ecological communities is extremely challenging. As coastal communities face increasing risks to natural hazards, understanding the damage to social-ecological systems (SES) following a major disaster is key for fostering adaptation and resilience. Participatory modeling, as a form of both scientific inquiry and stakeholder engagement, has become increasingly popular in SES research with co-benefits of social learning, trust building, and empowerment. We describe a case study using fuzzy cognitive mapping (FCM) as a form of participatory modeling to assess perceptions of damage in a SES post-disaster. We conducted in-person FCM interviews with twenty-three residents of Key West, Florida between one and three months after Hurricane Irma. Each interview was structured to determine the key state variables and corresponding relationships associated with storm impacts on the people and environment of Key West. Individual FCMs were combined to integrate the knowledge of various stakeholders represented. In total, twenty-three components and 187 connections were identified by community members through which model centrality highlights the economic damage and housing burden inflicted by Irma. Results from the community model show the perceived costs of seawalls and benefits of mangroves in storm mitigation. Using Mental Modeler software for scenario building, results indicate the value of mangroves in decreasing the negative impacts of seawalls. Maps aggregated by industry show that those working in ocean recreation perceive shorelines as mitigating storm impacts, while those working in resorts or other industries perceive little value in shorelines for storm mitigation. Through this bottom-up approach of participatory modeling, we demonstrate how the collective knowledge and experiences of community members can be represented and used by decision-makers in rebuilding, restoration, and resilience planning efforts.

Garcia, Rosa Marie
Texas A&M

Factors Affecting Water Usage from Texas' Colorado River

Rapidly increasing population along with episodes of drought puts a substantial strain on water resources in parts of the state of Texas. Thus, sustainable and long-term management of the future of water supply has become the priority among the state agencies and water managers. With municipal water demand expected to increase in the future it is important to understand the drivers of residential water demand in Texas. This study focuses on the Colorado River basin, which represents one of the largest basins delivering water to 41 counties across the state. Importantly, in order to meet the future needs for water, counties that typically rely on the Colorado River will likely be forced to depend increasingly on limited groundwater reserves in the future. A

greater rate of depletion of these ground water reserves and their disappearance due to drought in turn, may threaten the long-term availability of water from the Colorado River basin. In this research we analyze the effects of climate patterns, socioeconomic factors, and land use patterns on per capita water usage from the Colorado River across counties over the period from 1971 to 2014. Using fixed effects panel regression model, water usage is found to be significantly determined by income, population density, race, age, total yearly precipitation, and the number of heat days (temperature exceeding 29.44C) during summer months, along with the land development density. Results suggest that more affluent, non-minority counties with a lower population density and higher proportions of open space and low to medium developed land are more likely to have higher per capita water usage. Results also suggest that per capita water usage increases with a higher total yearly precipitation and as the number of heat days in the summer months of June and September increases.

Gautam, Tej
Krishna P. Paudel

Department of Agricultural Economics and Agribusiness, Louisiana State University

Factors Influencing the Choice of Irrigation Technologies and Acreage Allocation in Louisiana Crop Production

As of 2016, 70 percent of total Louisiana corn area and 40 percent of total soybean area are irrigated. Irrigation has been increasingly used by farmers as a risk prevention strategy in crop production in Louisiana. Groundwater is the major source of irrigation and continuous extraction of groundwater may reduce the water table in the long run leading to salt water intrusion in some aquifer. To avoid such potential risk, a serious effort is required to maintain water table balance so as to ensure sustainable use of groundwater in the long run. In this mission, adoption of efficient irrigation technology in the agricultural production process is one of the potential efforts. This study estimates and evaluates the major factors affecting irrigation technology adoption and acreage allocation for different irrigation technologies among the soybean producers in Louisiana. For this purpose, we have conducted a survey to collect information regarding irrigation practices and concerns among the soybean producers in Louisiana. Then it applies a logit model to estimate the determinants of irrigation technology adoption and multinomial fractional logit regression method to estimate the acreage allocation. Preliminary results indicate that risk aversion behavior, source of information dissemination, laser leveling, distance to equipment dealers, total farm revenue, and energy costs are the major determinants of irrigation technology adoption. Generally, producers are more concerned about present level of productivity and net on- farm profitability, whereas resource sustainability perspective aims at the minimization of water use while maintaining the required level of moisture to the plant crops. It is evident that center pivot irrigation technology is more efficient than commonly used furrow irrigation system. However, producers can be reluctant to shift to more efficient irrigation technology when initial investment costs are high. Although using an efficient irrigation technology is generally viewed as a feasible way to reduce consumptive water for agricultural production, conversion to more efficient irrigation technology has increased groundwater extraction. It implies that the adoption of an efficient irrigation technology is necessary but not sufficient for water conservation. However, it is evident that the adoption of efficient technology adoption along with irrigation water management practices such as sensor-based scheduling, flow meter adoption, surge valves, and computerized hole selection enable producers to conserve water, achieving reasonable water productivity without adversely affecting crop yield. The findings of this study would be beneficial to those who are concerned about water productivity and water resource conservation. For example, information dissemination concerning new studies and findings through effective and reliable source of information can optimize its implementation probability and thus be productive in achieving the goal of water resource management efficiently.

Gould, Shea
Dan Petrolia
Mississippi State University

Hank Hodde
Smart Home America

Return on Investment for Wind Mitigation

Due to the serious impact natural disasters have on individuals and communities in the Gulf Coast region, the government, policy makers, community developers, and homeowners have begun to seek out ways to lessen the impact. One potentially valuable tool to increase the resiliency of properties in the event of a periodic and catastrophic event is wind mitigation. Wind mitigation is considered to be a process of adding various features to a building, i.e. a house, to increase the strength of the structure in the midst of a storm such as a hurricane. In this research, we use the three tiers of FORTIFIED homes as the specific mitigation strategies. For the project, we evaluate two questions regarding wind mitigation strategies for homes in the Alabama and Mississippi Gulf Coast region. The first question is: what is the return on investment of wind mitigation at the household level? The second question is: what factors affect return on investment at the household level? In order to answer the posed questions, we determine the benefits and costs of the wind mitigation strategies. The benefits that we capture are composed of three parts: lower expected damage costs, higher property values, and lower insurance costs. The costs are the initial costs of FORTIFIED homes, which include both new construction and retrofit homes. By determining the return on investment of the mitigation techniques, we will be able give homeowners the information they need to make an educated decision on whether or not they should consider taking action to mitigate their homes against wind exposures along Mississippi and Alabama's coastline.

Hayes, Chris
University of Maryland Center for Environmental Sciences

Lisa Wainger
University of Maryland Center for Environmental Sciences

Including Stakeholder Preferences in Fisheries Management Decisions Using Multi-Criteria Decision Analysis

Chesapeake Bay oyster management can be contentious when stakeholders support different management strategies to reverse the historic decline in oyster abundance. To find common ground, fifteen stakeholders from the fishing industry, non-governmental organizations, and state and federal management agencies met over two years to negotiate consensus management recommendations for the Choptank River basin (a tributary of the Chesapeake Bay) through a process known as OysterFutures. Stakeholders proposed management options and contributed to an integrated ecological and economic simulation model that produced numeric values for agreed-upon performance criteria. Using the collaborative modeling process, stakeholders reviewed performance criteria and negotiated recommendations (75% of stakeholders rated acceptable) for balancing sustainable harvest with restoration. Since the negotiated process did not generate a ranked set of options, which some stakeholders suggested could be useful, we considered alternative approaches to using stakeholder preferences to rank management alternatives and explore consistency of expressed preferences with the negotiated recommendations. Although rarely applied in U.S. fisheries management, multi-criteria decision analysis (MCDA) is a collaborative approach to engaging stakeholders in explicitly identifying management objectives and ranking management options based on stakeholder priority objectives and performance criteria, rather than directly rating management options. This study employed MCDA to rank the management options identified by the OysterFutures working group and compare the MCDA rankings to the OysterFutures negotiated recommendations. During post-workshop semi-structured interviews, individual OysterFutures stakeholders rated the importance of four objectives for the oyster resource: increase fishery revenue, increase full-time employment, improve water quality, and increase oyster reef habitat. Preference weights for criteria were created in proportion to the stakeholder representation of the OysterFutures working group, and we tested the sensitivity to the composition of the working group. Normalized, model-generated performance criteria were scaled using the preference weights. Summary scores for each management option were assigned by summing the preference-weighted criteria, and the options were ranked by the summary scores. Cost-effectiveness was not explicitly addressed in MCDA, so we compared the summary score (representing benefits) to the costs for each intervention in a cost-effectiveness analysis. The resulting efficiency frontier demonstrates the greatest possible summary score per investment in management. For example, at an intermediate investment of about $1.3M annually, the greatest benefits in 10 years are expected from adding spat every year in the Middle Choptank, completing ongoing oyster reef restoration in two tributaries: Tred Avon and Little Choptank, and ensuring full compliance with current size laws and sanctuary regulations. MCDA and cost-effectiveness results will be compared to the OysterFutures recommendations in order to identify potential implications for future stakeholder engagement in fisheries management.

Hayes, Chris
NOAA Office of Legislative and Intergovernmental Affairs

NOAA's Blue Economy Priorities

Coastal regions of the United States are home to 40% of the population, and the U.S. ocean economy contributes $320 billion to our GDP. Under the Department of Commerce, the National Oceanic and Atmospheric Administration (NOAA) supports the sustainable use, management and conservation of our ocean and coastal resources through research, observations and environmental forecasts. The White House expressed support for the ocean economy when proclaiming June 2018 as National Oceans Month; the proclamation highlights priorities of developing new technologies through public-private-academic partnerships, protecting marine and coastal environments, expanding seafood and aquaculture jobs and productivity, and exploring/mapping the Nation's waterways. NOAA contributes to those priorities by providing critical advances in fisheries management, aquaculture production, ocean mapping, and maritime transportation while improving the understanding and protection of important marine resources. NOAA aims to responsibly streamline unnecessary regulation, end the importation of illegal, unreported, and unregulated seafood and expand domestic aquaculture, install precision navigation tools that increase access to ports, explore and characterize ocean and coastal resources, and ensure clean and safe marine environments are available for recreation and tourism for generations.

He, Siyu
Krishna Paudel
Weizhong Zen
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Forced Relocation Because of a Natural Resource-based Industry: A Vulnerability Assessment of Displaced People

Many large hydroelectricity projects in China and elsewhere in the world require forced resettlement of native population. These displaced people have an adjustment problem in the new place and likely to suffer from poverty. We use panel data collected from 2015 and 2016 from the resettled population of hydropower project constructed on the upper-stream of Yangtze River Basin. We use Vulnerability as Low Expected Utility (VEU)

approach, analyze the possibility of reservoir migrants falling into poverty in the future (self-perpetuating poverty), and decompose the vulnerability to identify influencing factors. Results show that poverty accounts for 36%, natural disasters account for 34%, and other forms of risk account for 30% of vulnerability breakdown. Risk and shocks increase the consumption expenditure yet relocated migrants postpone much-required expenditure, decrease income, increase the possibility of future poverty, and ultimately inhibit sustainable development. Improving the education level of migrant families and providing sufficient cultivable land have the potential to reduce the vulnerability.

Heaton, Michael
Louisiana Sea Grant Law &
Policy Program

Changes for Gulf Red Snapper Management

During the 2017 and 2018 fishing seasons, the National Marine Fisheries Service (NMFS) implemented major changes in Gulf red snapper management. In 2017, an extension in length of the fishing season for the historically overfished red snapper stock prompted an unsuccessful lawsuit. In 2018, NOAA Fisheries began to issue "exempted fishing permits" allowing states to set their own seasons for red snapper. These actions seemed to draw criticism from all sides. Some believed states deserved even more authority to regulate fisheries, while others expressed concern that these moves could be dangerous and harmful to a stock that was supposed to be rebuilding. Gulf red snapper are particularly difficult to regulate because they exist primarily in deeper federal waters but are also in shallower state waters. In light of this reality, there was a trend toward uniform federal and state regulation at the end of the last century; however, the pendulum now seems to be swinging in the opposite direction toward more state control. Other characteristics of the species and of the fishery make it difficult to reliably measure changes in red snapper stock and thus complicate the regulatory process even further. Management of Gulf red snapper has long been shaped by controversy. Challenges by commercial fishermen and advocacy organizations have led to significant regulatory changes in the last few decades; the most recent lawsuit seeking more stringent regulation of the fishery failed. In light of this litigation and recent shifts in management styles, the future of Gulf red snapper is unclear. This poster will examine the history of the red snapper fishery and unpack what recent developments might mean for its future.

Helgeson, Jennifer
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Claudia Nierenberg
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Business Disruption Associated with Extreme Events and Pathways to Planning for more Robust Recovery

Some of the most significant costs associated with the impact of extreme weather and climate events are those associated with disruption of small- and medium-sized businesses (SMBs). Current support for businesses, like the rest of society, tends to be oriented toward recovery rather than for planning, preparation, and adaptation. Researchers associated with two federal agencies (NIST and NOAA) with mission interests in promoting adaptation and resilience in support of strengthening U.S. commerce, have designed a distributed research project to improve understanding of the nature of impacts experienced by SMBs facing a range of extreme events. Mirroring the nature of resilience in a systems context, the study leverages the experience and characteristics of embedded research and services networks, specifically the RISA network, the Sea Grant network and the NOS Resilience Awards. This project is based around the administration of a NIST-designed survey aimed to: 1) better define the economic and social impacts experienced by local businesses post extreme weather events, 2) identify insights important for policy makers interested in creating incentives for advanced planning, and 3) provide feedback to both the business community and services providers to further identify best practices with respect to early action. By undertaking case studies in four communities across the U.S. where the business exposure and experience crosses hazard types (e.g., hurricane, inland flooding, and fire) our intention is to build a study process that yields insights broadly relevant to building the interest in and capacity for planning and preparedness on the part of the business community, which is specific to needs indicated by SMBs. This presentation overviews the partnership across NIST and NOAA to advance the development of a tool that can be used pre- and post-disaster, especially at different stages during recovery, to gauge business impacts and opportunities for improving information and services that help business communities better incorporate risk management information. We will also provide initial data analysis findings in the case study locations, the potential to inform decision-making on the local and regional levels and discuss future research directions. A specific example of survey deployment, sampling, community engagement, and preliminary analysis in the Charleston, SC community will be presented. This case represents the use of the survey in a location that experiences flooding from extreme events, such as hurricanes, and frequent nuisance flood events. Information presented covers damage and business interruption, employee-related interruption, business information (background), business recovery trajectory, finance and mitigation information, and owner/manager demographics. Findings from these surveys will contribute to the business communities in the locations surveyed, wider community planning in those locations, the research and services communities in those locations, efforts to further evaluation and valuation of NOAA applied research investments, and the development of the NIST Coastal Community Resilience Program.

Heming, Mikaela
Northern Gulf of Mexico
Sentinel Site Cooperative

Renee Collini
Northern Gulf of Mexico
Sentinel Site Cooperative and
Mississippi-Alabama Sea Grant
Consortium

Gulf TREE: A Resource for Finding Climate Resilience Tools

Gulf TREE (Tools for Resilience Exploration Engine) is a filter-based search engine designed to match users with relevant climate resilience tools quickly, easily, and confidently. With over 100 tools relevant to the Gulf of Mexico (and more being added all the time), Gulf TREE sorts through the options to match users with a climate resilience tool that meets their criteria. The website, released February 2018, was created by the Northern Gulf of Mexico Sentinel Site Cooperative, the Gulf of Mexico Alliance, and the Gulf of Mexico Climate and Resilience Community of Practice. Gulf TREE is relevant for users of all experience levels and across a wide variety of sectors, including natural resource management, community officials, and many more. Input from nearly 200 prospective end-users across the climate resilience spectrum was sought to understand which specific issues stakeholders are tackling, questions and needs for tool suitability, and to ensure an intuitive, user-friendly website. The result is a powerful and capable resource for Gulf of Mexico stakeholders and a solution to common obstacles faced by stakeholders interested in climate resilience. In this presentation, the Gulf TREE purpose and abilities will quickly be reviewed. Feel free to explore the site at www.GulfTREE.org.

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State University

Economic Contribution of Coastal Fisheries Harvesting and Processing Industries along the Mississippi Gulf Coast by County

The economic contribution created by fisheries harvesting and associated processing industries is of interest to policy makers and useful to advocates of these industries. This information can be used to communicate how the local economy benefits by maintaining healthy marine fisheries that supports the local harvesting and processing industries that depend upon these fisheries. The value to the economy is greater than the value of the sales or jobs (direct effects) of fisheries harvesting and processing industries, since these operations obviously create demand for goods and services in other sectors of the economy, including household spending by employees and proprietors of fisheries harvesting and processing industries (indirect and induced effects). The input-output model, developed by Nobel Laureate Wassily Leontief, is ideal for assessing economic contributions of one or more sectors on the rest of the economy because it accounts for direct, indirect and induced effects. A technique is presented that can be easily replicated to estimate the economic contribution of the coastal fisheries and processing industries. This presentation will include a brief review of input-output analysis using IMpact Analysis for PLANning (IMPLAN) software and data and how IMPLAN can be used to conduct economic contribution analysis to estimate the contribution of a sector or group of sectors to an entire economy. The methodology presented describes a technique that accounts for bias that results when modeling sector output as a final demand. This type of bias can be corrected by adjusting the direct effect to account for the indirect and induced effects a sector can have upon itself and other sectors of interest. IMPLAN models will be developed for each Mississippi coastal county to determine the direct, indirect, and induced effects of fisheries and associated processing industries output and employment. Four key statistics can summarize results of economic contribution analyses:: 1) employment, consisting of the number of full- and part-time jobs; 2) employee compensation in wages and salaries; 3) output in the form of value of production; and 4) value-added, sum of employee compensation, proprietary income, property income, and indirect business taxes. For each of these key statistics, input-output models indicate the three ways sectors of interest can influence an economy: direct, indirect, and induced effects. This relatively simple procedure using IMPLAN can be used to help empower advocates of marine fisheries and associated processing industries by quantifying the economic contribution that is made to the local economy that accrues to all other sectors of the economy and to what degree. This presentation complements the assessment of the economic impacts of natural disasters and harmful coastal events discussed in another presentation entitled "Economic Recovery Paths of Mississippi Oyster Harvesting."

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Resources for the Future

Hurricanes and U.S. County-to-County Migration

Hurricanes are the most damaging natural disaster in the United States and worldwide. The U.S. Federal Emergency Management Agency (FEMA) provides financial assistance after many disasters, and homeowners with flood insurance can file claims to receive money for home repairs, but many households may respond to a hurricane by choosing to move. We combine U.S. county-to-county migration data from the Internal Revenue Service (IRS) with FEMA Presidential disaster declarations to analyze the extent to which hurricanes cause migration. We find that one additional hurricane in a given year causes a 1-2 percent increase in county-to-county out-migration in the first two years after the hurricane—i.e., the number of households moving from the county hit by the hurricane to another county goes up by 1 to 2 percent in the first two years after the storm and then drops back to zero. Overall county out-migration—i.e., to all destination counties—increases by 3 percent. We also consider differences in the underlying level of storm risk in each county using spatially detailed information on storm surge flood depths from the National Oceanic and Atmospheric Administration

(NOAA). Counties with a higher level of underlying storm surge risk experience a larger increase in out-migration after a hurricane. Finally, when we separate the destination counties by level of risk (as measured by surge), we find that hurricanes cause a larger and more persistent migration to less risky counties, providing further evidence that households are moving to avoid future storm impacts. The findings shed light on one likely adaptation response to climate change—if the number of coastal storms and hurricanes increases in the future, we can expect to see a movement of households away from the hardest hit areas.

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Investment in Coastal Communities: Financing Options for Coastal Protection and Restoration

Today, the long-term stability of the communities in coastal Louisiana rests in multiple hands—federal, state, and local governments, as well as in those of private actors. To keep pace with and maintain current economic viability, South Louisiana needs continued investment at every scale, from individual homeowners to businesses and major lenders. That will require planning and preparation that embraces three objectives: maintaining existing revenue streams and creditworthiness; taking full advantage of available water infrastructure finance options; and working independently and with others to extend and expand financing options. Investment depends on confidence, and coastal and climate change threaten to erode investor confidence in a number of ways. For example, confidence may diminish if property owners believe a storm will wipe out a property's value or if local governments lose their ability to maintain necessary infrastructure. Investor confidence could also be shaken by less tangible causes – skyrocketing insurance premiums, for example – that do not alter the physical landscape but change the financial calculus of investment decisions. Even if homeowners are otherwise willing to invest, the loss of a community pillar such as a major employer, hospital, or economic resource (e.g. fisheries) could tip the balance away from viability. The fate and future of coastal Louisiana depends on more than coastal restoration or business development. Rather, it depends on an entire web of stewardship and investment. At the heart of this analysis, one must consider what actions need to be taken; who is responsible for acting; and whether the authorities and resources necessary to support those actions are identified and at hand. These questions and their answers (or lack thereof) are fundamental to identifying and preparing for the spectrum of tipping point decisions facing coastal communities at the governmental, private, and individual levels. When it comes to public water finance, the importance of infrastructure, especially in dealing with water needs and threats, is indisputable, and it is a pervasive responsibility of state and local governments. Governments can create conditions conducive to investment by prioritizing capacity building in environmental and social factors, including by making investments of their own through participation in programs such as the Community Rating System of the National Flood Insurance Program. They should also build strong, environmentally engaged portfolios in order to attract investors who place value in environmental, social, and governance criteria when selecting their investments. In sum, the parties that place resources, such as time, money, and assets, into coastal communities rely on their governmental partners to provide a stable and functional environment where their investments can thrive.

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Value of Proximity and Access to Public Trust Resources on the Coast

This paper explores the influence of proximity and access to public trust resources on coastal property values. Many coastal resources, such as open coastal waters, estuarine habitats and wet portions of sandy beaches, are designated common property resources held in the public trust. Property owners' ability to benefit from these coastal resources is not only influenced by their direct proximity to those resources, but also their proximity to resource access and their legal rights of use. We hypothesize that coastal property markets differentiate between the types of benefits derived from these resources based on these characteristics. This means the measurement of the flow of these ecosystem services to property owners must be captured in a spatially explicit way, accounting for 1) the characteristics of the ecosystem service, 2) the proximity of the resource to the property, and 3) the proximity to resource access. Using housing market transactions on the barrier islands of Pinellas County, Florida, we measure the benefits of resource proximity, proximity to resource access, and proximity to public access. Our results indicate that property owners prefer close proximity to public trust resources as well as access to those resources. We also find that shorefront property owners view close proximity to highly used public access as an economic bad. As an extension to previous theory, we argue that the interpretation of marginal willingness to pay for use and access to public trust resources depends upon factors such as property rights, individuals' understanding of biophysical processes, and their expectations for future management interventions.

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Casing out Contaminants: Avoidance Behavior along the Hydrogeologic Gradient

If deeper aquifers have cleaner water, we would expect homeowners near water pollution sources to drill deeper groundwater wells. This form of rural avoidance behavior highlights that the social cost of water pollution includes direct exposure and private defensive investments to avoid exposure. Among our nation's 15

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million homeowners relying on private wells, the relationship between private groundwater well depth and local surface contaminant risk remains undocumented because private well construction specifications and corresponding water quality testing data are seldom available. Establishing a causal link between a homeowner's proximity to surface contaminants, groundwater quality and well depth is also complicated by the geographic sorting of households, along socioeconomic lines, in response to environmental exposures. We examine well drilling behavior and water quality results among homeowners in the rural North Carolina (NC) counties of Duplin and Sampson that lead the nation in pork and poultry production and store animal waste in uncovered surface lagoons vulnerable to breach and surface-to-ground runoff. Our empirical strategy exploits highly local variation in the modelled and sampled subterraneous hydrogeologic spectrum to support a novel econometric identification strategy. For each home in our dataset, the marginal cost of sourcing water from a sub-surficial aquifer is estimated based on (i) each well's soil profile and (ii) the width and composition of the first aquitard directly beneath the home. Soil granularity influences drilling costs and the capacity for soils to filter waterborne contaminants while the width of the first aquitard, or confining layer, influences the drilling depth required to tap into a protected aquifer. The uncertainty and variance in soil composition and aquifer depth means the homeowner only realizes the marginal cost of drilling to a confined aquifer after drilling has commenced. At this point, the homeowner decides whether to source water from the riskier but cheaper surficial aquifer or the protected but more expensive confined aquifer. The decision's timing renders variation along the hydrogeologic gradient plausibly exogenous from homeowners' geographic sorting behavior. In 2009, NC required the completion of drilling logs for all private groundwater wells and mandated initial water quality testing on all new private well installations. Over 1,800 well drilling logs and water quality samples, from the first ten years of regulation (2009-2018), were matched by address, digitized and georeferenced from each of our two counties' environmental health offices. Proximity of homes to the counties' 992 hog facilities (3.5 million hogs) and 520 broilers (110 million chickens), as an indicator of surface runoff risk, is calculated using georeferenced NC concentrated animal feeding operations sources. Early findings show that the average home is two-thirds of a mile from their nearest animal farming operation and nearly one-fourth of all homes test positive for total coliform or have nitrate levels exceeding federal drinking water standards. These results suggest that (i) homeowners are considering their proximity to surface pollutants and the protective services of confining soils when installing drinking wells and (ii) private defensive investments by rural homeowners may contribute to the social cost of water pollution.

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Can Mangroves Shelter Coastal Economic Activity from More Frequent Storm Damages? A Spatial Economic Analysis

Evidence suggests that climate change will increase the frequency of intense storms. Mangroves may protect economic activity in coastal areas. We develop a model that illustrates protections from mangroves and coastal elevation and estimate the impacts of cyclones on coastal economic activity. We find that higher elevation or expansive mangroves alone shelter economic activity from "indirect" cyclone exposure whereas economic activity is only protected from "direct" cyclone exposure in high elevation communities with expansive mangroves. Our global mapping reveals that the majority of these "safe havens" are in upper middle-income countries but are used by populations in lower middle-income countries.

Hopkins, Michael
John Lopez
Lake Pontchartrain Basin Foundation

Community Engagement through Regional 'Surge Consortiums' to Reduce Risk and Enhance Resiliency in Southeast Louisiana

Human vulnerabilities to hazards like storm surge in Southeast Louisiana are due to a combination of factors that have both natural and anthropogenic origins. Community engagement is an essential component to reduce risk and enhance resiliency to storm surge from tropical cyclones. In particular, overlapping state, local and federal entities create challenges to disaster mitigation and resiliency, which stems from confusing or circuitous policies and management traditions. To alleviate this, the surge consortiums act as a platform for interconnected entities to see and hear what others are doing and to engage with community leaders and technical experts. For the past several years, the Lake Pontchartrain Basin Foundation (LPBF) has spearheaded a cooperative endeavor to "leverage local expertise and additional technical resources into a regional collaboration […]". Rather than focus on specific locations, this 'consortium' focuses on regions with shared risks and interests and works to the betterment of the group as a whole. The first consortium focused on the region near New Orleans and the communities surrounding Lake Pontchartrain and Lake Maurepas. That workshop series concluded in 2017. LPBF has launched a new series focused on the Lake Borgne-Breton Sound region. There are distinct differences between the two consortium areas basins with respect to surge dynamics and thus risk and resiliency strategies. Therefore, a region-by-region framework enables us to tailor risk reduction strategies and target community resilience issues based on the needs and wants of the involved communities' direct feedback and impact on one another.

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Entry, Exit and Continuous Participation in Louisiana's Fisheries Markets among Licensed Seafood Dealers

Seafood dealers, also known as docks, fish houses, or seafood houses, perform important buying, selling, and grading functions in the seafood marketing chain. They serve as the points of first contact for commercial fishers and frequently collect and transmit commercial seafood landings data to state and federal fisheries management agencies. Like the commercial fishers with whom they work, seafood dealers are affected by changes seafood production and coastal resource conditions. Many seafood dealers may be especially vulnerable to local environmental changes because the nature of their enterprises does not readily facilitate physical mobility. Even as the number of licenses commercial fishermen in Louisiana has declined markedly from 20,367 resident commercial fisherman licenses in 1990 to 16,829 in 2000 and 10,728 in 2017, the number of resident wholesale/retail dealer licenses has remained relatively stable, varying from 1,243 in 1990 to 1,161 in 2000 to 1,139 in 2017. These figures, however, distort the number of active participants because they represent a count of those who held the licenses, not necessarily the number who exercised the titular dealer function by purchasing seafood directly from commercial fishers. Louisiana Department of Wildlife and Fisheries trip ticket data provide a more accurate enumeration of active commercial seafood dealers by counting those who reported commercial seafood landings. This research will examine that database further to identify the number of commercial fishermen who purchased blue crab, oyster, and shrimp fisheries directly from commercial fishers in each year from 2000 to 2017. It will examine the extent to which dealers specialized in purchasing single seafood types or diversified by handling different seafood species. It will also examine the seafood purchasing reports of individual licensed dealers from year to year to assess the number who entered, exited, or stayed active within Louisiana's dealing sector during the study period.

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Trends in Specialty Recreational Fishing License Sales: Potential Impacts Associated with Increases in the Issuance of Discounted Multiple-Privileged Licenses

Like many state fisheries management agencies, the Louisiana Department of Wildlife and Fisheries derives much of the financial resources needed to support its mission from recreational license fees. Many developments have affected the Department's license revenue potential, including decreasing participation in fishing and hunting, an aging population of anglers and hunters, and the availability of license categories that offer multiple fishing and hunting privileges at discounted fees. The State of Louisiana offers one particular recreational license type that compounds two of these trends, offering most recreational hunting and fishing privileges at a fee equal to about half that of a basic recreational fishing license to residents 60 years or older. The number of resident Senior Hunt/Fish Licenses has increased from 3,351 in license year 2001 to 81,957 in license year 2011 to 121,041 in license year. The State also offers several classes of licenses that grant the bearer multiple fishing and hunting privileges for the remainder of his or her life. Through license year 2017, the State had issued over 36 thousand licenses proffering both lifetime hunting and fishing privileges to licensees 14 years and older for s one-time payment $500. That fact that the average age of a person acquiring such a license was 31 years old suggests that the future license revenue stream will be affected for decades to come. This research will analyze the change in potential license revenue by using a unique, intertemporal identifier, the recreational license numbers, of Louisiana residents who acquired Senior Hunt/Fish Licenses or Lifetime Hunting and Fishing Licenses in 2014 through 2017 to identify which individual recreational fishing and hunting licenses acquired in previous years. This will assist in assessing potential changes in future revenue streams and in understanding the characteristics of those who obtained these licenses.

Jensen, Mark
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Management (BOEM)

Estimating the Economic Impacts of Oil and Gas Activities in the Gulf of Mexico

BOEM estimates the economic impacts of oil and gas activities in the Gulf of Mexico for various purposes. For example, BOEM provides forward-looking impact estimates for environmental documents developed by BOEM's Headquarters Office and Gulf of Mexico Regional Office. BOEM also develops retrospective analyses for the annual Department of the Interior Economic Report. Over the course of several study contracts, BOEM has developed a modeling framework for these various analyses. The most recent of these study contracts is being conducted by Industrial Economics, Inc. (IEc). IEc is making various methodological improvements and is improving the consistency among BOEM's analyses. In this presentation, Mark will first provide an overview of BOEM's economic impact analyses. This will include discussions of BOEM's analysis needs and the historical evolution of BOEM's economic models. Mark will then discuss the two models being developed by IEc: the Cumulative Impacts Model and the Life-Cycle Impacts Model. The Cumulative Impacts Model will analyze the impacts of all Gulf of Mexico oil and gas activities in a past or future year. The Life-Cycle Impacts Model will analyze the impacts of a particular action BOEM is considering; these actions include 1) a 5-Year Program of oil and gas lease sales, 2) A single oil and gas lease sale, and 3) a single lease awarded in a lease sale. Both models will estimate the impacts arising from industry spending, direct government revenues, and industry profits. These models will provide BOEM with a rigorous and flexible framework to understand the benefits of

offshore oil and gas development, which will allow BOEM to better weigh these benefits against the associated environmental costs.

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Southeast Regional Office
NOAA Fisheries

Matt McPherson
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Focus Groups and Automated Data Collection: Testing New Avenues for Informing Fisheries Management in the Southeast

Southeast Fisheries social scientists have been building a suite of management tools to inform social impact assessment of fisheries management for over a decade. Community Social Vulnerability Indices were implemented in 2015 after several years of development. Since then, these quantitative measures have been used primarily in a descriptive manner in social environments. A new attempt to automate the collection of census and fisheries data and generate indices will allow staff to devote more time to develop new tools and trend analysis. At the same time, there has been a long-standing need to better refine how qualitative data becomes incorporated into fisheries management. Recent focus groups were convened to understand how commercial and recreational fishermen viewed recent reallocation of a managed species by one of the regional councils. The summarized results of the focus groups were in alignment with public testimony and advice provided by advisory panels, providing a valid and efficient gathering of the qualitative information surrounding the management alternatives. The presentation will discuss both of these attempts to improve social science within the region and other innovative methodology now being used.

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Michael Jepson, Social Science Branch Chief, Southeast Regional Office, NOAA Fisheries, NOAA. Dr. Jepson is the Social Science Branch Chief with NOAA Fisheries' Southeast Regional Office in St. Petersburg since 2009 where he oversees the conduct of social and economic impact assessments for fishery management plans in the Southeast Region. Prior to coming to NOAA he served as Program Director for the Gulf and South Atlantic Fisheries Foundation and was technical staff with the South Atlantic Fishery Management Council from 1994-1999. He has conducted research on fishing communities in the South Atlantic, Gulf of Mexico and Caribbean regions of the US. He was previously a member of the Gulf Council's Socioeconomic SSC and Standing SSC. He has taught courses in cultural anthropology and community science at the University of Florida, College of Charleston and University of South Alabama. His current interest in developing social indicators for fishery management has developed into important applied research and several publications on the topic have appeared in such journals as Marine Policy, Coastal Management, Fisheries, NAPA Bulletin and Human Organization. Additionally, his work on identifying and defining fishing communities has been instrumental in meeting the mandates for National Standard 8 to the Magnuson-Stevens Fishery Conservation Act for the Gulf, South Atlantic and Caribbean regions.

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Understanding the Socio-Spatial Variation of Perception of Resilience Among the Mississippi Gulf Coast Communities

One of the priorities of the Sendai Framework is to enhance disaster preparedness to increase resilience and effective response. Enhancing disaster preparedness, however, requires an understanding of the existing resilience of an at-risk community as well as the perceptions of risk and resilience held by its residents. This study focuses on examining the relationship between perceptions of risk and resilience. The study involved administration of a survey that consisted of the Communities Advancing Resilience Toolkit (CART) and a series of socio-demographic questions to the Mississippi Gulf Coast residents in spring of 2015. Analysis of survey responses to questions pertaining to five domains of the CART (Connection and Caring, Resources, Transformational Potential, Disaster Management, and Information and Sharing) provide a multi-faceted view of how people see the resilience of their communities within the context of a variety of social and spatial characteristics. These results demonstrate that using CART to measure community resilience can help policy makers and community organizations understand variations in resilience among the ethnically diverse communities of the Gulf Coast. Such information is helpful in communicating risks and identifying mitigation strategies for climate change, sea level rise, and other human-environment interactions associated with the Gulf Coast.

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Jeff Gilliam
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**James Jackson,
Bob Battalio**

The Political Economy of "Managed" Retreat: A Case Study of Pacifica, CA

This presentation involves a recent economic analysis conducted for the City of Pacifica and funded by the California Coastal Commission and California Coastal Conservancy. The presentation will begin with an overview of the methods used for the economic analysis. This study incorporated: (1) geospatial "parcel" data containing values assessed for property taxes adjusted to market/replacement costs, (2) some attendance data applying benefits transfer to beach recreation, (3) very little analysis of other EFGS. Our results indicated that "retreat" was the least cost option for many planning areas. However, the economics of this retreat has been

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left unexamined. Retreat generally involves someone absorbing a significant loss. Without some form of public subsidy, homeowners will absorb a large loss, often a significant share of their total net wealth. This paper examines the economics of various mechanisms for retreat such as setbacks, leaseback arrangements, transfer of development rights, as well as potential financing mechanism and restrictions (e.g., second homeowners receive no or low subsidy) for any public subsidy.

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Charles Colgan
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Center for the Blue Economy

Estimating Benefits from Public Investments in Operational Oceanography

Marine resources play an important role in generating economic value. The ocean economy contributes an estimated 2% of US GDP through sectors ranging from offshore minerals to maritime transportation, fisheries, and coastal tourism and recreation. Ocean economy GDP has been growing at a rate nearly twice as fast as the US economy as a whole. It is likely that the US will depend even more heavily on marine resources in the coming decades. These resources and the value they generate are at risk from changing climate and growing anthropogenic pressure as coastal population and development grow. Responsible stewardship requires an understanding of marine and coastal ecosystem, how they respond to anthropogenic stresses, and how management measures can maximize their value over time. This, in turn, requires data on ocean conditions and marine resource status, and models to predict future conditions in the context of human use of these resources. Public investment in understanding and managing ocean resources competes for budget and attention with many other public needs. Identifying the socially optimal level of public investment in data collection, model development, and management is an important public policy objective.   It requires understanding the economic return from investments made by NOAA and other federal, state, and local agencies in ocean observation, modeling, and management. This session focuses on the challenges and state of the art approaches to estimating benefits from public investments in operational oceanography – the collection and analysis of data on ocean conditions and resources, and their contribution to human welfare and economic activity.   Topics to be covered include a framework for assessing economic value of federal investments in operational oceanography, and results from specific case studies in areas such as climate change effects (ocean acidification, Arctic sea ice, [others]) and ecosystem services (carbon uptake and sequestration, [others]).

Kuwayama, Yusuke
Bethany Mabee
Resources for the Future

The Consortium for the Valuation of Applications Benefits Linked with Earth Science (VALUABLES)

National and international organizations are placing greater emphasis on the societal and economic benefits that are derived from applications of satellite data, yet improvements are needed to connect the decision processes that produce actions with direct societal benefits. Quantifying the socioeconomic benefits of Earth observations can (a) demonstrate return on investment in satellites and data products, (b) help satellite programs make informed choices about how to invest limited resources, (c) give Earth scientists an effective tool for communicating the value of the their work in socioeconomically meaningful terms, and (d) increase the likelihood that a satellite or satellite data application produces socioeconomic benefits by requiring Earth scientist to think about how project outcomes will be evaluated. To encourage the use of impact assessments to quantify the value of Earth science information—and information from Earth-observing satellites in particular—energy and environmental economists at Resources for the Future (RFF) are collaborating with scientists at the National Aeronautics and Space Administration (NASA) through a cooperative agreement called the VALUABLES Consortium (Consortium for the Valuation of Applications Benefits Linked with Earth Science). Created in 2016 with a $3.5 million award from NASA, the consortium is working to quantify and communicate how the use of satellite information in decisions can improve outcomes for people and the environment. The consortium is conducting impact assessments for specific satellite data applications using an approach called the value of information (VOI). The VOI method compares outcomes in two different states of the world: a state in which action is taken based on currently-available information and a different state in which action is taken using improved information. The difference in socioeconomically-meaningful outcomes between the two states represents the value of the information. The consortium also seeks to build capacity within the Earth science community to quantify the value of Earth observations. Tutorials, webinars, workshops, and digital media describe the terms, concepts, and methods scientists can use to develop rigorous impact assessments for specific satellite data applications. Key to these capacity building materials is the development of a framework the scientific community can use to design impact assessments for their applied research. In this presentation, we will summarize the consortium's ongoing impact assessments, which quantify the value of using satellite data to enforce air quality standards, regulate air emissions from oil and gas development, detect harmful algal blooms, inform post-wildfire response, and predict ice sheet decline. We will focus especially on the air quality study (Sullivan and Krupnick 2018), which uses satellite data to find that about 24.4 million more Americans than previously thought live in counties that do not meet the annual PM2.5 health standard set under the Clean Air Act, and that if such areas had sped up their PM2.5 reductions as much as nonattainment areas did, 5,452 premature deaths would have been avoided, a welfare gain to society of $49 billion.

Lambert, Bruce
Metro Analytics

A Case Study of an Avulsion on the Mississippi River and its Disruption on U.S. Agricultural Movements via Barge

The Lower Mississippi River (LMR) is the largest port complex in the western hemisphere. Inland navigation via barge keeps American agriculture competitive in world markets, as barges generate economies of scale that create lower transport costs to shippers. (Center for Ports and Waterways, Texas A&M Transportation Institute, 2017) However, traffic could be disrupted by an avulsion, which could relocate the river, and strand navigation access to existing maritime facilities. The Mississippi River has experienced many avulsions over its history. The river has been "trying" to move to an older channel, which resulted in the U.S. Army Corps of Engineers opening the Old River Control structure in 1963. As such, a potential avulsion would disrupt not only waterways in Louisiana, but industries that depend upon reliable inland navigation. The performance of the inland waterway system has been studied, some of which addressed system disruptions. There have been studies conducted on lock outages, showing the interconnected system of inland navigation (Center for Transportation Research, The University of Tennessee, Vanderbilt Engineering Center for Transportation and Operational Resiliency, 2017), while other studies have questioned the ability of modal diversion to handle system disruptions. The research community has also addressed asymmetric risks from other events, such as Tsunamis, but research on avulsions remains sparse. In 1980, Louisiana Water Resources Research Institute published, "A Change in the Course of the Lower Mississippi River: Description and analysis of some economic consequences". (Johnson, 1980) The study did not focus on the implications on navigation, focusing on highway, rail and pipeline disruptions. The irony is that more ports are examining moving facilities away from downtown areas, so these more structured events may provide some ideas concerning responding to system disruptions. This paper, using a case study structure, reviews some potential reactions to an avulsion, focusing on the implications on agricultural shipments by barge, primarily for export markets. Several critical factors must be examined in evaluating any disruptions such as the loss of river anchorages and storage capacity, seasonality, and reduced international maritime access. Given the volume and importance of agricultural trade on the LMR, disruptions of the type considered here will impact the competitiveness of U.S. agriculture and could have spillover effects throughout the world. The results should be of interest to others seeking to evaluate the exposure of river systems to asymmetrical disruptions**.**

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Program

Multidisciplinary Knowledge Integration to Support Louisiana Coastal Indigenous Communities' Response to Natural and Technological Disasters and Adaptation to Climate Change

The project team collaborated with two United Houma Nation communities to document how environmental stressors affect the livelihoods of these communities and shape the mitigation strategies they use. The researchers, in collaboration with the tribe, made use of traditional ecological knowledge and current mitigation efforts in order to understand the tribe's adaptive capacities. We produced a story-map based resource that can be used by the UHN and other indigenous communities facing similar challenges. This work may encourage other mitigation and adaptation planning efforts and increase communication between communities and policymakers. Goals and Objectives: Goal 1: Integrate policy, science and local knowledge to aid the UHN in adapting to chronic and acute environmental stressors; Goal 2: Analyze the adaptive capacity of the UHN using physical science, social science, and TEK; Objective: Examine and compare structural and nonstructural mitigation measures implemented in the area by the tribe and policymakers; Goal 3: Assist the tribe in honing its adaptive capacity to adapt to chronic and acute environmental stressors Objective 1: Prepare a timeline of historical events in collaboration with the tribe Objective 2: Share the analysis with the tribe so that the tribe can hone its adaptive capacity for future chronic and acute environmental stressors and influence mitigation policy implemented to lessen those stressors; Goal 4: Engage local agencies in the adaptive capacity analysis and disseminate the results beyond the case study communities. Deliverables: Interviewed five TEK experts from the two study areas; Created a timeline of stressors in order to track adaptations over time; Acquired and processed historical aerial and satellite image data of areas of interest that emerged from the analyses of the TEK expert interviews to include in the story map resource; Create an online story map tool, to help with future adaptation efforts.

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Measuring Risk Preferences in the Field

We devise an experimental design that should permit assessment of risk preferences within the context of a mail or internet survey, while allowing further exploration of risk perception. Utilizing historical weather data, we present mail survey respondents with information about rainfall and temperature probabilities. We then allow them to "gamble" their $5 incentive payment on one of four possible weather outcomes, each designed to bracket a range or risk preference parameters (via Constant Relative Risk Aversion formulation of Expected Utility). Responses permit inference on risk tolerance in the context of weather, which is relevant for the survey

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subject matter – flood risk and climate change. We also assess subjective beliefs about historical weather outcomes to produce information that is useful for Bayesian updating of weather beliefs. We present empirical results to explore the utility and limitations of our approach.

Consumer Preferences for Post-storm Coastal Adaptation: An Application of Choice Experiments

Recent hurricanes, like Michael, Irma, and Sandy, have revealed the vulnerability of coastal development. Aside from erosion, storm surge, flooding, and wind, sea level rise presents a chronic, press disturbance that calls into question models of stationarity and viability of some developed coastlines. Coastal protection includes structural approaches (e.g. seawalls, rip-rap, bulkheads), beach nourishment, shallow sand deposition, and use of living shorelines. Organized retreat, reclamation, and restoration will also likely be parts of adaptation in some locations. After devastating storms strike low-lying coastal areas, there is an opportunity to either upgrade coastal development for resilience or to relocate people from threatened shorelines. So-called "buyouts", however, suffer from coordination problems and raise equity concerns regarding the use of coastal land. In this paper, we may use of a stated preference analysis designed to assess coastal residents WTP for post-storm mitigation to their home and the WTA buyouts, that would permit them to move elsewhere. Our study sites are Mobile and Pensacola Bays in Alabama and Florida, respectively. In addition to eliciting information on subjective risk perceptions (likelihood of hurricane strikes, conditional damage estimates), we evaluate tradeoffs associated with building "as was", upgrading structure to be more resilient, accepting a buyout from a nature preserve, or accepting a buyout from a developer. We vary out of pocket expenses for rebuilding (as a proportion of structure value) and buyout payment (as a proportion of total value [land and structure]), while also varying the level of risk associated with future location (whether rebuilding or moving). An additional design feature offers random assignment of social pressure, where the survey indicates that the majority of neighbors have elected for one of the four options. This permits some exploration of coordination problems and social influence. Preliminary results from a mixed logit model indicate that Bay residents prefer upgrading to rebuilding 'as was', all else being equal. Both buy-out options are seen as inferior to rebuild, and there is a slight, but not statistically significant, preference for nature preserve vs. developer buy-out. Risk of housing loss reduces likelihood of rebuilding, indication the remaining on the coast is decreasing and convex in probability of loss. The coefficient on ln(rebuilding cost) is negative, permitting welfare analysis of rebuilding options. The coefficient on ln(payment), however, is negative, which is counter-intuitive, suggesting homeowners prefer lower buyouts. We suspect endogeneity problem, since payment is based on percentage of total parcel value, which is likely endogenous. We explore an IV – control function approach to address this.

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Determining the Economic Impacts of a Failure of the Old River Control Structure

The Mississippi River has changed course several times over past millennia. It is possible that a potential avulsion due to the failure of the Old River Control Structure (ORCS) could cause the river's course to be altered again. The ORCS was built to control the latitude flow of water down the Mississippi and Atchafalaya Rivers to approximately seventy and thirty percent, respectively. The structure has been tested over the years by flood waters since its completion, resulting in modification and improvements to the ORCS. The ability of the structure to withstand the pressures of future natural events is not certain. A number of industries are dependent on a navigable Lower Mississippi River system. An avulsion at the ORCS would interrupt commercial navigation, disrupting the supply-chain for numerous commodities and industries. Potential implications of an avulsion include flood damage to residential homes and commercial property, collapse of major highway and railroad bridges in the Atchafalaya Basin, and salt water intrusion affecting the drinking water supply of local residents as well as manufacturing and refining facilities along the river. The purpose of this paper and presentation is to summarize and update previous research that examined the physical and economic consequences of an ORCS failure. This will be achieved by using the economic estimates provided by previous research and updating these estimates to reflect their value in current dollar values. In addition to this update of previous estimates, we will review other factors that should be considered in future research to best determine the economic impacts of a Mississippi River avulsion.

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Impacts of Climate Change on U. S. Peanut and Peanut Butter Prices

The study examined the impact of changes in climate (maximum temperature during the peanut development, maximum temperature during the harvesting period, rainfall during the planting period, and rainfall during harvesting period) on peanut and peanut butter prices in the United States through a two-step approach. We first develop an Equilibrium Displacement Model for U.S peanut butter industry through which climate change-induced market responses may be evaluated. Changes in climate indirectly impact on peanut butter market through their direct impacts on peanut supply. Therefore, in the second step, a translog restricted profit function was employed to estimate the impacts of climate variations on peanut supply. The results from translog restricted profit estimation suggested that the effect of average maximum temperature during the

plant development and rainfall during the harvesting period on peanut supply are negative, while that of average maximum temperature during the harvesting period is positive. In detail, peanut supply will decrease by 9.91% in respond to a rise of 1% in average maximum temperature during the peanut development. While an increase of 1% of rainfall during the harvesting period may reduce peanut supply by 0.32%. In contrast, an increase of 1% in average maximum temperature during the harvesting period will raise the peanut supply by 4.99%. Changes in climate impact on peanut butter market through their effects on peanut supply. Results from the simulation demonstrate that an increase of 1% in average maximum temperature during the peanut development may raise the peanut butter price by 0.77%, and therefore demand for peanut butter may drop 0.15%. Demand for peanut butter may drop 0.05% due to an increase of 0.03% in peanut butter price which is resulted from an increase of rainfall during the harvesting period of peanut. On the other hand peanut butter price may drop 0.39%, and demand for peanut butter may increase by 0.07% in response to 1% increase of average maximum temperature during the harvesting period of peanut.

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Coastal Dynamics and Adaptation to Uncertain Sea Level Rise: Optimal Portfolios for Salt Marsh Migration

Until recently, coastal marshes have been largely resilient to changes in sea level due to natural adjustments in vertical elevation via vegetation growth and sediment accretion, and by migrating landward as sea levels rise. However, there is now widespread concern about the loss of marsh benefits given the accelerated and uncertain rise in sea level. Amidst this uncertainty, efforts to sustain marshes threatened by rising sea levels often emphasize the preservation of transgression zones - undeveloped and non-armored uplands onto which marshes can migrate landward as sea levels rise. The extent to which preserved upland transgression zones eventually become marsh, however, depends on uncertain future sea level rise and natural dynamics that determine how, when and where marshes migrate and drown. Different types of transgression zones (e.g., different land types at different elevations and/or locations) will hence differ in their expected productivity of future marsh "supply," where this dynamic productivity is subject to uncertainty. The joint dependence of marsh migration on uncertain future sea level and the types of land that are preserved implies that systematic diversification can likely enhance management outcomes, much as it does in financial portfolios. This reflects the capacity of diversified approaches to hedge against risk in ways not possible using traditional management. Yet despite the potential advantages of diversification in management contexts such as these, no coastal marsh conservation program has capitalized on this insight. The resulting marsh conservation strategies may inadvertently "put too many eggs in one basket," increasing the probability of ineffective adaptation. This paper develops the first portfolio model designed to optimize the benefits of a dynamic coastal system such as migrating salt marshes. The continuous-time dynamic model focuses on the diversification of transgression zone investments to maximize marsh conservation benefits over time, while hedging risk across transgression zone types. Our approach enables closed-form analytical solutions that offer generalizable intuition unavailable through empirical results alone. The underlying biophysical model accounts for the dynamic nature of salt marsh geomorphology via a spatially explicit, process-based approach that accommodates uncertain sea level rise. The model is illustrated using a case study application to the Virginia Coast Reserve Long Term Ecological Research (LTER) site on the Eastern Shore of Virginia, USA, focusing on portfolios that combine preservation of (1) agricultural land, (2) forest land and (3) intertidal land with established marsh. The model provides theoretical and empirical insights for coastal adaptation unavailable from prior work. Results demonstrate how optimal portfolios are influenced by factors such as the cost of different land classes, the effect of marsh migration on land cost, and the mean rate (and variance) at which marsh migrates onto different types of land, and the rate of uncertain sea level rise. Calibrated empirical results suggest that current (observed) preservation portfolios are sub-optimal, and this sub-optimality increases with expected sea level rise. Results also provide guidance for how preservation can be adapted to accommodate factors such as expectations about sea level rise and the additionality of preservation, among other features that determine optimal diversification.

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Winning Ugly: The Potential for Converting Ugly Food to a Horizontally Differentiated Product

Food waste has attracted significant attention in recent years due to the substantial economic, societal, and environmental costs it exerts. However, food waste is difficult to curb even with clear goals and refined initiatives. Hence, for progress towards goals to manifest, we must uncover the causal drivers of food waste across the supply chain, including at the consumer level. In this paper we focus on food waste arising from 'ugly' food, i.e., produce with size, shape or color that deviate from prevailing cosmetic standards. Even though efforts exist to convince consumers that certain cosmetic features do not influence nutritional or functional quality, the unwillingness to sell, purchase, and consume ugly produce still causes substantial food waste along the supply chain. For example, annually nearly 25% of the 115,000 tons of fresh fruits and vegetables produced in Kenya are denied entry into overseas markets for aesthetic reasons. In the United States, around 20 billion pounds of fruits and vegetables go to waste on farms every year, often because of cosmetic concerns. To reduce waste from ugly food, some retailers such as Meijer and Imperfect Produce offer ugly food at a discount and Walmart sells ugly fruits and vegetables at a 30 percent discount in their United Kingdom-

based chain. Although discounting ugly food seems to convert would-be waste into windfall, such discounts may reinforce the fallacious link between imperfect appearance and lower quality, undermining the initial policy goal and potentially generating unexpected and unfavorable consequences. Hence, we argue that, instead of selling the ugly food as inferior products to all consumers with discounted prices, a more sustainable solution is to help consumers treat ugly and standard produce varieties as horizontally differentiated products rather than as vertically differentiated products. To study this, we conducted a choice experiment for US consumers to estimate attitudes and preferences for ugly food. We found that 1) farmers markets with larger proportion of customers who value the freshness of the food and prefer all natural foods would be a better marketplace for ugly food than traditional grocery stores or supermarkets; 2) by linking ugly food to fresh and all natural food, the imperfect appearance becomes the evidence of 'naturalness' rather than defectiveness and, as a result, ugly food can be desirable to some consumers who have higher preferences for fresh and all natural products. This study is the first to discuss the potential for converting ugly food from a discounted suboptimal food marketed in a strictly vertically differentiated market to a horizontally differentiated food that is preferred by some consumers without price discounts. The work could identify the scope of such a novel solution to reduce the discard of ugly produce in the long run.

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Quantifying the Impact of Different Management Regimes on Two Otherwise Similar Fisheries

We explore the different behavioral adaptions and economic outcomes of two similar fisheries managed under different management regimes. The US Gulf of Mexico reef fish fishery and the snapper-grouper fishery on the Atlantic coast of the southern USA consist of similar fish species, similar fishing vessels and methods, and supply similar markets, but they are managed by different fishery management councils (FMC). Between 2007 and 2010, the Gulf of Mexico FMC transitioned all the major species in the reef fish fishery into catch share management, effectively creating tradable permits. In contrast, the (US) South Atlantic FMC continued to manage the snapper-grouper fishery primarily with input control measures. Using logbook data and detailed revenue and cost data, we explore the resulting differences in these two fisheries brought about by the management regimes. Further, we quantify the aggregate economic costs, benefits, and rents generated by each fishery. We highlight the behavioral adaptions that lead to the increased profitability brought about by of catch share management.

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Influence of Land Titling Policy on Land Abandonment in China

China has experienced rapid economic growth and development since the 1980s. However, there exists a wide income gap between rural and urban sectors of the economy. During the last decade, the per capita income of an out-migrated rural laborer grew by an average of 11.56% per year, and by 2016, it reached about $474.63 per month. In contrast, the average annual income per mu fluctuated quite a bit and averaged around just $94. With an average farmland holding of only 2.26 mu per person, the average monthly income for a rural laborer is approximately $17.74. It is obvious that there is a huge gap in income between those who out-migrate to a city and those stay behind and cultivate farmland. This rift has resulted in 282 million rural laborers migrating to cities, and as a consequence, it had left 7.78-9.43% of farmland uncultivated due to labor shortage, aging rural population, feminization of agriculture, and lack of functioning farmland transaction market in the country. Using face to face interview data collected in 2015-2016 from nine provinces in China, we find that Land titling has different effects on land abandonment depending on homogeneous clusters considered. Specifically, we find (I) land titling may significantly reduce the abandonment rate for the clusters of population characterized by closer to business centers and ownership of hilly land, but not for the cluster with closest to business centers and flat land. (II) Land titling reduces land abandonment in a cluster with a high proportion of family members who are dependent on agriculture, the farm is located farther from the business center, and the farm terrain that is mountainous but not for the cluster with non-agricultural employment having similar other characteristics. Although the effects are different based on the cluster characteristics, we can conclude that land titling policy would reduce a land abandonment problem by enhancing land property rights.

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Current Status and Trends of Soft Shell Blue Crab Production and Producers in Louisiana, Maryland and Virginia

Soft crab production is notoriously prone to high mortality, yet the causes for mortality are poorly defined. The industry is also in severe decline. In order to better understand the current practices in the soft shell blue crab industry, we designed a survey for shedders in Maryland, Virginia, and Louisiana. We collected a total of 71 surveys (45 from VA; 12 from MD; and 14 from LA) in 2016- 2018. Respondents were new and seasoned crab shedders with the average time in the industry of 23.2 years. These shedders reported producing an average of ~8,000 soft shell crabs per year with a range of 120 to 100,000 individual soft shell in a range of 1 to 250

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trays. Overall, the vast majority of shedders catch their own peelers or busters (76.9%), but ~17% also buy peeler crabs from others. Mortality rates in shedding systems using peeler pot-caught crabs ranged from 10-30%, while those caught in traps had mortality rates ranging from 5-65%. It is possible that crab injury is less likely in a peeler pot than in a standard trap or during harvest of a standard trap where peelers are mixed in with other hard crabs. Therefore, it is important to screen peelers for injuries and damage before entering the shedding system. Almost twice as many shedders (n=40) screen for injuries compared to those that don't (n=23). Recirculating or flow through systems are the most common for soft shell production with a few using a hybrid combination of both. In all three states, 53% of shedders reported using a recirculating system while 38% were running flow through systems. This supports anecdotal reports that shedders are switching to recirculated systems for better control over water quality and other factors. The water source is also very important, especially for flow through systems. The vast majority (71%) of shedders were using the local waterway as their water source. The average length of time peeler crabs spent in the system was 4 to 7 days with a range of 1 to 21 days. Our survey began to characterize an aquaculture industry that often operates with little notice or attention. Our findings will help educate and guide research and outreach efforts with this sector in the future.

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Tapping a Research Resource: Rich Datasets of Coastal Information for the Gulf of Mexico, US and Beyond

For more than 50 years, Sea Grant has established collaborative relationships across the United States, linking science to application. Recently, Sea Grant, the National Centers for Environmental Information (NCEI), and the Northern Gulf Institute (NGI) partnered to expand the use of long-term coastal data records that support environmental prediction, scientific analyses, and formulation of public policy. This collaborative project focuses on Gulf of Mexico restoration activities and applying emerging technologies to synthesize these records into integrated products and services. With multiple field locations, cooperative institutes, and regional climate centers, NCEI is a leading authority for environmental information. The audience will learn about a sampling of NCEI-developed products with prominent socioeconomic components, such as the Gulf of Mexico Data Atlas, which includes visual representations of living marine resource locations, areas utilized for shipping and navigation, and oil and gas exploration. The Harmful Algal BloomS Observing System (HABSOS) will also be discussed. This data-driven project provides environmental managers, scientists, and the public with information on bloom events in the Gulf of Mexico. Information on NCEI's data indicators that highlight weather and climate's effects on society and the economy will also be shared. In an effort to better serve target audiences, session attendees will also be asked for feedback to inform the next generation of NCEI products and services and how they would like to receive those products and services.

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The Value of Water Quality to Coastal Recreation in New England

Nutrient over-enrichment is a significant problem in coastal waterbodies, particularly estuaries, across the United States. There are few existing studies of participation in and values for coastal recreation other than fishing, particularly as related to water quality; and those that exist are outdated. Moreover, recreation at the many smaller but heavily-used coastal access points is not well-studied. This information is critical for informing efforts to improve water quality in coastal systems. At the Atlantic Ecology Division of the U.S. EPA, we are conducting research that explores the social dimensions of water quality and recreation, including understanding the number of people who use coastal areas for recreation, how much they value coastal recreation, and how those values are affected by changes in water quality. Our research includes a primary data collection effort using a revealed preference survey to elicit coastal New England residents' values for water recreation, sense of place, and perceptions of water quality. This presentation will include an overview of the survey and related research and preliminary results, including discussion of various models that we will be estimating using the survey data and water quality data. These include the use of water quality perceptions versus objective measures, modeling short trips to nearby smaller access points as opposed to visits to major beaches, and other topics. The aim of this work is to provide a picture of how water quality affects the value of various types of recreation in coastal areas and estuaries, especially the many smaller access points.

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Development and Transfer of a Predictive Water Pricing Model from Australia to Texas

Given current water scarcity in various geographies around the world, and the likelihood of increasing scarcity of water moving forward, it is important to build frameworks to improve the efficient allocation of this resource. Development of water markets can expand the current allocative toolkit but will require an understanding of the value (price) of water as a commodity. Other nations have worked on developing water markets, and Australia in particular has created a robust water market over the past two decades. This long running data set has the requisite data for analysis by advanced analytic techniques. By combining Australian market (commodities) and biophysical (hydrological) data, and using them as inputs, it is possible to generate the price

of water as an output. Running the model with identical inputs, but with values from Texas, will yield a theoretical price for water regionally. Model generated prices can be compared to existing spot transactions in the Rio Grande Valley.

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Potential Changes to Louisiana Hardwood Timber Industry Economic Contributions Following Emerald Ash Borer Invasion: An Input-Output Approach

The Emerald Ash Borer (EAB, *Agrilus planipennis*) will have untold impacts on the contributions hardwood timber products provide Louisiana's economy. We modeled a scenario where ash mortality was assumed to follow a beta distribution to kill essentially all Louisiana ash within 25 years. Future ash mortality volumes were discounted to the present and valued using market prices to estimate an annualized effect on timber receipts. Assuming the dead timber would have otherwise been typical trees of average quality, stumpage was valued at $1.57 million, with deliveries totaling $3.48 million. A salvage arrangement using the double declining balance method coupled with a second beta distribution centered upon Louisiana's current 2.84% harvest-to-inventory proportion depreciated the timber's value monthly over one year. Following salvage, average stumpage revenue declined -$1.54 million, mill deliveries fell -$3.41 million, while state timber severance tax collections declined by -$46,800. The value added and employment direct effects to Louisiana's economy averaged -$882,400 and -41.6 jobs respectively. The multiplier effects of these losses emanating from the timber industry resulted in additional declines averaging -$2.56 million in value added and -45.6 jobs across the state economy on the drop-in output of -$4.51 million. The total economic effects summed to -$3.44 million in value added and -87.1 jobs on output declines of -$9.46 million.

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Geologic potential for Lower Mississippi River Avulsion

On average the Mississippi River has changed course about once every 500 years over the past 7000 years. On a few rare occasions channel switches have resulted in major changes of the course of the river into a significantly different hydrologic basin. These changes are called avulsions of the river. The Mississippi River intercepted the course of the Red River in the 16th century near the current location of Old River. The two rivers have shared and exchanged flows since then. In the 1800s the Atchafalaya River, which had previously been the downstream arm of the Red River began receiving more flow through the juncture. As a result, Congress enacted the Flood Control Act of 1954 which authorized the construction of the Old River Control Structure to prevent the inevitable change in course of the river. An examination of the geological controls that have determined the locations of previous changes in course and avulsions of the river can be used to assess the potential for future changes. Recent studies of geologic faults as a part of the Louisiana Coastal Geohazards Atlas have suggested that they may have played a role in past avulsions. Course changes tend to follow well-worn pathways because the abandoned channel belts of earlier courses of the river consist of sand substrates that are easily erodible. A future change in course may also be caused by the failure of man-made structures that are intended to control or divert the flow of the river. These factors suggest a set of initial conditions that will favor the site of a change in course or avulsion that when combined with a trigger event, such as a major flood, will determine the most probable location. Scenarios for a future change in course are examined for three locations: the Old River Control Structure, the Morganza Spillway and the junction of the Mississippi River and Bayou Lafourche at Donaldsonville.

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Community Preferences for Tidal Energy: A Choice Experiment in Puget Sound Washington

In this study, we administered a choice experiment concerning tidal energy in Puget Sound, Washington. Local opposition in Washington for tidal energy has been strong in the past, with no project ever coming to actualization. Projects come across financial barriers as well as strong community opposition. Despite being a renewable energy source, tidal energy turbines are feared to damage marine ecosystems. This paper aims to explore what aspects of tidal energy are favorable and what would be a subsidy amount to offset the perceived negatives such that communities would be in favor of tidal energy development. Our choice experiment included 4 attributes, including a cost attribute. Tidal energy is described in terms of green electricity generated, provision of a whale protection device, depth in water column, and subsidy off electricity bill. The standard approach in choice experiments is to include a cost attribute, for example a tax, percentage increase to electricity bill, or a one-off payment. We choose to ask respondents choice sets which include a subsidy to try and offset the negative perception of tidal energy. In addition, much of the energy produced in Washington state is from renewable sources, therefore production of tidal energy would not equipoise any dirty energies. We estimate willingness to accept for different projects of tidal energy. We find that respondents who believe tidal energy will occur in the Puget Sound in the next 10 years are more accepting of tidal energy. Additionally, respondents who believe that climate change deserves our attention are most willing to compromise on subsidy amounts. This paper is novel in that there are few stated preference studies which elicit preferences for tidal energy development. In addition to exploring the preferences for tidal energy, we also determine whether anticipation of future development influenced choice strategy. The notion of Not-In-My-Backyard can help

describe support for renewable energy projects in general, but opposition for plants to be local (Petrova, 2013). This may be the case for tidal energy as well; despite that tidal turbines would be located offshore and underwater, the depth of the turbine in the water column proved to be a significant factor in predicating acceptance. Depth can be considered a proxy for location in this instance. We find that acceptance is higher for projects which are further away from shore. However, respondents were by far the most concerned about wildlife, particularly the orca whale, which is an endangered species in the area. The results from this project can help future developers understand the drivers of local acceptance and where they could focus research and campaigns in order to address community opposition.

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Fish or Flight: The Impact of Transferable Access Rights on Rural Alaskan Salmon Harvesters

This paper explores how salmon harvesters in rural Alaska responded to the implementation of a limited access management regime that introduced transferable permits in 1975. In the context of a predominantly subsistence economy, the lump-sum payments from salmon permit sales were significant wealth shocks. Using household survey data collected in nine remote Alaskan villages, I estimate the impact of permit sale on the initial permit holders and their descendants. The eligibility rules used to allocate permits allow me to identify the impact of transferability by comparing the original permit holders to their younger siblings and to applicants given non-transferable permits. Sale of the permit by original permit holders makes their descendants more likely to migrate out of the original village and less likely to participate in commercial or subsistence harvest. Predominantly allocated to men, the higher value drift net permits were leveraged into an immediate increase in the probability of outmigration, an increase in durable assets, but no long run improvements in descendant outcomes. Contrary to the intentions of the permit system, set net permit sales by women diminish the assets of the original permit holder, but make their descendants more likely to be formally employed outside the village. The results suggest that a transition to rights-based management of natural resources will have unintended distributional consequences that undermine the sustainability of rural fishing operations. The magnitude of these effects depends on liquidity, gender norms, and labor market frictions.

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Measuring Individual Community Capacity, Resilience and Recovery in Three Louisiana Coastal Parishes

Louisiana's coastal communities face tremendous challenges related to severe weather events, threatened ecosystems, Inundation, rising sea levels, hazardous spills, and land subsidence. The physical safety as well as the livelihoods of coastal citizens are being severely impacted. While the challenges to both rural and urban areas of the Louisiana coast are similar, these communities are not homogeneous in their strengths and struggles. Additionally, there needs to be a better understanding of what "recovery" looks like for each community through comparison of pre and post disaster capacities. As part of a large, transdisciplinary research project focused on solutions to this coastal crisis, a wellness index was developed to measure the variations and capacity gaps among three coastal Louisiana Parishes both prior to and after the south Louisiana flooding event of August 2016. Adopting the methods of Burton (2015) and Cutter et al. (2010), we collected 49 variables relating to local well-being at the census-tract level in East Baton Rouge, Ascension, and Livingston parishes. The variables were categorized into public health and safety, community identity, economic stability, natural environment, and built environment to capture dimensions of well-being and to better understand how each community could be aided in developing a plan for future resilience.

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Sustainable Seafood Certification: The End or Just the Beginning?

Over the past many years, some vocal stakeholder and advocacy groups have been clamoring for third-party assurance that marine natural resources are being responsibly managed, and seafood is sustainably harvested. In response, a plethora of business, NGO, and/or governmental entities have created sustainable seafood assurance programs, some more formal than others. Even in the Gulf of Mexico region, stakeholders created the Audubon G.U.L.F. Responsible Fisheries Management certification program. With the mushrooming of such programs, the certification movement culminated in the Global Sustainable Seafood Initiative (GSSI), which benchmarks and validates certification programs against the UN FAO Guidelines for the Ecolabelling of Fish and Fishery Products from Marine Capture Fisheries. With the advent of GSSI, many industry players hoped the sustainability debate would be settled and the confusion about sustainable seafood cleared. But has it? It is still unclear what the costs and benefits are, who reaps the benefits and who bears the costs, and, perhaps most importantly, whether such certifications will remedy the overarching issue of unsustainable fishing practices globally. Even with GSSI, given the up-front costs, the question remains as to whether industry should embrace or shun certification. This question is more likely to be answered by individual industry players depending on their position in the market rather than whether their product is being responsibly and sustainably managed by management authorities. This lightning round will touch on these issues with specific reference to the Gulf of Mexico.

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Changing Geographies of Flood Mitigation Policies: A Case Study of Central, LA

Louisiana is experiencing rapid relative sea-level rise. Despite deep attachments to place, residents are migrating inland. These dual processes are shifting the coastal zone inland and creating policy challenges for public officials. The city of Central, Louisiana is one that will quickly see the effects of an inwardly moving coastline. Previously a part of Baton Rouge, Central is a relatively new development that expanded into the 100-year floodplain in 2005 (City of Central 2018). This poster will graphically present the changing geographies of flood mitigation policies since a major flood in 1983 to the present in Central. Drawing upon interviews, review of public policies, focus groups, and scenario building workshops, the poster will show the progression of existing policies and ordinances from 1983 to 2016, summarize expressions of community opinion and input in flood planning, and compare them with policy change in recent decades. The best ways to increase a community's resilience to natural hazards is to give them power in the decision-making process. A changing coastline can put major stress on both the communities that are being lost and on those that are morphing into their role as the new coastal areas and must be given the proper resources to be able to succeed in leading the way in a more fluid policy arena. The results of this longitudinal comparative analysis indicate a lack in evolution of government policy to match the speed of development into flood-prone areas, the recent growth in public expressions about flood safety and the lack of prior adaptations taking coastal encroachment into consideration when planning adaptation and mitigation strategies.

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Spatial and Temporal Dimensions to the Value of Recreational Fishing in U.S. Waters

In 2016, President Obama signed into law the Outdoor Recreation Jobs and Economic Impact Act of 2016 (Outdoor REC Act), which mandates that the contributions of the outdoor recreation industry, including recreational fishing are effectively measured and accounted for when computing gross domestic product (GDP). Although substantial advancements have been made in measuring the outdoor recreation industry's contribution to the overall economy, there is a lack of information on trends in outdoor recreation value from an economic welfare perspective. This current paper aims to fill this gap in the literature using coastal fishing as the case study. Leveraging data for over 300,000 shoreline fishing trips to coastal waters along the Atlantic and Gulf coasts from 2004 to 2016, we estimate how the value of a coastal recreational trip varies across time and space. A repeated discrete choice model of participation and site choice is employed in two-month intervals from 2004 until 2016, disaggregated by region. The results show considerable temporal heterogeneity within a year, but limited heterogeneity across years. Further, the results reveal spatial heterogeneity across five regions of the United States. Surprisingly, recreational fishing value was robust to the recession, although there is suggestive evidence that the value of coastal fishing is co-linear with GDP per Capita growth. Benefits transfer is often critiqued for not accounting for temporal instability of estimates over a wide time horizon. These results provide evidence of the feasibility of transferring estimates of coastal recreation value across time, as long as the systematic variation in value from season and region are accounted for.

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Combining Aggregate and Individual-level Data to Estimate a Repeated Choice Recreation Demand Model

Outdoor recreation demand models based on a random utility maximization framework—in particular, variants of the repeated choice multinomial logit model—are widely used by researchers and policy analysts to explain outdoor recreation behavior and to evaluate the economic benefits of environmental quality improvements at recreation sites. The standard approach to estimating such models involves collecting individual-level data on the recreation site choices for a representative sample of the user population. The time and expense required to collect a sufficient quantity of such data limits wider application of the approach, so it would be desirable to develop methods of estimation that could use data that are more readily-available. In this study we develop and apply an approach to estimating the parameters of a traditional recreation demand model using aggregate data on the number of visitors to each of multiple outdoor recreation sites in the study area, combined with supplemental data on a random sample of individuals' total demand for trips in the study area. In many cases these data may be substantially easier to obtain than individual-level site choice data, since aggregate visitation data are routinely collected by federal and state resource agencies who manage public parks and other publicly owned recreation areas. To evaluate our proposed approach, we first test the estimator using a simulated dataset. We show that the alternative data sources described above are sufficient to estimate all key parameters of a site-choice model, and that a second-stage ordinary least squares regression can recover the coefficients on the site attributes. We also used simulations to compare the expected information content of aggregate data to that of individual-level data, which are traditionally used for estimation. We then applied the model to a case study of outdoor recreation activities in the Chesapeake Bay watershed. We combined three datasets to estimate the model: 1) aggregate site visitation data, which comprise records of the total number

of visitors per year to a collection of outdoor recreation areas in Maryland, Virginia, and Delaware between 2001-2011; 2) census data on the number and location of households that live within an approximately three-hour driving distance from Chesapeake Bay; and 3) supplemental data from two recent stated preference surveys on the total number of outdoor recreation trips taken by random samples of respondents to water access sites on the Chesapeake Bay. We use the model to estimate the benefits of the Chesapeake Bay Total Maximum Daily Load (TMDL) requirements to recreational users of the bay, and we discuss limitations of the approach and possible directions for future research.

Niebuhr, Michael
Galveston Bay Foundation

Galveston Bay Foundation's Oyster Shell Recycling Program and Volunteer-Based Oyster Gardening Program

The Eastern Oyster is an essential component of the Galveston Bay estuarine ecosystem, providing habitat and food for other species, sediment stabilization, shoreline protection, filtration of contaminants from the water, and a huge economic value as a commercially harvest resource. Yet over 50% of the Galveston Bay oyster reefs were destroyed by Hurricane Ike sedimentation in 2008 (TPWD). As a result, Galveston Bay has experienced a shortage of hard substrate, a key component of successful oyster development. In an effort to reestablish hard substrate in Galveston Bay, GBF partners with local restaurants to collect shucked oyster shells. The shells are transported weekly by GBF staff to upland sites where they are stockpiled and sun-cured for a minimum of 6 months. The recycled shells are returned to the bay via shoreline protection and small-scale reef creation projects as well as reef enhancement initiatives like volunteer oyster gardening. GBF piloted the Oyster Shell Recycling Program in 2011 with 1 restaurant and 1 shell storage site. Over the last 6 years, the program has progressed through an expansion phase, resulting in 10 restaurant partnerships and 3 shell storage sites, thanks to the assistance of Coastal Management Program (CMP) funding and private donations. Since 2012, GBF has fostered relationships in multiple bayfront communities where waterfront residents suspend recycled oyster shells ("oyster gardens") from their piers to recruit spat. The "gardened" oysters are transplanted onto nearby restoration reefs to enhance the existing oyster populations. By incorporating volunteer oyster gardening in the Oyster Shell Recycling Program, the benefit of shell recycling can come full circle, returning an otherwise lost natural resource to the bay. In addition, the community outreach and education aspect of the gardening program is vital to the continued promotion of the importance of oysters to Galveston Bay. As GBF returns recycled oyster shell as well as new oyster spat to the bay, it can restore and enhance crucial oyster populations that then can contribute to the already stressed commercially available oyster reefs. All GBF reefs and spat transplant are in non-harvestable waters as a chance for those reefs to reestablish, to then eventually help repopulate harvestable reefs.

Niu, Huizhen
Krishna P. Paudel, Louisiana State University and LSU AgCenter

Qiuzhuo Ma, Guangdong University of Foreign Studies; Doleswar Bhandari, New Mexico State University

Identifying the Optimal Locations for Poultry Litter based Electric Reactors using Multi-Criteria Evaluations in GIS

Many southern U.S. states, including Louisiana, have poultry production as a major agricultural industry providing substantial revenue and employment. Poultry production is also a source of litter production, which, when applied excessively on land as a plant nutrient source, can cause water pollution problems. There is a lack of sufficient land for the safe disposal (based on the phosphorus consistent application rule of litter) of poultry litter within the economically viable transportation distance from poultry houses. An alternative to the application of poultry litter to the land is to use it in electricity production. We identify the optimal spatial location of poultry litter-based electricity-producing reactors and the allocation of litter from a farm to using reactor(s) and calculate the economic impacts of the construction and operation of poultry litter based electric reactors in Louisiana. We use poultry production data available from Louisiana Ag Summary 2017 and by combining this information with actual physical locations of poultry facilities identified using Google Earth. An optimization model was built using multicriteria evaluations in GIS with constraints including certain distance away from wildlife refuge, parks, urban area, lakes, and rivers. We developed scenarios with one and three reactors. We found that it is possible to utilize 95% of all poultry litter produced in the 11-parish region within 40 miles from the poultry production facilities when three electric reactors are built. Building three electrical reactors can generate substantial revenue, employment, and net return. Litter to energy production can also solve the excessive litter surplus problem plaguing Louisiana and other poultry production states in the United States.

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Ardian Harri
Seong Yun
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William C. Walton

Optimal Portfolio Design to Manage Oyster Resources

The State of Mississippi has an ambitious goal to produce "one million sacks of oysters per year and to increase ecological and economic benefits." This study proposes an oyster resource management approach based on modern portfolio theory (MPT) to aid the state's efforts in achieving this goal. By employing MPT (a method developed to overcome deficiencies in investment decision-making with the objective of minimizing risk for the expected returns, i.e., efficient frontier), we incorporate multiple oyster resources (natural oyster beds, off-bottom farms, and restored / constructed reefs) as technologies producing multiple ecosystem services (oysters for harvest, improved water quality, habitat for blue crab and redfish, and shoreline protection). Data are

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collected using a modified Delphi (expert elicitation) approach. Four ecosystem services provided by three oyster resources are elicited from oyster biologists, ecologists, and resource managers over twelve environmental scenarios (covering oxygen, nutrients, sedimentation, and salinity). These values of ecosystem services are then assigned money-metric values taken from the economics literature and combined with cost estimates for each technology to compute the means, standard deviations, and correlations of net benefits across all technologies. The anticipated result is the optimal efficient frontier of oyster-resources portfolio.

O'Donnell, Kiera
Sharon Harlan
Tori Tomiczek
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Impacts of Hurricane Irma on People and the Built Environment in the Florida Keys: A Survey of Coastal Residents

Hurricanes are one of the deadliest natural hazards in the united states, and the damage caused by hurricanes can have lasting effects in coastal communities. Through a survey of 282 residents of the lower Florida Keys one year after hurricane Irma, this study focuses on understanding the relative roles of individual-level preparation behaviors and landscape characteristics (e.g. waterfront vs. inland, natural vs. built shorelines) on property, social, and health impacts. One year after the storm, our survey results show a range of overall home damage states from ruined to no damage, with most respondents reporting their homes as moderately damage. Recovery from this and other extreme events is a slow process with over half reporting their home as partially recovered and a few reporting they are not recovered from the storm (recovery recorded by December 2018). Variation also occurs in the landscape characteristics, of the respondents. In the Florida Keys many people are waterfront homeowners, with a variety of structures protecting them such as mangroves and bulkheads. Respondents also reported on a variety of preparation taken for the storm, for example; evacuated or stayed, stocked supplies enough for 3 days, and attending a meeting or taking part in a drill. These variations in behaviors and landscape characteristics have different impacts to the damage states and recovery of the respondents. Typically, hazards and potential damage are recorded through meteorological or monetary studies, however this study adds to disaster research by including social metrics and accounting for the interaction of the attributes measured. Our findings, along with field observations, shed light on the variety of spatial and social patterns of damage in the Florida Keys post hurricane Irma. Our results show that homeowners with natural mangrove shorelines have similar recovery responses as homeowners with bulkheads or seawalls. However, homeowners with beaches represented some of the most damaged and least recovered respondents. Therefore, recovery and damage are dependent on a combination of the type of structure, the social vulnerability, and the surrounding environment. These findings show a possible path towards better preparation and adaptation for future hazards based on damage states from past storms.

Pace, Niki
Louisiana Sea Grant Law &
Policy Program

Louisiana's Living Shoreline Reference Guide

As one part of a gulf-wide project, teams are developing state-specific resource guides for living shorelines and green infrastructure across the gulf. This presentation will provide an overview of the five-state process as seen through the lens of the Louisiana guide development. Attendees will also preview the resource guides.

Parry, Dominika
2oC Mississippi

Unique Challenges and Adaptive Solution to Climate Science Communication:
Case Study from Mississippi

The United States lacks federal climate policies, lagging behind the rest of the developed and even some developing economies. The reasons for this discrepancy are complicated and vary depending on whom you ask. In this paper, we focus on the partisan entrenchment that hinders effective climate dialogue and the weaknesses of standardized climate communication techniques when applied in a highly diverse political, social and cultural environment of the US. There is already an extensive literature on climate communication that provides robust theories and practical communication techniques. We claim that the limited success of these techniques in the US is their inadequate adaptability to specific, local socioeconomic and cultural circumstances. We address this claim using a case study from the state of Mississippi, the poorest, least educated state in the U.S., with its society polarized by political preferences and income disparity, and with racially charged historic heritage. Mississippi is also home to many counties that are expected to incur some of the highest damages from climate change in the nation (over 20% of GDP equivalent). These local complexities require more than just standardized techniques of communication between climate scientists and the policy makers or general public for effective climate dialog. As a first step, we propose educating the youngest Mississippians (K-12) before their political views are formed. This effort is meant to ensure that not only the new generation of voters are climate literate, but also that their climate knowledge trickles down to their families and communities. This model parallels anti-tobacco campaigns that reached their tipping point when science was introduced to school children. Our K-12 curriculum includes exclusively science with no social science elements to minimize potential for political conflict. The lessons are designed for Mississippi's very specific socio-cultural environment, where many misconceptions and denialistic views are present. This approach is influenced by the

classic "Teaching as a Subversive Activity" work by Weingartner and Postman. Individual methods are also based on educational strategies used in the region to teach another highly controversial topic - evolution. The curriculum introduces individual topics by providing evidence rather than stating conclusions. It discusses also relevant denialistic arguments along with contrary evidence allowing students to decide for themselves. All topics are illustrated with local examples and visuals and designed with hands on activities to enhance knowledge retention. The current impact of the curriculum is assessed based on pilot results showing increased climate literacy among science teachers from 20-60% pre-intervention to 80-100% post-intervention and similarly among students from 20-40% to 70-100%. The trickle-down effect measured by the pilot subsample indicates initial sharing with 2.5 people on average. Further assessment is ongoing.

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Emily Maung-Douglass
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Stephen Sempier
Tara Skelton
LaDon Swann
Mississippi-Alabama Sea Grant

Monica Wilson
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Improving Community Preparedness for Oil spills: A Multi-Regional Approach

The National Academies of Science Gulf Research Program's (GRP) Thriving Communities Initiative seeks to improve the quality, accessibility, and use of information about how to protect communities from the impacts of oil spills. In 2017, the GRP sponsored a workshop entitled "Preparing for a Rapid Response to Major Marine Oil Spills: Protecting and Assessing the Health and Well-Being of Communities," where participants identified opportunities for improving community preparedness, including "Improving Communications and Building Trust" and "Improved Understanding of Oil Spill Science, Impacts and Mitigation Strategies." The Sea Grant Oil Spill Outreach Program has spent the past several years conducting outreach activities within the Gulf of Mexico and beyond to bring the science of oil spills to communities impacted by Deepwater Horizon and thus was well positioned to address the opportunities. Beginning this past December with support of the GRP, the Sea Grant Oil Spill Outreach Program began co-hosting a series of five regional workshops in partnership with Alaska Sea Grant, Virginia Sea Grant, and University of Southern California Sea Grant. These workshops, based in Houma, La.; Anchorage, Alaska; Santa Barbara, Calif.; Virginia Beach, Va.; and Mobile, Ala., addressed three main topical areas related to oil spills: social disruption, economic impacts, and public health. Each regional workshop was organized with the express goal of identifying region-specific outreach and research needs, potential pilot programs, and possible modifications to existing response protocols that would improve oil spill preparation in those communities. The discussions generated during the workshops are summarized into individual reports, which will be synthesized into a document that may be utilized by NAS and the GRP in future calls for proposals. Session attendees can expect to hear some of the universal needs and concerns raised by workshop participants as well as those uniquely personal to individual regions.

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Economic Impact of Flood in Rice Farming Communities of Eastern Nepal

We administered semi-structured interview schedule among 218 randomly selected rice farmers in Saptari district of Eastern Nepal to assess the impact of riverine flood and resulting adaptation measures taken by those farmers to mitigate the flood related impact. While making with-without flood comparison method, we found that area under rice (p=0.001), gross return (p=0.009), productivity (p=0.009) and annual household income (p=0.0001) were found to be significantly varying in flood affected and unaffected areas. The Gini coefficient was 10.21% higher in flood affected areas (0.507) than in flood unaffected areas (0.460). Only 6% farmers were found to be insuring their crops despite evidences of annual flood damage in affected areas. Many farmers were found to be adopting indigenous/traditional measures of flood adaptation. The results obtained from logistic regression model indicated that off-farm income and access to relief program had a positive influence on flood adaptation while the perception of increasing intensity of flood event had a negative influence. This study suggests that the indigenous flood adaptation measures need to be combined with modern one with incentives for purchase of agricultural insurance and trainings for generating off-farm income to ameliorate the deleterious impact of flood in the study region.

Patil, Pawan G.
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Global Ocean Partnership

Toward a Blue Economy: Nourishing Nations and Stimulating Sustainable Growth (Keynote)

Pawan G. Patil, PhD is a development banker, Harvard, Oxford, and London School of Economics trained economist and serial social entrepreneur. Over 19 years at the World Bank, he has followed his twin passions, co-developing the institution's multi-billion-dollar portfolio on Oceans and the Blue Economy, and co-creating social enterprises and initiatives in support of adolescent girls and young people. His work has been featured in dozens of peer reviewed journals and newspapers, including The Economist, Financial Times, New York Times, Huffington Post, and Nature. Dr. Patil is the recipient of several innovation awards in support of ocean-facing developing countries. He was selected as a World Economic Forum Young Global Leader and served as a member of WEF's Global Agenda Council for Oceans and the founding boards of Nike Foundation, Youth2Youth, Mobile Movement, and Mapping Ocean Wealth – which was awarded the 2017 Tourism for Tomorrow Innovation Award and WTTC's annual Global Tourism Summit in Bangkok. He currently lives in the Washington DC area with his wife of over twenty years and two children.

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Louisiana's Seafood Future: An Industry Adapts to Coastal Change

The Mississippi River Delta and Chenier Plain are dynamic coastal regions that are changing, and Louisiana's seafood industry is changing too. Land loss, commodity prices, and coastal restoration and protection projects all affect how members of the seafood industry adapt to these challenges. For generations the seafood industry has built successful businesses and supported their families and communities. Louisiana's Seafood Future (LSF) is an initiative by Louisiana Governor's Office requesting Coastal Protection and Restoration Authority and Louisiana Department of Wildlife and Fisheries in collaboration with Louisiana Sea Grant College Program to highlight adaptation strategies created by fishers most affected by coastal changes. The objectives of LSF includes the following: (1) Identify challenges facing the seafood industry related to changing environmental conditions (coastal land loss, water quality, and other factors). (2) Identify environmental, economic, and policy information that could be helpful to members of the seafood industry. (3) Discuss the State of Louisiana's restoration and protection efforts, including issues related to when and how projects are brought on line. (4) Identify adaptation strategies that are or may be available to the industry. (5) Identify possible funding sources that could help the seafood industry put adaptation strategies into practice. A process was developed to survey members of the seafood industry to come together and discuss how to keep their businesses competitive and sustainable. In rounds of meetings throughout the coast, industry members shared their ideas about how to adapt and what they need to make those adaptations work most effectively. Results of regional meetings and questionnaires will be discussed that identify tools needed to keep Louisiana's seafood industry sustainable by considering ecosystem, economic, and community needs—both short and long-term. The most significant result in all fishing commodities was making sure that fishers could harvest from the most productive areas given anticipated changes to coastal habitats.

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Public Opinion of a Gulf-Wide Beach Conditions Reporting System

This study gauged public interest in a Gulf-wide beach conditions reporting system. Key methodological contributions include two hypothetical-bias mitigation treatments (cheap talk and budget and substitutes Q&A), and a method for eliciting expected improvement in benefits due to information provision. Data were collected March-May 2018, via online surveys of Gulf Coast beach visitors, administered to two samples: a "snowball" convenience sample distributed by the researchers directly to local individuals and organizations, and a probability-based sample consisting of households participating in GfK's Knowledge Panel. A total of 3,622 individuals completed the questionnaire. Most respondents were not aware of the existing Florida beach conditions reporting system, and less than 10% indicated that they had used it before. Less than 15% believed that they could access the same information from other sources, but over 60% were not sure if they could. Specific types of information of interest to respondents (in order from most to least) were weather, swim hazards, water quality, red tide events, flag color, crowds, beach debris, surf conditions, and live video. Respondents were asked how many beach days out of ten would they consider to be "good" days, where the "weather is good, the beach is not too crowded, the water is clear, the waves are not too rough, and so on." About 70% responded 7 or more days would be "good". About 40% of respondents indicated that the expanded beach conditions reporting system would increases their chances for a good day at the beach, with most of these indicating a one- or two-day increase. Respondents were then asked about their willingness to subscribe, for a monthly fee, for access to the beach conditions reporting system if it were available as a website and smartphone app. Of those asked if they would subscribe if the fee were $1 per month, about 35% said yes; for $5 per month, about 15-20% said yes; and at $10 per month, about 10% said yes. Overall, however, about 80% of respondents indicated that they would not be willing to pay for access. Those willing to subscribe indicated that they would do so for an average of about 5 months out of the year. Taking all of the above information into consideration, it was estimated that the average annual willingness to pay would be between $12 and $14 per year per household. Using Gulf Coast beach visitors as the population of interest, and using the 46% incidence rate from the GfK sample as the best estimate as the proportion of the Gulf-Coast population that visits Gulf Coast beaches, it is estimated that aggregate benefits of the expansion of the reporting system is $177 million per year. Discounting benefits and costs to present value over a 16-year period, it is estimated that the present value of benefits ($1.5 billion) is well in excess of the estimated present value of costs ($303 million). Thus, in spite of the relatively low proportion of households expressing interest, the net benefits of the expansion would still be positive.

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Joonghyun Hwang

Accounting for Attribute Non-Attendance in Three Previously-Published Choice Studies of Coastal and Marine Resources

We revisit three recently-published papers that apply discrete-choice experiment methods to coastal and marine ecosystem goods and services, in light of attribute non-attendance (AN-A). We find that accounting for AN-A does not always improve model fit, but when it does, the improvement can be substantial. Estimated

Florida Fish & Wildlife
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price and attribute coefficients change, but these changes do not follow a consistent pattern, either in direction or magnitude. Mean attribute increment value (i.e., willingness to pay, WTP) estimates change, but also with no discernible pattern. However, in several cases, generally in those cases where accounting for AN-A improves model fit, we observe substantial improvements in the confidence intervals on WTP, i.e., accounting for AN-A appears to produce much more precise WTP estimates. In short, we find that accounting for AN-A is not always warranted, but when it is, the key payoff appears to be more precise WTP estimates.

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Preferences and Values for the Gulf Coast Ocean Observing System

Integrated Ocean Observing Systems (IOOS) provide real time oceanic data and sea state forecasting information that is utilized by numerous public and private sectors engaging in maritime activities. The U.S. Gulf Coast constituent of this system (GCOOS) consists of 321 platforms, buoys, and sensors that provide measurements of wind speed, wave height, water quality, and other parameters. Government entities have proposed an expansion of this infrastructure by 40% at an estimated cost of $35 million for installation and $33 million annually for maintenance. As part of a larger project commissioned to estimate monetized benefits of this expansion, this study applied contingent valuation (CVM) methodology in a survey of avid IOOS users located in the Gulf and Atlantic regions of the United States (N=18,000; n=484). The objective was to estimate general preferences for IOOS data and specific values for the proposed GCOOS expansion. A probit model was used to examine factors associated with a respondent's likelihood to support the expansion under a public referendum. Responses were solicited via six randomized treatments containing varying tax levels. A majority of respondents (74%) indicated support for the measure, with imputed willingness-to-pay (WTP) estimates ranging from $14.11 and $36.47 annually. Consistent with economic theory, the dollar amount of the tax was significant and negatively associated with referendum support. Proxies for avidity; however, proved either irrelevant or contrary to hypothesized effects. Vessel ownership, vessel size, distance traveled, and hours per trip were non-factors while the number of trips taken proved to be a significant, but negative predictor of referendum outcome. Alternatively, Gulf respondents engaged in fishing and fee-based services were more likely to support the measure indicating that proximity could be a more influential driver than avidity. Interpretation of these results is limited by the relatively small population queried. A broader depiction will emerge parallel versions of this survey are completed with larger populations. Taken together, these studies should prove valuable in characterizing preferences for IOOS data, assessing the economic merit of GCOOS expansion, and demonstrating the potential for non-market approaches in the valuation of publically-funded information systems.

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A Critical Source Approach to Control Water Pollution Using Best Management Practices

Critical source area (CSA) is the area which contributes the maximum amounts of pollutants in water bodies from a sub-watershed level. The objective of this study is to identify CSA by implementing Soil and Water Assessment Tool (SWAT) to recommend the most cost-effective BMPs to reduce nonpoint source pollution. We selected the lower Ouachita watershed located in the north-eastern part of Louisiana, USA that is characterized by row crop agriculture and poultry farms. Model is calibrated and validated for discharge in a monthly time step. Results indicate that the SWAT model can identify CSA accurately and thus helps to pollutants from the adoption of best management practices at a lower cost. To prioritize conservation practice implementation and better protection of water quality at low cost, Critical Source Area (CSA) is identified by imposing 15% phosphorus load yield threshold from each sub-basin because phosphorus is the main ingredient in many fertilizers used for agricultural activities. Sub-basin number 27 meets the CSA criteria. Various BMPs are implemented in the CSA to evaluate its economic effectiveness. No-till BMP is the most economical for sediment and nutrients reduction. CSA is 8.61% to 73.88% more cost effective to reduce phosphorus load compared to non-CSA areas.

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Economic Recovery Paths of Mississippi Oyster Harvesting

More than 13 years ago, Hurricane Katrina devastated the coastal areas in the Northern Gulf of Mexico in August 2005. The closures of significant portions of Gulf waters to commercial and recreational fishing due to the Deepwater Horizon (DWH) oil spill in April 2010 altered the production, recreation, and consumption decisions of households and businesses in affected communities. Mississippi was in the process of restoring the public oyster reefs after H. Katrina and the DWH oil spill when the Bonnet Carre Spillway (BCS) opening in 2011 resulted to massive oyster mortalities in the shellfish growing waters. These mortalities halted the recovery process of the oyster fishery to its baseline levels in 2002-2004. The prolonged exposure to freshwater which caused massive mortalities of the oyster populations required restoration projects to enable the fishery to recover to its baseline status. The restoration efforts included but not be limited to the dredging of non-affected oyster seed stock and relaying them to affected reefs. Oyster shells and other cultch materials were purchased and planted in affected areas. These restoration efforts were expected to replenish the damaged oyster populations in public reefs. Long-term data were compiled to develop economic recovery models (ERM)

for oyster harvesting. The ERM explains the individual and joint effects of the recent natural and technological disasters, output and input markets, environmental conditions, and regulatory and management strategies on the levels of commercial oyster harvests and dockside values.

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New Measurement of the U.S. Marine Economy

The global marine economy is poised for growth. According to the Organization for Economic Cooperation and Development (OECD), the global marine economy, will more than double its current contribution, reaching over $3 trillion and employing about 40 million people full time by 2030. NOAA has developed a project in conjunction with the Bureau of Economic Analysis (BEA) to measure the marine economy of the U.S. While the ENOW database already provides an estimate of the marine economy, it only incorporates businesses that all fully dependent on the ocean and Great Lakes. The new measurements of the marine economy will incorporate contributions from government, marine research and education, electric power generation, and marine technology. The results will provide GDP and perhaps other economic values for industries to use to characterize their contribution to the U.S. economy and better describe their importance. The results will provide investors with indications of which industries might be profitable to invest in. For policy makers, the marine economy values will be key in determining which sectors and industries of the marine economy are rapidly growing and would benefit from support.

Richardson, Matthew
Pengfei Liu
Michael Eggleton
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Valuation of Wetland Restoration Program in Arkansas: A Difference-in-Difference Approach based on Machine Learning Method

Prior to the 1970s, wetlands were considered to be a nuisance to property owners and were continuously converted into agricultural land. However, wetlands provide economic value in the form of direct benefits, such as harvestable timber and fish, and indirect benefits, such as water purification, flood abatement and wildlife habitat. To combat these losses, the Wetland Reserve Program was introduced in the 1990 Farm Bill to provide financial and technical assistance to land owners to help facilitate the restoration of these converted agricultural lands back to their natural wetland state. While many studies have taken a look at quantifying direct benefits, ways of quantifying indirect benefits have proven to be a much more complicated process. Due to this level of complexity, there is no prior investigation into the return on investment of the Wetland Reserve Program. Through a difference in differences approach, we utilized residential housing and wetland easement data to estimate the value of restoring wetlands within Arkansas. Additionally, we used variable selection via machine learning processes such as elastic net and spike-and-slab regression to isolate variables of interest from our data set and robustness checks such as a fixed effects model, falsification test, and regression discontinuity to test the validity of our results. Post restoration, our results show that there is a statistically significant increase in property values of homes located within wetland treatment zones compared to homes located outside of these zones by a mean value of 5.73%. Our study indicates that the Wetland Reserve Program has generated approximately US$120 million within the state of Arkansas since its induction.

Ristroph, E. Barrett

Ristroph Law, Planning, and Research, Fairbanks, AK

The Costs of Climate Justice: What is the Value of a Village and Who Should Pay to Move It?

From the coasts of Louisiana to the coasts of Alaska and elsewhere in the world, indigenous and place-based communities are at risk of inundation due to climate change. These communities have historically contributed little to climate change but tend to be more vulnerable due to their location in low-lying areas, lifeways that are dependent on the surrounding natural resources, and lack of financial resources. Villages such as Newtok, Alaska are attempting to relocate and facing price tags in the hundreds of millions to move small numbers of people. This presentation considers the value of maintaining such communities intact and the tangible and intangible costs of doing nothing. It also considers who should pay to help communities retreat and what role a community dependent on external assistance should have in deciding its own fate. The presentation is based on my Ph.D. work to highlight obstacles to climate change adaptation for Alaska Native Villages (which included 153 interviews of people involved in Alaska Native Village adaptation and policy) as well as my work as a lawyer and planner for Newtok.

Ritchie, Liesel
Oklahoma State University

Dr. Liesel Ritchie (Oklahoma State University) is the Associate Director of the Center for the Study of Disasters and Extreme Events, as well as an Associate Professor for the Department of Sociology at Oklahoma State University. Dr. Ritchie has 30 years of experience in research and evaluation, studying the effects of many natural disasters including Exxon Valdez and BP Deepwater Horizon oil spills, the Tennessee Valley Authority coal ash release, Hurricane Katrina, and earthquakes in Haiti and New Zealand. Since 2000, her focus has been on the social impacts that disasters can have on community resilience, in particular the effects on technological

disasters, social capital, and renewable resource communities. Before her time at Oklahoma State University, she was the Associate Director of the Natural Hazards Center at the University of Colorado Boulder as well as a research professor within CO's Institute of Behavioral Science as well as the Environmental Studies Program. Dr. Ritchie was also a Senior Research Associate at Western Michigan University's Evaluation Center as well as the Coordinator for the Social Science Research Center's Evaluation & Decision Support Laboratory at Mississippi State University.

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Research Center

CWPPRA: Preserving Wetlands Since 1990

The Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) was enacted in 1990 and brings together five federal agencies and the State of Louisiana in a committed and concerted program to stabilize, protect and rebuild the nation's coastal wetlands. Because roughly 40 percent of the contiguous United States' wetlands are in Louisiana and because the rate of land loss is so extreme, most of CWPPRA's efforts are focused on Louisiana, which experiences land loss at a rate of a football field every 100 minutes. Wetlands are vitally important as storm buffers, flood control devices, and water filtration systems while providing habitat and breeding grounds for a variety of wildlife and aquatic life. Additionally, the human component of the wetlands cannot be understated--Louisiana's working coast is an economic, recreational and cultural asset. Since its inception, CWPPRA has funded over 200 coastal restoration and protection projects, creating over 100,000 acres and enhancing another 350,000 acres, through a combination of methods including water diversion, shoreline protection, barrier island restoration, dredged material/marsh creation, hydrologic restoration, sediment and nutrient trapping, marsh management, and vegetative planting. CWPPRA projects are notable for their interagency cooperation, academic collaboration, and local engagement to move a project from conception to construction in three to five years. These near-term solutions address immediate coastal needs which allow other agencies, like Louisiana's Coastal Protection and Restoration Authority, to focus on large-scale and long-range projects such as sediment diversion. CWPPRA's area of activity encompasses 19 parishes and nearly half of Louisiana's population and thus, includes the public, local governments, stakeholders and sympathetic organizations in a synergistic approach to coastal restoration and protection. Each year, a variety of projects—in 2017, 54 project proposals were submitted--are presented and screened for consistency with existing plans and methods, with 20 or so projects moving forward for another round of evaluation and discussion. This list is then reduced to 10 potential sites that undergo further evaluation and site visits. The CWPPRA Task Force then uses cost-effectiveness, critical need, and other factors to determine the final projects that will move into the engineering and design phase. Each project is sponsored by a lead federal agency in partnership with the state and undergo comprehensive review throughout the life of the project. Although current funding levels do not support all of the necessary restoration required for a sustainable ecosystem, CWPPRA continues to address immediate restoration needs while establishing a foundation of strong science, public participation, and agency cooperation that will continue to serve as the cornerstone of future programs.

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Watershed Stewards Academy: A Community Engagement Model for Meeting Chesapeake Bay Restoration Goals

The Chesapeake Bay is the largest estuary in the United States. It measures 64,000 square miles and spans six states and the District of Columbia. It is home to more than 18 million people and each year approximately 150,000 people move into the watershed (CBP, 2017). In order to clean up the Bay, the Environmental Protection Agency's (EPA), Chesapeake Bay Program (CBP) established the Chesapeake Bay total maximum daily load (TMDL) in 2010, with a goal of a clean bay by 2025. Urban stormwater is the only sector that is increasing in nutrient loading and is responsible for 22% of phosphorus, 18% of nitrogen and 51% of sediment for Maryland's annual load contributions into the Chesapeake Bay (MDE, 2012). Economic estimates calculate that complying with the Bay TMDL will cost an estimated $7.3 billion for urban stormwater restoration strategies and local governments will be responsible for the majority of the cost and implementation burden (MDE, 2012, p56). This presents a complicated problem in meeting local pollution goals because the majority of the land across the watershed is held by private landowners (Bay Journal, 2006; WIP Phase 2, 2012), landowners, who have demonstrated low knowledge and awareness about stormwater pollution (Newburn, 2014; Maeda, 2018). In order to address the gaps in private landowner knowledge, awareness, and increase implementation of small-scale stormwater best management practices, the Watershed Stewards Academy was created in 2009. The Watershed Stewards Academy (WSA), is a volunteer train-the-trainer program developed to build a cadre of citizen stewards and scientists capable of identifying and solving stormwater pollution problems. To obtain certification, Stewards must complete an intensive, research-based, hands-on training, and implement a community stormwater project. Once trained, Stewards work with their communities to assess community stormwater problems and to take action solving those problems. To date, this program has trained over 350 volunteer Stewards across six Maryland counties who have installed hundreds of small-scale stormwater projects, interacted with over 25,000 people, and leveraged over $500,000 in funding. This session will give an overview of the Academy and how it serves as a cost-effective citizen engagement program helping communities meet Bay restoration goals.

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Evaluation the Economic Feasibility of Pigfish (*Orthopristis chrysoptera*) Aquaculture for the Texas Baitfish Market

In 2014, marine recreational fishers took nearly 1.1 million fishing trips in Texas and spent approximately $627 million on trip related expenses. The purchase of bait represents a major expense of recreational anglers and is a key driver of the economic impacts associated with marine recreational angling in Texas. Currently, the majority of bait used by marine recreational anglers in Texas is wild caught. The Texas commercial bait fishery is a growing industry; total dockside value of landings increased 7.8% annually between 2009 and 2016 and reached a value of $1.4 million in 2016 (finfish only). Aquaculture of marine baitfish for recreational fishing purposes has the potential to both decrease pressure on baitfish stocks by decreasing the need for wild harvest and enhance working waterfronts through the development of new businesses and jobs. Pigfish (Orthopristis chrysoptera) possess a number of traits that make the species an ideal candidate for baitfish aquaculture. Pigfish mature at a small size (20-35 cm in length) and are tolerant of crowding, handling, and varying environmental conditions. In addition, pigfish is already a popular live bait choice for Texas anglers. In this research, we examine the economic feasibility of pigfish aquaculture for the marine recreational fishing market. The analysis evaluates both production costs and market demand for baitfish in Texas. The production analysis examines the feasibility of two distinct production techniques: 1) outdoor low-cost production incorporating fertilized ponds, and 2) higher-cost indoor larval rearing combined with cage grow out in red drum ponds. The analysis uses the results of research trials conducted at the University of Texas Marine Science Institute (spawning and larval rearing), results of cage grow out trial at a Texas red drum farm (grow out), and a trial of all outdoor production in fertilized ponds completed at the Texas Parks and Wildlife Department red drum hatchery in Corpus Christi. Data from the research trials were used to estimate production and transport costs associated with potential commercial operations. Market data on live baitfish demand was collected from a 2018 survey of Texas bait stands to gather information on current market demand (quantity and price), key attributes bait stands look for when sourcing live bait (size, survivability, price, consistent supply, etc.), estimated demand if baitfish supply was not seasonal and supply constrained.

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Incorporating the Human Dimension into the Ecosystem Approach to Fisheries Management

Often has it been stated that the human dimension should be incorporated into the ecosystem approach to fisheries management. To date, an integrated methodology that explicitly allows for feedback between the human and ecosystem dimensions has not been fully developed. While the human dimension consists of a myriad of social facets, at its core is the marketplace; a mechanism organized by social entities to facilitate the orderly exchange of goods and services. This market mechanism that reflects human behavior through the revealed preferences of individuals is interrelated with the ecosystem trophic levels represented by predator, prey, and competitor species behavior. A conceptual, theoretical model demonstrates the interrelationships between the marketplace for fishery products and the predator, competitor, and prey relationships in a marine ecosystem. Based on this conceptual model, optimal control theory is used to develop an empirical model that complies with price theory and incorporates the ecosystem trophic level and market interactions. Estimated parameters from this model are utilized to calculate changes in net benefits due to natural disasters or management regulations affecting a specific species as well as the ecosystem and marketplace associated predator, prey, and competitor species. In addition, these results can be used to develop an unbiased metric of fish stock abundance, and an estimate of fishing fleet harvesting costs for use in economic impact models.

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The Price of Water: from Economics to Equity

This study summarizes an economic approach to residential water demand management and water affordability that incorporates water price data. Assessing water demand in the context of available water supply is critical to making informed land use, transportation, and infrastructure investment decisions. Incorporating water price and other demand drivers into long term water demand forecasting helps water managers make better decisions such as encouraging actions that conserve water, protect supply, and/or pursue alternative drinking

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water sources. An analysis of the evolution of residential rate structures over the past decade is based on water and wastewater rates surveys of water systems collected from websites, local ordinances, and telephone interviews over the period 2008 – 2018 for over 200 communities in the greater Chicago region and compared to national trends. The conservation demand-response potential of residential water rates is examined by examining the structure of rates and estimating price elasticity of demand. The affordability of water is assessed calculating baseline representative monthly-equivalent residential billings in relation to other household expenditures, overall cost of living, and income. Utility-management and policy recommendations are elicited, and the role of multiple, potentially conflicting, water rate-setting objectives such as water conservation, full cost pricing, and affordability is discussed.

Sempier, Steve
Mississippi-Alabama Sea Grant
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Steve Sempier, Outreach and Deputy Director, Mississippi-Alabama Sea Grant Consortium and Manager, Gulf of Mexico Sea Grant Oil Spill Science Outreach Program. Steve Sempier is the Outreach and Deputy Director for Mississippi-Alabama Sea Grant Consortium. In addition, he leads a team of Sea Grant extension professionals based in the five Gulf of Mexico states that translates and delivers science to diverse target audiences. The primary focus for each of these roles are to provide science to serve coastal audiences and facilitate the transformation of research to application. During the last twelve years Steve has addressed Gulf-wide coastal issues. He has led or coordinated the development of the Gulf of Mexico Research Plan, a NOAA Restoration Center community-based program that addressed hydrologic restoration in the Gulf of Mexico, and an oil spill science outreach team. Steve received a B.S. in marine science at Eckerd College, M.S. in marine resource management at Oregon State University, and Ph.D. in coastal sciences at the University of Southern Mississippi. Prior to joining Sea Grant, he worked at Mississippi State University on a U.S. Department of Agriculture aquaculture risk management project, at Oregon State University for a USAID program devoted to increasing food security in developing nations, and at marine and environmental education programs in California and Minnesota.

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Increasing Capacity for Local Communities to Respond to Climate Change

Gulf communities are beginning to recognize the importance of adapting to increased flooding and inundation. Coastal flooding can have a negative impact on the built environment, natural systems, and the overall economy. In many cases, having the capacity to respond to such events requires technical expertise, knowledge, and resources from a variety of organizations. Expanding the capacity of coastal communities to identify and address issues related to these problems will greatly increase their resilience. The Gulf of Mexico Climate and Resilience Community of Practice (CoP) is a network of coastal communities and outreach and extension professionals working together to adapt to climate change in the coastal zone through the exchange of ideas, opportunities, and expertise. At the 2016 annual CoP meeting, attendees from 36 organizations worked together to identify key challenges associated with the impacts of saltwater intrusion, increased localized flooding, and the subsequent economic consequences to businesses and communities. Next steps to address these key challenges focused on: (1) outreach activities, (trainings, roadshows, documenting case studies and lessons learned), (2) higher regulatory standards at the local level, and (3) synthesizing tools and scientific data into accessible formats. The CoP created three working groups, one on each of the key challenges, and each working group received funding to tackle one project related to that challenge. This poster will highlight the projects being completed by the working groups, including work being done related to the Community Rating System, stormwater management, and living shorelines.

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Transcending the Gap from Flood Risk Awareness to Action: A Roadmap to Resiliency

How do property owners and local communities use flood hazard information to raise risk awareness and drive flood resilient decisions? How is flood risk awareness converted to flood risk action? What barriers exist in the space between flood data access, use and understanding, to implementing mitigation strategies (e.g. new policy, higher standards, flood control projects, insurance campaigns, etc.)? In this panel discussion we will hear lessons learned recovering from a flood disaster and explore the opportunities and challenge that exist in using today's data and technology to improve flood resiliency.

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Natural Disasters and Price Gouging: Evidence from Gasoline Sales before and after U.S. Hurricanes

Will emergency supplies be affordable and accessible before and after natural disasters like hurricanes? How can public policy lower the costs of disasters by ensuring that emergency supplies are available and accessible to all, including to the most vulnerable populations? The answers to these questions are crucial for

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understanding and enhancing coastal population resilience and adaptation. One of the more controversial issues surrounding hurricane preparedness and response is gasoline price "gouging." A quick Google news search for phrases like "hurricane price gouging" reveals the discussion is salient and current. On one hand, gasoline for evacuations, generators, and emergency response is essential for human well-being. Rising prices are potentially serious concerns, especially for lower income populations. The politics of price gouging around natural disasters are notorious. On the other hand, at least some gas price increases around natural disasters may be warranted. Hurricanes disrupt offshore oil platforms, crude refineries, pipelines and other infrastructure, and local transportation. Higher market prices may help regulate supply, ensuring that gasoline provision covers its costs and actually makes it to those that need it most. Allowing prices to rise may also provide incremental incentives for wholesalers and retailers to acquire additional gasoline in trying times. Given substantial public interest and large benefits at stake, understanding the extent and nature of price changes in the wake of natural disasters is crucial. Surprisingly, we have limited systematic evidence. This research estimates the causal effects of hurricanes on gasoline prices. First, we study how retail gasoline prices change before and after hurricanes. We also study how such price changes vary across locations, paying particular attention to heterogeneity across socio-demographic factors like income and race. Second, we study how hurricanes affect the pass-through relationships between spot, wholesale rack, and retail gasoline prices. Identifying the nature of pass-through allows us to separately understand if and where "unusual" or "egregious" mark-ups may occur. Third, we explore the possibility of asymmetries, or "stickiness", in retail gas prices. We explore if consumer prices respond more persistently to crude and wholesale price increases as hurricanes make landfall or to crude and wholesale price decreases as hurricane shocks dissipate over after landfall. Although we build off a related literature, these questions remain unanswered for multiple storms and multiple locations. To explore the causal impact of hurricanes on gasoline prices, we collect forecast and landfall data for United State hurricanes from NOAA's National Weather Service. We merge in geographic, demographic, traffic, and weather data from a variety of sources including the US Census Bureau and the National Historical Climatology Network. We combine hurricane and supplemental data with extensive gas price data from the Oil Price Information Service (OPIS). We obtain daily data for every major chain retail gas station in FL and LA, as well as all daily wholesale and crude prices throughout the region. The sample period spans 2002 to 2008, covering several of the most costly hurricanes in US history.

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Characterizing the Southern Flounder Fishery in Louisiana

Southern flounder (*Paralichthys lethostigma*) is a coastal flatfish species that supports both a recreational and

have been declining over the last decade for reasons that are not fully known. In addition to questions surrounding the harvest, gaps remain in biological information, which resulted in the most recent (2015) state-wide Louisiana Department of Wildlife and Fisheries (LDWF) stock assessment being data deficient. The goal of this study is to evaluate the Southern flounder fishery in Louisiana and provide missing biological and resource-use data for future stock assessments. Age, growth, and maturity information are currently being collected from fishery-independent sampling across Coastal Louisiana, along with select sampling from seafood dealers. Concurrent to the biological evaluation, we are also analyzing approximately 20 years of recreational and commercial flounder catches to identify any patterns or trends that may further describe the overall decline we have observed. Preliminary analyses of commercial data collected by the LDWF Trip Ticket Program suggest large declines in both volume and participation within the Southern flounder fishery. Catch volumes fell from 177,191 pounds in 2000 to 25,154 pounds in 2017. The number of commercial fishers with reported Southern flounder landings in Louisiana also fell from 715 in 2000 to 63 in 2017. Ultimately, our goal is to maximize the fishery information that can be used to assess the Southern flounder stock in Louisiana to develop a sustainable management strategy.

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Unpacking Property Owners' Shoreline Modification Decisions: Survey Evidence from Coastal Virginia

Coastal Virginia is facing a loss of shoreline due to sea level rise and storm surge. These coastal areas are home to a large population with significant investments in coastal real estate. Because of this, many property owners already have modified or in the near future will modify their shorelines to protect them from erosion. The goal of our project is to better understand how owners make decision about managing their shoreline property. Owners can choose from a number of different management options including bulkheads, riprap, and groinfields as well as living shoreline structures such as marshes, vegetation buffers and oyster reefs. The choice of management option has implications not only for the property owners' property but also for neighboring property and the larger ecosystem in which the property lies. In the Fall of 2018, we sent out a mail survey to a random sample of shoreline property owners in three Coastal Virginia localities: the city of Norfolk which is a highly developed urban area, the county of Gloucester which is a mixed suburban/rural county and the county of Lancaster which is primarily rural. We stratified our sample based on three dimensions – the status of the shoreline (i.e., living shoreline, defensive/offensive modification, no known

modification), the level of fetch for the shoreline, and the level of connectivity of the shoreline. The survey asks owners to provide data on how the property is used (primary residence, secondary residence, rental property, etc.) and how long the owner has held to property. It also asks about the owners experience with flooding and erosion on the property, the types of shoreline modifications on the property, whether the owner made the modifications, and why the owner made the modifications. Data collection has just been completed and we currently have close to a 30% response rate. In addition to the survey data, we have cadastral data for each property including acreage, owner information, tax assessments for both land and improvements, and current zoning. Using geographic information systems we were able to overlay data on bank height, fetch, special flood hazard areas, and hurricane storm surge inundation. We also use data from the Virginia Marine Resource Commissions permit database to determine whether there had been a permitted shoreline modification at the parcel as well as data from a shoreline inventory to identify known modifications. Our analysis will examine how various factors including property characteristics, neighborhood characteristics, SLR experiences and personal preferences affect management choices. These results will help us to build a model to predict future shoreline property management choices for integration into a larger project to investigate the linkages between human and natural components of shorescapes. Our long-term research goal is the development of a modeling framework that integrates physical, biogeochemical, and human components in order to simulate and select climate change adaptation strategies that will support a sustainable system.

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Lessons from Ecology: Building Resilience into Coastal Systems

The theory of ecological resilience has been used to describe the behavior of coupled social-ecological systems (SES). Scott Thomas and David Kerner have incorporated the theory into a framework for assessing the resilience posture of government installations, utility providers, and various agencies. This presentation will discuss lessons learned from ecological resilience theory and how resilience concepts can be adopted to develop strategies for enhancing the resilience of coastal SES. The authors will discuss the concepts of the Adaptive Cycle, system thresholds and tipping points, and the resilience response-recovery curve. They will explore how to incorporate system resilience attributes into plans for enhancing coastal resilience. These SES attributes, which fall into the categories of adaptive capacity, readiness, and stability, include response diversity, modularity, redundancy, connectedness, autonomy, balance, single points of failure, pathways for controlled reduction in function, situational awareness, skewing subsidies, and critical dependencies, among others. This work incorporates and builds upon previous research by the authors including the Resilience Attributes and Metrics that we presented at CNREP 2013, as well as the Measuring Coastal Resilience Panel at CNREP 2016.

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How to Build Resilience in Our Coastal Communities, Our Businesses and Our Lives

Most communities and many businesses on the coast take actions to make themselves more resilient but deciding to do so and knowing what steps to take are two different things. We know that we need to prepare, but it's hard to find the time and resources. And what specifically do we prepare for? Coastal leaders and business owners control risk by establishing safety plans and evacuation routes, controlling storm flows and mitigating flood hazards, purchasing insurance, and similar actions. They may establish back-up power capabilities. They hope these activities make them more resilient. It's a good start, but resilience is more than this; more can be done. This lightening talk will provide a rapid-fire exploration of the ways that we can build resilience into our communities, our businesses, and our lives. The talk will provide an entry point for more detailed planning and spur analysis to examine risks and vulnerabilities.

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Compounding Disruptions and Cascading Failures: A Framework for Assessing and Enhancing Resilience

This project evaluates a methodology to rationally and systematically assess the resilience posture of a coupled social-ecological system – in this case a coastal military installation and the adjacent community. The framework maps system components and characterizes baseline functions and conditions, including interactions with adjacent systems as well as dependencies and the potential for cascading failures across subsystems and across scales. A crucial element of the analysis involves mapping the interaction of threats and how multiple disruptive events may interfere with response dynamics and adaptation. The evaluative framework also provides a starting point for developing strategies to address shortfalls in resilience posture, monitoring programs for key variables relating to disturbance regimes and system thresholds, and approaches for addressing both general and specified resilience. This work builds upon previous research by the authors including the Resilience Attributes and Metrics that we presented at CNREP 2013, as well as the Measuring Coastal Resilience Panel at CNREP 2016.

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Groundwater over Extraction and Energy Cost

Two major aquifers (Chicot and Mississippi River Alluvial Aquifer (MRAA) in Louisiana have been excessively withdrawn. Implications of this excessive withdrawal are saltwater encroachment which may render aquifer unsuitable for irrigation and appearance of cones of depression which increases extraction cost. We analyzed the groundwater decline pattern in MRAA between 2004 and 2015. We combined this information with survey data collected from Louisiana farmers on the types of energy used to extract groundwater. Louisiana farmers used propane, diesel, and electricity to extract groundwater. Results show that farmers are extracting from higher aquifer depth and paying more for energy every year. The fuel use, as well as fuel cost, are three times higher in 2015 than in 2004 indicating that groundwater decline will impact farmers directly. Even considering land use expansion and land use pattern change, energy use cost is increasing substantially. Policies encouraging groundwater conservation will help to ameliorate some of the negative impacts of groundwater over-extraction in Louisiana.

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Reversing Wetland Death from 35,000 Cuts: Opportunities to Restore Louisiana's Dredged Canals

We determined the number of permits for oil and gas activities in 14 coastal Louisiana parishes from 1900 to 2017, compared them to land loss on this coast, and estimated their restoration potential. A total of 76,247 oil and gas recovery wells were permitted, of which 35,163 (46%) were on land (as of 2010) and 27,483 of which are officially abandoned. There is a direct spatial and temporal relationship between the number of these permits and land loss, attributable to the above and belowground changes in hydrology resulting from the dredged material levees placed parallel to the canal (spoil banks). These hydrologic modifications cause various direct and indirect compromises to plants and soils resulting in wetland collapse. Although oil and gas recovery beneath southern Louisiana wetlands has dramatically declined since its peak in the early 1960s, it has left behind spoil banks with a total length sufficient to cross coastal Louisiana 79 times from east to west. Dragging down the remaining material in the spoil bank back into the canal is a successful restoration technique that is rarely applied in Louisiana but could be a dramatically cost-effective and proven long-term strategy if political will prevails. The absence of a State or Federal backfilling program is a huge missed opportunity to: 1) conduct cost-effective restoration at a relatively low cost, and, 2) conduct systematic restoration monitoring and hypothesis testing that advances knowledge and improves the efficacy of future attempts. The price of backfilling all canals is about $335 million dollars, or 0.67% of the State's Master Plan for restoration and a pittance of the economic value gained from extracting the oil and gas beneath over the last 100 years.

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Assessing the Effectiveness of Feed-in-Tariffs and Renewable Portfolio Standards: An Analysis of Global Renewable Energy Policy

Countries across the world are committing themselves to the reduction of greenhouse gas emissions and the diversification of their electricity portfolios. Two of the most common policies implemented by national governments to achieve these ends are the feed-in-tariff (FIT) and the renewable portfolio standard (RPS). A feed-in-tariff is a subsidy per unit of renewable electricity, as guaranteed over a set number of years. A renewable portfolio standard is a mandate of a specific amount or percentage of renewable energy by a set year, such as 20 percent renewables by 2020. While we know a great deal about the motivations behind policy adoption among U.S. states and various countries (see, e.g., Bayer and Urpelainen 2016; Lyon & Yin 2010; Jenner et al. 2012; Schaffer and Bernauer 2014; Stadelman and Castro 2014; Carley et al. 2016a), as well as how RPS policies have fared in the U.S. context (for recent analyses, see, e.g., Maguire and Munasib 2016; Carley et al. 2016b; Upton and Snyder 2015a), we still know relatively little about how FIT and RPS policies have worked at the national level. Furthermore, empirical evaluation in this context is especially challenging since these policies are highly heterogeneous across countries (Carley et al. 2016b) and the possibility of policy endogeneity biasing causal inference is high (Upton and Snyder 2015a; Fowler & Breen 2013; Ming-Yuan, Carter & Langholtz 2007; Lyon & Yin 2007). Yet, as countries weigh their options for how to achieve a low-carbon future, information will be essential regarding how well these policies work, which renewable resources are developed as a result of these policies, and whether there are other market consequences such as changes in electricity price. To assess the effects of FITs and RPSs on renewable energy generation and related market outcomes, we utilize a panel of more than 120 countries from 1990 until 2010. Combining data from multiple large cross-country data sources such as the World Bank's World Development Index and the Penn World Tables, we compare energy market outcomes in FIT and RPS countries, respectively, before and after policy implementation. To overcome the methodological challenges associated with previous empirical evaluations in this context, this study uses a synthetic control method (Abadie, Diamond, & Hainmueller 2010) that allows for the comparison of outcomes of interest in FIT and RPS countries, respectively, relative to countries that did not implement these policies with similar economic and political characteristics. We confirm the robustness of our approach through a series of placebo and robustness checks. We first estimate a baseline specification, which is simply a descriptive analysis of the actual change in renewable energy generation in FIT countries relative to

non-FIT countries post policy implementation. Results reveal that FIT countries experienced a 20 percent increase in renewable generation per capita relative to non-FIT countries. They experienced 121 percent increase in wind generation per capita and 21.9 percent increase in solar generation per capita. The baseline specification finds no change in fossil fuel generation per capita in FIT countries. Next, our synthetic control method compares renewable generation in FIT countries relative to a synthetic country with similar economic and political characteristics in years that pre-date the policy. Results suggest that FIT countries experienced a 28.9 percent increase in RE generation in total, with a 60 percent increase in wind and 12 percent increase in solar, all on a per capita basis. Using the synthetic control analysis, we find that FIT countries experienced a 24.3 percent decrease in fossil fuel generation relative to synthetic countries. Also using the synthetic control method, we find that countries with an RPS policy have, on average, 94.4 percent more wind per capita than countries without the policy. Those countries with an RPS, however, do not have statistically significant differences in other renewable energy market outcomes. These various results are robust to placebo tests where a synthetic control is created for each non-treated country. Our SC analysis finds that RPSs are less effective at increasing renewable energy generation than FIT policies. While we do estimate a 9.4 percent increases in wind energy generation per capita in RPS countries relative to SC non-RPS countries, we find no effect of renewable energy generation per capita in aggregate, nor do we find evidence of reductions in fossil fuel generation. There are several important conclusions that one can draw from our analysis. First, the differences in estimates between the baseline and the synthetic control analysis suggest that adoption of these policies is not random and failing to account for policy endogeneity with a technique such as a synthetic control can bias empirical results. Second, using this technique, we find that both FIT and RPS policies have achieved energy market diversification objectives. Third, while the RPS policy has nearly exclusively resulted in wind energy development, the FIT has incentivized a broader range of renewable energy technologies, including both wind and solar.

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Well Water and Welfare: Behavioral Responses to Potential Groundwater Contamination

Rural eastern North Carolina relies heavily on unregulated private groundwater wells for household drinking and sanitation. These communities are also among the most vulnerable to flooding and well impairment from microbial and inorganic contaminants that cause gastrointestinal illness and other adverse health impacts. Currently, the eastern North Carolina counties of Duplin and Sampson lead the nation in pork production and use open-air waste storage systems that place additional sources of contamination in close proximity to shallow residential drinking water wells. Hurricane Florence brought record flooding to the Cape Fear River basin, including Duplin and Sampson counties, resulting in widespread evacuations and property damage. Following the storm, several advisories have been issued ranging from the treatment of well water to, in many cases, the purchase of bottled water. Groundwater well installation is priced approximately by feet of depth, though soil profile also influences the efficacy of natural water filtration on site. Similarly, the preventative measures taken by residents can have significant impacts on those residents' health and livelihoods. Assessing the relationship between groundwater well depth, drilling cost, and water contamination will improve understanding of the relationship between income disparity of rural coastal North Carolina residents and the perceived benefits of installing a well drawing water from confined, rather than surficial, aquifers. An interpolation of contaminants within each aquifer will provide an indication of the relationship between depth and potential for contamination and health impacts at each site. While the physical outcomes will provide a background for health impacts, the behavioral changes of residents will provide a more thorough understanding of the relationship between income, health outcomes, and preventative behavior. Taken together, this work will shed light on the social cost of groundwater pollution in marginalized and vulnerable rural communities. We gather both physical water quality information and survey responses about individual defensive actions taken at residences with groundwater wells before and on more than one occasion following Hurricane Florence. The dataset will allow for an analysis of changing behaviors associated with water treatment, the perception of well water safety, and measured contamination. Collecting data multiple times following the storm event maps changing risk perceptions with the availability of additional water quality information – i.e, dynamically adjusting risk salience. Our findings indicate that residents feel unsafe using their well water for consumptive purposes following Hurricane Florence based upon their past experiences and personal observations. Many residents, however, appear to have settled on a long-term adaptation to locally impaired water quality (e.g. drinking bottled water or investing in deeper wells or filtration systems if well water is the primary source of drinking water). The variations in well contamination are likely the result of economic opportunity where residents that can afford to drill a deeper well, drawing from a confined aquifer, are more insulated against harmful environmental exposures when flooding occurs. These findings suggest in particularly remote areas where expansion of public infrastructure is infeasible, well water sharing networks that provide rental options by matching shallow well and deep well owners may improve rural welfare.

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Transient Boaters Potential for Economic Development on Communities that are Proximate to the Atlantic ICW

The Inter Coastal Waterway (ICW) is a protected transportation route that runs from New England to the southern tip of Florida in the Atlantic Ocean and continues north along the coast of the Gulf of Mexico. Maintained by the US Army Corps of Engineers (USACE). This water trail provides passage for commercial, recreational, and transient watercraft. While a great deal is known about commercial freight use of this waterway, little if any data is available concerning recreational and transient use patterns of the ICW. Transient users otherwise known as "snowbirds", may be of particular interest to NC coastal communities. It is believed that these users make annual trips up and down the ICW based on seasonal climate conditions. Much like migratory birds, in the fall they travel south to escape the cold of the northern winter, and then return north in the spring. Coastal communities who wish to attract these users may provide amenity rich waterfront areas in the hopes that these transients will stop for a few days and provide positive economic impacts in the communities. However, very little is known concerning the travel behavior of these transient boaters. Additionally, no information is currently available to determine the efficacy of development efforts that are intended to boost local economies by luring them to coastal communities. Information regarding their willingness to travel specific distances off the ICW for goods and services, as well as the types of goods and services that would induce them to travel the greatest distances would assist coastal communities adjacent and proximate to the ICW to better invest in amenities and service delivery options designed to target the transient boater market segment. The primary purpose of this project was to develop, test, and refine a methodology to collect travel behavior data from transient boaters on the ICW. A secondary purpose of the project was to collect data on travel behaviors and to develop a preliminary social-economic profile of ICW transient boaters. Data was collected through a combination of short intercept surveys and more extensive mail-back surveys that were given to transient boaters at several locations on the ICW in NC during Fall, 2015. Discussion will focus on what amenities transient boaters look for when determining where they will make port, as well as what types of these amenities or attractions will convince them to travel the furthest distances off the ICW. In addition, data will also be presented that describes the travel behavior of transient boaters and the importance of the voyage in relation to their final destination. Recommendations will be provided to assist communities proximate to the ICW to more efficiently create goods and services that are desired by the travel segment of ICW snowbirds. This will include specific recommendations for the development of outreach materials to educate transient boaters about amenities, goods and services that are available in different ICW proximate communities.

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A Zonal Travel Cost Approach to Estimating Recreational Damages from the Deepwater Horizon Oil Spill

Leveraging the largest and most extensive on-site recreation data set ever collected, we develop and estimate a zonal travel cost, random utility model for coastal recreational activity in the four-state Gulf Coast region of Louisiana, Mississippi, Alabama and Florida. In particular, we use over 120,000 on-site counts to construct estimates of recreation trips to 53 coastal sites from the Louisiana/Texas border to the Florida Keys originating from over 31,000 zip codes in the contiguous US. We then merge these trip estimates with travel costs estimates for all zip code/site pairs and estimate a two-level repeated discrete choice, nested logit model. The estimated model is used to generate natural resource damage estimates for the 2010 Deepwater Horizon Oil Spill, the largest spill in the history of US waters. Interestingly, our per user day damage estimate matches the estimate generated from a separate off-site survey designed for damage assessment. This convergence suggests that our zonal travel cost model based on on-site counts represents a promising approach to economic valuation.

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Policy-relevant Economic Valuation of Research & Restoration in Large Water Bodies (Panel)

Despite great progress in economic valuation methods, much work remains to accurately account for societal concerns when measuring benefits generated by large water body restoration and research and to integrate results into decision making. This session will highlight recent efforts to enhance the understanding of benefits, including their spatial and temporal heterogeneity, resulting from improved ecological information and restoration. The goal of such research is to enhance the ability to make tradeoffs in selecting water body restoration goals and methods, to minimize the costs of achieving restoration goals, or to maximize net benefits. The set of research to be presented has implications for improving the science of primary valuation and benefit transfer techniques. The group of studies included in this session were designed to inform water body restoration questions across diverse geographic areas including the Baltic Sea, Chesapeake Bay, New England, and large lakes of Florida. The types of management actions considered in these case studies include nutrient, sediment and contaminant management; invasive species management; and direct restoration of beach, intertidal, wetland, scrub-shrub and forest systems. Benefits were measured for a suite of ecosystem services, including water quality aesthetics, recreational fishing, commercial oyster fishing, human health, and

shore-adjacent recreation including beach visitation, swimming, and general recreation. Although the case studies differ in details, common themes emerge. All studies aim to fill gaps in understanding the heterogeneity of human use and preferences. Studies also shared the approach of designing valuation studies in collaboration with interdisciplinary groups of scientists and decision makers to generate robust modeling and results relevant to policy questions.

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Evaluating the Social Efficiency of Chesapeake Bay Restoration: Implications for Measuring and Maximizing Net Benefits of Water Quality Programs

Many cost benefit analyses (CBA) of water quality programs result in low benefit cost ratios. Does this finding suggest that social benefits are low or that CBA could more accurately represent social efficiency of such programs? This talk will synthesize results from multiple projects to examine three specific questions embedded in the low CBA ratios: 1) are major sources of benefits being omitted from analyses? 2) could implementation costs be lower? 3) should water quality programs be complemented by other management strategies to achieve the largest benefits? The three projects that will be presented represent findings from distinct modeling efforts in the Chesapeake Bay that integrated ecological and economic data and information. The first project examined approaches to measuring ecological resilience as a means to quantify this frequently stated goal of water quality restoration. The second project examined the potential for lower cost pollution control strategies, including effects of using offsets, nutrient credit trading, and other polices to achieve goals. The third project distilled implications of a stakeholder-driven collaborative modeling approach to oyster management. The first and second projects were part of an effort to understand the expected environmental outcomes of fully achieving the Chesapeake Bay Total Maximum Daily Load (TMDL). Water clarity and recreational outcomes were well covered in the valuation studies conducted by US EPA. However, environmental managers expressed concerns that a primary goal of ensuring future resilience of the estuary to climate change or other perturbations was not captured. A team of ecologists reviewed the evidence for indicators of ecological resilience and proposed two indicators that could be tested in economic valuation. To examine the cost of achieving the TMDL, a detailed optimization modeling effort was used. This project demonstrated that costs could be substantially lower under policy scenarios that generated nutrient reductions from diffuse sources and created spatial flexibility in where reductions occurred. The third project is a synthesis of results from a stakeholder engagement process to redesign oyster fishery management in a portion of the Chesapeake Bay (oysterfutures) to meet diverse stakeholder goals and to complement water quality restoration activities. The integrated ecological economic model demonstrated substantial water quality effects from many oyster management options and those options also improved harvests and watermen's profits, after a time lag. The study further suggested that oyster reef restoration and harvest management generated benefits that are synergistic with other water quality restoration efforts. A future goal is to examine the relative contribution of upland pollution management vs fishery management in generating fishery profits and increasing benefits derived from water quality improvements.

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Factors Affecting Farmers' Risk Perceptions Towards Feral Hogs as Disease Vectors

In Louisiana, feral hogs have emerged as species causing substantial damage to crops, wildlife, recreation, landowner safety, as well as acting as vectors for disease transmission in humans, wildlife, and farm animals. Although no such cases of disease occurrence, at least in humans, have been reported in Louisiana, management and investment actions by landowners reflects choices strongly influenced by such potential risks. Understanding the risk perceptions of landowners, both directly affected and those influenced by reports, is useful to natural resource agencies in selecting appropriate management actions and allocating resources; however, there has been very limited effort to describe these perceptions related to feral hogs. To promote knowledge of public understanding of risk perceptions in the context of feral hogs management, we used a questionnaires mailed to a stratified random sample (n=4,035) in Louisiana aged from 25 to 75 years and older to accomplish two objectives: 1) assess farmers' risk perception of feral hogs serving as vectors for diseases harmful to humans, wildlife, and farm animals; and 2) identify socio-demographic factors and education efforts by federal, state, and local agencies underlying these risk perceptions, which can provide policy guidance to better control feral hog populations through a comprehensive management approach. Risk perception was measured by grouping the risk score on the typical five-level Likert scale. A multivariate probit model was used to econometrically identify the determinants of risk perception. The results revealed that farmers with more farming acres, longer tenure in farming, and overall negative opinion on feral hogs were likely to agree that feral hogs posed disease transmission risks. Majority of the farmers believed that current management actions by federal agencies were not adequate, consequently influencing their perceptions regarding feral hogs acting as disease vectors. Younger farmers were more likely to disagree that feral hogs transmitted diseases that harmful to humans. Overall, the results support the notion that stakeholders are concerned about health risks regardless of whether the targets are humans or animals, and communication and management actions must focus on the interdependence of human, wildlife, and livestock health.

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Planning for Unpredictability: The Value of Invasive Species Research

Public and private institutions fund numerous forms of ecological research as part of their missions to manage environmental resources. Decisions on how best to allocate research funds would be improved with knowledge of resulting benefits, however such evaluation is challenging and rarely undertaken. We assessed the net benefits of research to assist control of hydrilla in the Kissimmee Chain of Lakes (KCOL) in central Florida. Hydrilla is considered one of the most problematic aquatic invasive species in the area, dominating government control budgets. In the mid-1990s to early 2000s, control methods began to lose effectiveness in some Florida lakes. Research revealed that hydrilla had developed resistance to the most commonly applied and cost-effective herbicide, despite hydrilla being a dioecious (asexually reproducing) biotype that would not be expected to develop resistance. Additional research generated new effective treatments that lowered herbicide concentrations and costs relative to conventional treatment and minimized harm to native plants. We applied a Value of Information (VOI) approach from decision science in a novel, a posteriori fashion to quantify the economic benefits of the state and federal government supported research. We compared the net benefits of a scenario in which research-informed treatment protocols were used (actual scenario) to the net benefits of a scenario based on treatment protocols available prior to research (counterfactual scenario). Net benefits accounted for ecosystem service impacts of hydrilla on fishing and non-fishing recreation. We estimated the value of hydrilla research for the KCOL lakes at $23.7 million (2017 $), discounting at 3% over a 5-year period. The recreational losses avoided and treatment cost savings more than compensated for research costs. Net benefits were achieved for all but two levels of the sensitivity analysis, suggesting the finding is generally robust to uncertainty regarding hydrilla growth rate and the level of effort that managers would undertake in the absence of research-informed protocols. We consider the finding to underestimate research benefits since research costs for hydrilla could not be precisely isolated, and we only included one type of ecosystem service (recreation opportunity), whereas hydrilla can interfere with navigation, flood control, and ecosystem functions in ways that could not be quantified with available data.

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Legal and Economic Options for Incentivizing Recreational Fishing Access in Coastal Louisiana

In recent years, there has been an escalating boundary conflict involving aquatic access in coastal Louisiana, primarily between private landowners and recreational fishermen. The origin of this conflict stems from the geophysical deterioration of the state's coastal zone and the associated legal, economic, and technological changes that have emerged in response to that crisis. In July 2017, the Louisiana Legislature directed Louisiana Sea Grant to study and make recommendations on the creation of public servitudes to facilitate increased recreational access in coastal waterways. A guiding principle imposed by the resolution was to limit the study focus to voluntary actions that would not impinge on individual property rights or impede commerce. This presentation details the findings of that study. It provides a general overview of the context, history, and drivers of this issue; describes the process utilized for soliciting stakeholder input; and details economic and legal considerations for ten preliminary options that could be used to partially mitigate this conflict.

Wright, Roy
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Science Driving Resilience: Stronger Homes, Business and Communities (Keynote)

Roy Wright joined IBHS in 2018 with more than 20 years of experience in insurance, risk management, mitigation, and resilience planning. Convinced that the continuing cycle of human suffering that strikes families and communities in the wake of severe weather can be broken, Roy leads a team of scientists and risk communicators who deliver strategies to build safer and stronger homes and businesses. IBHS' real-world impact enables the insurance industry and affected property owners to prevent avoidable losses. Roy joined IBHS from the Federal Emergency Management Agency (FEMA) where he served as the Chief Executive of the National Flood Insurance Program, led the agency's Federal Insurance and Mitigation Administration, and directed the resilience programs addressing earthquake, fire, flood, and wind risks. In these roles, he guided several programs that promote a risk-conscious culture, enable faster disaster recovery, and address long-term vulnerabilities to life, property, and well-being in communities across the United States. Prior to joining FEMA in 2007, Roy worked in public and private sector roles with Coray Gurnitz Strategy Consulting and the U.S. Department of the Interior.A native of California, Roy earned a bachelor's degree in political science from Azusa Pacific University and a Master of Public Administration from The George Washington University.

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Risk Information Seeking Behavior Intention of Online Food Purchasers in China

Consumers' food safety risk information seeking behavior plays a vital role in improving food quality and safety awareness and preventing food safety risks. WeChat is the most frequently developed social media platform in China with 1.04 billion monthly active users as of the first quarter of 2018. Wechat ranks third in the world behind WhatsApp and Facebook. Based in the Risk Information Seeking and Processing model (RISP) proposed by Griffin et al., this paper empirically analyzes the food safety risk information seeking behavioral intention and influencing factors using responses from 774 WeChat users. Results show that risk perception, information sufficiency, informational subjective norms, and relevant channel beliefs have significant positive effects on consumers' intention to seek information on food quality and food safety risks. Risk perception positively affects consumers' response to food safety incidents. Perceived information gathering capacity has no significant impact on consumers' intention. Moreover, the multiple-group analysis also shows that the effect of consumers' gender, age, education background, marital status, average monthly earnings, and food safety risk experience is different among different groups. Furthermore, recommendations are made to improve behavioral intention related to the food safety risk of consumers.

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Managing Water for the Extremes

The idea of a normal or average year concerning water is almost non-existent. Nowadays we move from one extreme event to the other with regularity. Drought may settle in for several years then extreme flooding may occur. For example, the City of Houston recently experienced 500-year floods three years in a row while the rest of Texas was coming out of an extended drought. In Louisiana, where the Bonne Carre spillway has been opened the same number of times in the last ten years as in the previous 20, increased flooding frequency along the lower Mississippi complicates river operations and can even affect parties outside the rivers confines. This session seeks to elucidate the policy and economic aspects of water management in light of the seemingly regularity of extreme events.

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Valuation Efforts in Coastal Ecosystems: Current Applications and Future Directions (Panel)

Coastal and marine ecosystems store vast quantities of ecosystem wealth, but difficulties measuring values held in coastal and marine ecosystems prevent its inclusion in the analysis of sustainability, resilience, and policy-relevant discussions. Economists have developed valuation theory and its quantification approaches for treating ecosystems as the production of ecosystem goods and services. Consistent upon these efforts, there are uncountable numbers of research to measure the ecosystem services value of coastal and marine systems. Yet, despite strong theoretical backgrounds and interdisciplinary supports, the valuation of coastal and marine ecosystems remains crudely measured at best as "dollar value" and its size comparisons under various scenarios to discuss implicit welfare improvement or weak sustainability. For the recent years, to fill this gap, there have been research efforts to integrate the economic theories from the fields outside of environmental and resource economics to the valuation methods. A few examples are to adopt financial economics model with nonmarket valuation, composite index approach with ecosystem indexes, and integrated assessment approach. Even though these approaches still require the rigorous theoretical buildups, they seem to deliver great success in the discussion on sustainability and practical suggestions on policy design. The presentations proposed in this session aims to introduce several pioneering works in these research efforts in coastal and marine ecosystems and to hold attendees' attention to seek potential research collaboration opportunities with these new approaches.

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Capital Asset Pricing for Nature (capn): Deterministic vs. Stochastic Approaches

Ecosystems are important stores of wealth. The 2014 Inclusive Wealth report suggests that 28% of global wealth is contained in ecosystems, which is certainly a lower bound. Wealth accounting (e.g., inclusive/comprehensive/genuine wealth) is a rigorous economic paradigm for measuring sustainability, but the difficulty of measuring prices of natural capital has been its Achilles' heel. Contingent upon the efforts to measure prices for natural capital, we, authors, contribute to the literature by suggesting capital asset pricing for nature (capn) methods to approximate realized shadow prices for natural capital stocks enables valuation of natural capital assets under the current management scheme without requiring the analyst to assume optimizing institutions. In Yun et al. (2017), we generalize the capn approach with single stock derivation to the case of the multiple interacting stocks of biotic and abiotic assets and liabilities that comprise ecosystems. In this paper, we extend these prior works to consider the valuation of assets linked through deterministic relationships to assets with stochastic dynamics including when there are multiple stocks with correlated stochastic processes. We derive asset prices for natural capital stocks governed by correlated diffusion and

show how function approximation techniques can be used to approximate these shadow prices across the domain of capital stocks. Using the reef fishery example in the Gulf of Mexico, we demonstrate the combined role biophysical dynamics, the management feedback rule, and the properties of the valuation function for benefits flows in influencing the salience of risk in the pricing of natural assets. For the CNREP presentation, we will introduce both deterministic and stochastic capn methods to approximate shadow prices with a single stock example. The main result will show that the stochastic dynamics from uncertain climate change or variation is leading a lower price of natural capital compared to the deterministic case. This is caused by the self-insurance and self-protection to avoid or reduce the risk from the stochasticity. In the policy aspect, risk or uncertainty contributes to the reduction of value of natural capital and harm to conservation efforts to maintain sustainability or social welfare.

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