***"How an offshore oceanic ecosystem responded to extreme perturbation: The 2010 Gulf of Mexico BP/Deepwater Horizon oil well blowout"***

**Dr. Samantha Joye**

The BP/Deepwater Horizon oil well blowout released roughly 5 million barrels of oil and more than 250,000 tons of natural gas into Gulf of Mexico during an 85-day uncontrolled deepwater (1500 meter water depth) discharge. Up to 50% of the discharged oil and all of the discharged gas released remained in the Gulf's deep water. The remainder of the oil reached the Gulf's surface waters, forming expansive and sometimes thick surface slicks. The hydrocarbon injection led to profound changes in microbial community composition and activity in the Gulf 's waters and sediments and in near shore benthic habitats. Microorganisms responded rapidly, particularly members of the "rare biosphere". The ability of microbial communities to efficiently consume the discharged hydrocarbons is poorly constrained and was likely limited, to a large degree, by environmental factors. Impacts of the 2010 oil well blowout also rippled through the food web. A particular aspect of the 2010 BP/Deepwater Horizon oil well blowout that warrants additional discussion is the use of chemical dispersants to facilitate oil dissolution and ideally oil biodegradation. The degree to which dispersants stimulated oil biodegradation is unclear but evidence is growing that dispersants negatively impacted some key biological components of the Gulf system. Although microbiological and ecosystem-level research following the blowout has led to many discoveries, it also revealed a clear need for a more comprehensive understanding of the environmental factors that regulate microbial hydrocarbon degradation in the environment and the absolute necessity for a comprehensive assessment of the role of chemical dispersants, both on microbial communities and microbial oil biodegradation rates as well as other key biological components of the Gulf ecosystem.

**Professor Athletic Association Professor of Arts and Sciences, Department of Marine Sciences, University of Georgia**

**Dr. Samantha Joye** earned her Ph.D. in Marine Sciences from the University of North Carolina-Chapel Hill in 1993 and joined the faculty of the University of Georgia in 1997, having served briefly as an assistant professor of oceanography at Texas A&M. She was awarded a fellowship at the Hanse Institute for Advanced Study in Delmenhorst, Germany, where she served as a visiting professor at the Max Planck Institute for Marine Microbiology in Bremen, in 2002-03. In 1997 and again in 1999, she served as a research fellow at the Marine Biological Laboratory in Woods Hole, Mass. Dr. Joye is a microbiologist, an educator, a deep ocean explorer, and a vocal ocean and environmental advocate. Joye currently holds the Athletic Association Professorship in Arts and Sciences and is a Professor in the Department of Marine Sciences. She is an expert in microbial geochemistry, focusing on hydrocarbon and trace gas dynamics, and works in both blue water and nearshore ocean ecosystems. Her work is highly interdisciplinary, bridging the fields of analytical chemistry, microbiology, and geology. In 2008, she was awarded the University of Georgia's Creative Research Medal for her work assessing the impacts of climate change on oceanic carbon cycling in nearshore ocean ecosystems. In 2014, she was named a fellow of the American Association for the Advancement of Science and in 2015 she was named the University of Georgia's recipient of the Southeastern Conference Faculty Achievement Award, highlighting her contributions to research and education at UGA.

Dr. Joy's research is widely published in leading scientific journals and books, and she is regularly called upon by national and international scientific and policy agencies for expert commentary. Her research has been supported by substantial, multi-year research grants from the National Science Foundation, the Environmental Protection Agency, the Gulf of Mexico Research Initiative, the Department of Interior, and the National Oceanic and Atmospheric Administration, among others. After her first submersible dive to the Gulf of Mexico seabed in 1994, Joye was hooked on deep ocean exploration; she has been studying the microbiology of natural seepage of oil and gas in the Gulf of Mexico since then. Her research related to the 2010 DWH oil spill examined the distribution of deepwater plumes of oil and gas, and her group continues to measure the activities of the microorganisms that break down oil and gas and assess the impacts of the spill on blue water benthic and pelagic ecosystems. She is currently the Director of a multi-million dollar research program, "Ecosystem Impacts of Oil and Gas Inputs to the Gulf", studying hydrocarbon dynamics in the Gulf of Mexico.

### *Rising Above: Building Resilient Coastal Communities through Large-Scale Ecosystem Restoration*

**Dr. Todd Crowl**

Coastal ecosystems are being modified at unprecedented rates through interacting pressures of global climate change and rapid human population growth, impacting natural coastal resources and the services they provide. The fate of coastal cities and neighboring wetland wilderness under climate change cannot be decoupled; their future is largely dependent on how well adaptation and mitigation decisions are guided by knowledge of these dependencies. Advances in socio-ecological approaches to coastal ecosystem science and eco-politics are providing solutions that balance the needs of urban and wildland systems. South Florida provides a particularly rich context for determining pathways for sustainable outcomes under climate change. The Everglades watershed and its 6 million human residents are exceptionally exposed to sea level rise and the long-term impacts of decades of freshwater drainage. Saltwater is intruding at unprecedented rates into the porous limestone aquifer, resulting in coastal ecosystem transgression and seasonal residential freshwater shortages. Landscape-scale Everglades restoration process is expected to reverse some of these trends. However, it is not clear how uncertainties about climate change prognoses and their impacts (e.g., sea level rise (SLR), changes in storm activity or severity, and climate drivers of freshwater availability) may influence human activities (e.g., population growth, resource use, land-use change), and how their interaction will affect the restoration process that is already steeped in conflict. Long-term, coupled biophysical and cultural studies are exposing and unraveling complex feedbacks that reduce uncertainty and provide solutions that generate resilience. Feedbacks to freshwater restoration include continued provisioning of freshwater for residential, agricultural and industrial while seas rise, reduced loss of stored carbon to the atmosphere, increased socio-economic and ecological resilience to high-energy storms, and sustained habitat for economically and ecologically important species. By engaging decision-makers in all steps of the scientific process, solutions for building resilience coastal communities can be co-produced for successful conveyance into decision-making.

**Director of the Southeast Environmental Research Center, Florida International University**

**Dr. Todd Crowl** is Professor and Director of the Southeast Environmental Research Center (SERC), founder and inaugural Director of the Institute for Water & the Environment (InWE) and a co-founder of the Sea Level Solutions Center (SLCS). His research interests include aquatic ecology, predator-prey interactions, food web ecology and most recently, urban stream ecology. As Co-PI of the Luquillo Puerto Rico LTER, he has spent the last 25 years looking at energy flow between tropical rainforests and rivers and foodweb dynamics. Other projects include the role of introduced fish on native fish communities in western US lakes and the role of urbanization on sustainable freshwater resources.

Prior to joining Florida International University, Crowl was a Program Officer at the National Science Foundation where he directed the US Long Term Ecological Research Program. He has been a Bullard Fellow at Harvard University and a Research Fellow in the University of Notre Dame Environmental Research Center. Crowl was the Principal Investigator and Founding Director of the Utah EPSCoR Water Sustainability Program at Utah State University.

### ***Impact of disturbances and climate change on ecosystem regulation, filtering, and exposure of mercury***

**Dr. Daniel Obrist**

Anthropogenic activities have led to global-scale atmospheric emission, distribution, and deposition of mercury, a neurotoxic environmental pollutant, for decades and even centuries. As a result, mercury has been accumulating in terrestrial and aquatic ecosystems to high levels, particularly in soils. These immobilized legacy pools of mercury are now at risk for potential re-mobilization, either back to the atmosphere or to aquatic systems through runoff. While human perturbation of the natural mercury cycle was originally driven by atmospheric emissions from gold mining and combustion activities, sources increasingly shift towards legacy re-emissions of mercury that volatilizes from soils, lakes, and oceans.

Through the research activities of my group, we found that ecosystem processes play a key role in how mercury accumulates in, and is re-mobilized from, terrestrial environments, and that mercury accumulation varies greatly by land cover types. Vegetation proves to be a key driver increasing deposition and accumulation, with productive ecosystems showing much higher mercury loadings and storage compared to low-productivity arid environments. Extreme events such as fires lead to significant re-mobilization, such as atmospheric emissions and increased runoff to rivers and lakes. Our most recent research shows that mercury also accumulates to high levels in remote arctic soils, with even larger pools of mercury residing in tundra permafrost soils compared to temperate soils. Although reductions in present-day anthropogenic emissions are urgently needed to reduce human and wildlife exposure, it is increasingly important to constrain the role of ecosystems, and disturbances thereof, in regulating global and regional pollutant impacts. A particular concern is that climate change and extreme events have the potential to re-mobilize legacy pollution from soils and terrestrial environments.

**Research Professor – Atmospheric Biogeosciences, Desert Research Institute**

**Dr. Daniel Obrist** is a Research Professor at the Desert Research Institute in the Nevada System of Higher Education and is a faculty member in the University of Nevada, Reno Graduate Programs of Atmospheric Science, Hydrologic Science, and Environmental and Health Sciences. He was awarded the 2000 Nevada System of Higher Education Board of Regents “Rising Researcher Award.” He is Editor of *Biogeosciences* and Associate Editor of *Elementa*, and has served as a reviewer and panel member for numerous National Science Foundation programs and contaminant assessments. His research combines atmospheric chemistry and surface-atmospheric exchange processes with terrestrial biogeochemistry to understand the fate of persistent pollutants in the biosphere. Dr. Obrist is particularly interested in the cycling of mercury and organic pollutants such as polycyclic aromatic hydrocarbons in ecosystems ranging from the arctic tundra to temperate forests and desert shrub steppes. He has an M.S. in plant ecology from the University of Basel, Switzerland and a Ph.D. in hydrogeology from the University of Nevada, Reno.