NCER

5th National Conference on Ecosystem Restoration

The Spirit of Cooperation

July 29 – August 2, 2013

Renaissance Schaumburg Convention Center Hotel
Greater Chicago/Great Lakes Region
Schaumburg, Illinois

www.conference.ifas.ufl.edu/NCER2013

Greetings on Behalf of the 5th National Conference on Ecosystem Restoration, NCER 2013.

Welcome to the Great Lakes region – whether this is your first NCER or you've been to every one since its inception in 2004, we are glad you are here. The Great Lakes have seen an enormous increase in restoration – and protection – activity, so it is especially appropriate for our region to host this year's conference. We are excited to be able to learn what's happening around the country and to share what's happening here.

Many conferences focus on science and engineering or specific regional ecosystems. NCER does this, too, but we also examine the planning and policy required to achieve success in these endeavors. NCER has become a true force in addressing the nation's ecosystem restoration needs, and in bringing together restoration leaders and experts to share information, discuss challenges, and seek common solutions.

As we execute our restoration workloads, each of us has a group of individuals we rely on to provide information and critical evaluation of our plans and decisions – a local ecosystem restoration community. NCER provides an essential networking opportunity that allows us to link our local communities, interact within the larger community, share knowledge, seek methodologies to solve our restoration problems, and benefit from the synergy this opportunity affords.

NCER 2013 presents an outstanding program of technical presentations from many areas of the country and a deeper exploration of the Great Lakes – a vast ecosystem, holding nearly 20 percent of the surface freshwater in the world that is undergoing unparalleled changes. The program also includes a stellar line-up of political leaders, agency officials, and visionaries who are speaking in four plenary sessions. In addition, we will have two stimulating restoration coffee house discussions—one on preventing, predicting, managing, and controlling harmful algae blooms that impact human and ecological health across the globe, and the other that addresses invasive species' enormous impacts on native species and ecosystems via an Asian carp case study. There will also be two poster sessions, allowing you the opportunity to discuss restoration activities with authors in greater detail.

The root of NCER's success can be traced directly to the dedicated efforts of numerous committee members involved in organizing the general program, special sessions, plenary program, restoration coffee houses, technical field trip, exhibition, and sponsorship efforts. We would like to thank those committee members, as well as the many moderators in charge of guiding our sessions throughout the week.

We would like to express our deepest appreciation to the conference's valued sponsors. It would simply not be possible to have a conference of this caliber without this support. We also thank Ms. Beth Miller-Tipton and her skilled staff at the University of Florida IFAS Office of Conferences and Institutes (OCI) for their dedication in hosting and organizing this and all previous NCERs.

We trust you will take advantage of every opportunity NCER provides throughout the week to view posters, visit with exhibitors, attend program sessions, and make new connections at our networking functions. Please let any conference staff or planning committee member know if we may be of assistance throughout the week. We are glad you could join us and thank you for attending.

On behalf of the entire planning committee, we as Conference Co-chairs welcome you to NCER 2013.

Sincerely,

Andy Buchsbaum
Regional Executive Director
National Wildlife Federation
Great Lakes Office

Cameron Davis
Senior Advisor to the Administrator
U.S. Environmental Protection Agency

Don Scavia
Director and Professor
Grahams Sustainability Institute
University of Michigan

Table of Contents

The NCER 2013 **Book of Abstracts** with full author recognition is posted on the conference web site at: www.conference.ifas.ufl.edu/NCER2013

About NCER

The National Conference on Ecosystem Restoration (NCER) is an interdisciplinary conference on large scale ecosystem restoration presenting state-of-the art science and engineering, planning and policy in a partnership environment.

The first NCER, held in Orlando, FL (2004) with over 900 restoration practitioners participating, lead to successful conferences in Kansas City, MO (2007), Los Angeles, CA (2009) and Baltimore, MD (2011). NCER brings together nearly 1,000 scientists, engineers, policy makers, planners, and partners from across the country actively involved in ecosystem restoration.

Initiated by the University of Florida, U.S. Geological Survey, U.S. Army Corps of Engineers and USDA's Natural Resources Conservation Service, NCER typically entails five days of presentations in six program tracks, multiple workshops, poster sessions, field trips and coffee-house discussions dedicated to both small and large scale ecosystem restoration programs including but not limited to the Missouri and Mississippi River Basins, the Louisiana Coastal Area, Columbia River, the Everglades, the San Francisco Bay/Delta, the Chesapeake Bay, Great Lakes and Puget Sound, just to name a few.

The purpose of NCER is to provide an interactive forum for physical, biological and social scientists, engineers, resource managers, planners and policy makers to share their experiences and research results concerning large-scale ecosystem restoration on both national and international levels.

Conference participants have the opportunity to learn about both large-scale and small local ecosystem restoration efforts and what their colleagues working at these levels have learned, what factors contributed to success, and how barriers and obstacles were overcome.

NCER explores the roles of policy, planning and science in establishing goals and performance expectations for achieving successful and sustainable ecosystem restoration. We will also look at the importance of considering ecosystem services in restoration cost/benefit discussions. Successful partnerships and means to leverage resources are important themes that run through this conference.

Previous NCERs established a forum for individuals engaged in all aspects of ecosystem restoration to exchange information and experiences. This and future NCERs will continue this tradition by being the leading National conference for interdisciplinary exchanges for sustainable restoration of ecosystems.

Executive Steering Committee

Conference Co-Chairs

- ***Andy Buchsbaum,*** Regional Executive Director for the National Wildlife Federation's Great Lakes Office
- ***Cameron Davis,*** Senior Advisor to the Administrator (Great Lakes), US EPA Great Lakes National Program Office
- ***Don Scavia,*** Graham Family Professor of Environmental Sustainability, University of Michigan

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WEBSITE: www.aecom.com
REPRESENTATIVE: Christopher Benosky (christopher.benosky@aecom.com)

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AECOM is a global provider of professional technical and management support services to a broad range of markets, including water, environment, transportation, facilities, energy, and government. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering solutions that create, enhance, and sustain the world's built, natural, and social environments.

ARCADIS US, Inc. [BOOTH #36]
WEBSITE: www.arcadis-us.com
REPRESENTATIVE: Robert Daoust (robert.daoust@arcadis-us.com)

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ARCADIS is an international company providing consultancy, design, engineering and management services in infrastructure, water, environment and buildings. We enhance mobility, sustainability and quality of life by creating balance in the built and natural environments. ARCADIS develops, designs, implements, maintains and operates projects for companies and governments. With 21,000 employees and more than $3.2 billion in revenues, the company has an extensive international network supported by strong local market positions. ARCADIS is a recognized leader in ecosystem restoration in the US and around the world. ARCADIS supports UN-HABITAT with knowledge and expertise to improve the quality of life in rapidly growing cities around the world.

Brown and Caldwell [BOOTH #14]
WEBSITE: www.brownandcaldwell.com
REPRESENTATIVE: Laynee Leslie (lleslie@browncald.com)

Brown and Caldwell is an engineering firm with a history of delivering innovative solutions. We are a recognized leader in water resources, infrastructure, and environmental services. We are ranked by Engineering News-Record among the Top 500 Design Firms worldwide (up to #47 in 2013), indicating the firm's strength in the midst of a difficult economy. Brown and Caldwell is the largest consulting firm focused on the U.S. environmental sector. By staying 100% environmentally focused, we maintain knowledge of regulatory drivers and know-how to implement solutions that cut the cost of compliance and achieve sustainability.

Cardno ENTRIX [BOOTH #2]
WEBSITE: www.cardnoentrix.com
REPRESENTATIVE: Cassondra Thomas (cassondra.thomas@cardno.com)

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Cardno ENTRIX offers water resources management, environmental liability and risk management, natural resources management, and permitting and compliance services. We specialize in habitat restoration approaches that incorporate sustainable, cost-effective strategies for the long-term management of natural resources. Our multidisciplinary staff offers the range of technical expertise necessary to assist clients with all phases of the habitat restoration process.

CDM Smith [BOOTH #10]
WEBSITE: www.cdmsmith.com
REPRESENTATIVE: Timothy Feather (feathertd@cdmsmith.com)

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CDM Smith provides lasting and integrated solutions for aquatic and terrestrial ecosystem restoration and for built infrastructure within these natural environments. Our worldwide portfolio of relevant projects encompasses studies, planning, design, and implementation. Working with diverse stakeholders, CDM Smith has delivered ecosystem restoration projects requiring multidisciplinary design, endangered species and habitat surveys, hydrologic and hydraulic modeling, and ecological risk assessments.

Coastal Protection and Restoration Authority of Louisiana [BOOTH #9]
WEBSITE: www.coastal.la.gov
REPRESENTATIVE: Jenny Kurz (jenny.kurz@la.gov)

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The Coastal Protection and Restoration Authority is established as the state entity with authority to articulate a statement of priorities and focus development & implementation efforts to achieve comprehensive coastal protection for Louisiana. Our mandate is to develop, implement and enforce a comprehensive coastal protection & restoration Master Plan. CPRA works to establish a safe and sustainable coast to protect towns, the nation's energy infrastructure, and natural resources for years.

Dynamic Solutions, LLC [BOOTH #35]
WEBSITE: www.dsllc.com
REPRESENTATIVE: Christopher Wallen (cmwallen@dsllc.com)

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Dynamic Solutions, LLC is building a better future and a cleaner environment through the expert application of advanced hydrodynamic, sediment transport, water quality, toxics transport and aquatic ecosystem modeling tools. For over 16 years, we have been one of the nation’s leading multi-dimensional surface water modeling firms focusing their modeling practice on restoring and enhancing the ecological viability of their water resources while balancing the needs of mankind.

Environment Canada [BOOTH #7]
WEBSITE: www.ec.gc.ca
REPRESENTATIVE: Tina Romaneh (Tina.Romaneh@ec.gc.ca)

Environment Canada is the federal organization whose programs, services, and people lead the way in implementing the Government of Canada’s environmental agenda. We collaborate with our partners at home and abroad, to realize concrete progress on initiatives that will protect the health of our people and our planet. At Environment Canada (EC), our business is protecting the environment, conserving the country's natural heritage, and providing weather and meteorological information to keep Canadians informed and safe. Environment Canada is building on its accomplishments with the environment through credible science, effective regulations and legislation, successful partnerships, and high-quality service delivery to Canadians. We support sound environmental decisions. We work to repair the damage of the past, to collect and pass on knowledge, and to develop, implement and enforce policies to prevent future issues. We also work to ensure that Canadians have a safe, clean and sustainable environment today, tomorrow and well into the future.

Environment Coastal & Offshore *[Table Top Display]*
WEBSITE: www.eco-tsc.com

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Environment Coastal & Offshore (ECO) provides comprehensive coverage and analysis of issues affecting the coastal and offshore environment field. Published six times a year in print and digital formats, each issue presents critical business intelligence for professionals in all disciplines of this multi-faceted industry including offshore oil & gas, government agencies, utilities, renewable ocean energy, academia, international banking, engineering, and construction. Highlighting the five key environmental areas of Science, Technology, Economics, Regulatory & Policy, and HSSE, ECO provides insight through a mix of in-depth articles, analytics, and news on the latest projects, trends, technology and policy.

Eureka/Measurement Specialties [BOOTH #11]
WEBSITE: www.meas-spec.com
REPRESENTATIVE: David Holt (david.holt@meas-spec.com)

Measurement Specialties leads the water resources market with over 25 years of industry experience in the design and manufacture of water-quality and water-level sensors and systems. Our expertise in media-isolated pressure sensors provides our customers with a unique advantage in creative product development and consistent product performance. Our multiprobes measure temperature, dissolved oxygen, pH, conductivity, water depth, ORP, turbidity, chlorophyll, ammonium, nitrate, and other parameters critical to water resources improvement and preservation.

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WEBSITE: www.forrestkeeling.com
REPRESENTATIVE: Mike Thompson (mthompson@fknursery.com)

Forrest Keeling Nursery is the world-renowned originator of the RPM (Root Production Method ®). Our patented RPM tree technology yields unsurpassed survivability and plant growth, which makes Forrest Keeling plants the benchmark for wetland restorations and large-scale installations in any application. In fact, superior growth rates make RPM trees the standard for problem-solving plantings including carbon sequestration, vegetative environmental buffers and reforestation.

Full Frame Productions [BOOTH #20 & 21]
WEBSITE: www.fullframeprod.com
REPRESENTATIVE: David Donnenfield (david@filmmakerscollaborative.org)

Full Frame Productions is an award winning video & film production company with expertise in broadcast, advertising, and corporate communications. Our mission is to create memorable viewer experiences that evoke emotion and stimulate thought by combining ideas with creativity. We bring a documentary sensibility to television, non-profit, and corporate communications and advertising – with a strong sense of imaginative, visual storytelling to broadcast and independent filmmaking projects. We have interest, experience, and knowledge in environmental restoration and are well-versed in communicating about large-scale environmental projects.

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WEBSITE: www.gecinc.com
REPRESENTATIVE: Amanda Roussel (aroussel@gecinc.com)

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GEC was established in 1986 in Baton Rouge, Louisiana, as a small engineering consulting firm. It has grown over the years into a firm of national prominence by assembling the talents of a large team of engineering, planning, economic, environmental, and Geographic Information Systems professionals focused on solutions to water and land resources concerns. GEC's success and growth is based on its reputation as a professional organization that provides complete and proficient services from planning to implementation of projects for private and public clients in all parts of the United States. We provide a wide range of expertise for applications to land and water projects. Services are provided separately or in an integrated fashion, depending on client needs. In keeping with the special needs of GEC's clients, our commitment to our clients is to produce high-quality planning and design documents on time, and within budget.

Great Lakes Dredge & Dock Company *[Non-exhibiting sponsor]*
WEBSITE: www.gldd.com
REPRESENTATIVE: William Hanson (whhanson@gldd.com)

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Great Lakes Dredge & Dock Company is America's premier dredging contractor. To create, maintain and restore a wide variety of port and coastal assets – harbors, waterways, rivers, wetlands, beaches, and storm-eroded shores – we use our sizeable fleet of specialized dredging equipment to excavate and transport the full range of underwater soils, including silts, sands, clays, and rock. We work worldwide.

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WEBSITE: www.louisberger.com
REPRESENTATIVE: Edward Samanns (esamanns@louisberger.com)

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The Louis Berger Group's Ecosystem Restoration Services Team understands the many benefits of a watershed approach. Our approach focuses on developing strategic watershed-based restoration plans that balance the realities of the future population growth and economic development with the need to sustain increasing strained natural resources. Successfully designing and implementing multifaceted and dynamic environments requires a sound technical foundation and creativity and ingenuity. Our ability to blend science and engineering to recreate nature is a reason we are one of the leading, full-service environmental consulting firms in the United States. With a resource base of more than 5,000 professionals and affiliate employees in more than 90 countries, we can respond to local conditions while providing clients with the world-class scientific and industry experts of a leading global organization.

Society for Ecological Restoration [BOOTH #32]
WEBSITE: www.ser.org
REPRESENTATIVE: Leah Bregman (leah@ser.org)

The Society for Ecological Restoration (SER) is a membership based non-profit organization with members in more than 70 nations and 14 regional chapters. SER works to promote ecological restoration as a means of sustaining the diversity of life on Earth and reestablishing an ecologically healthy relationship between nature and culture. 2013 marks the Society's 25th Anniversary which will be celebrated at SER's 5th World Conference on Ecological Restoration (SER2013). SER2013 will draw together more than 1,200 experts from around the world interested in the science and practice of ecological restoration.

Stanley Consultants [BOOTH #31]
WEBSITE: www.stanleyconsultants.com
REPRESENTATIVE: Dan Miller (millerdaniel@stanleygroup.com)

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Stanley Consultants has a long history of providing successful engineering services to federal, state and local entities. For over 20 years we have provided design services, assessments, studies, and documentation for the maintenance, preservation, restoration, and sustainability of the nation's natural resources, ecosystems, threatened or endangered species, and habitats. Our proven environmental experience includes wildlife and aquatic habitat restoration, water control features, impact statements, wetland permitting and mitigation, environmental management systems, land reclamation and natural resources management. We know you must implement your mission requirements while being sensitive to the needs of the environment, monitoring economic conditions, reaching sustainability goals, and staying on top of changing regulations and service demands. Our professional engineers, designers and environmental scientists do not have preconceived solutions for your complex needs. We listen to your concerns and explore all the options to tailor an engineering solution that will work for you now and in the future.

Stantec Consulting Services, Inc. [BOOTH #12]
WEBSITE: www.stantec.com
REPRESENTATIVE: George Athanasakes (george.athanasakes@stantec.com)

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Stantec, founded in 1954, provides professional consulting services in planning, engineering, architecture, landscape architecture, surveying, environmental sciences, project management, and project economics for infrastructure and facilities projects. Continually striving to balance economic, environmental, and social responsibilities, we are recognized as a world-class leader and innovator in the delivery of sustainable solutions. We support public and private sector clients in a diverse range of markets, at every stage, from initial concept and financial feasibility to project completion and beyond. Through our people, partnerships, and technology, Stantec supports the successful delivery of ecosystem restoration projects varying in size and complexity. Harnessing unique experience across multiple service areas into a fully integrated team approach yields the company's competitive advantage. Our strength lies in our commitment to diversity—in our team members, projects, and culture.

TetraTech, Inc. [BOOTH #8]
WEBSITE: www.tetratech.com
REPRESENTATIVE: Craig Kruempel (craig.kruempel@tetratech.com)

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Tetra Tech's multidisciplinary team offers the full lifecycle of natural resource protection and restoration services ranging from initial feasibility assessments and engineering design to post-construction biological and physical monitoring. With more than 14,000 associates operating from 350 offices worldwide, Tetra Tech provides its customers with innovative scientific, sediment management, and restoration solutions by combining world-class environmental services, terrestrial and hydrographic mapping, hydraulic and sediment modeling, geotechnical analysis and engineering, and economic analysis using the most cost-effective approaches. In recognition of our unparalleled qualifications and capabilities, Engineering News – Record (ENR) has ranked Tetra Tech #1 in Water and Environmental Management for the past nine years.

University of Maryland Center for Environmental Science [BOOTH #4]
WEBSITE: www.umces.edu
REPRESENTATIVE: Dave Nemazie (nemazie@umces.edu)

The University of Maryland Center for Environmental Science (UMCES) is the most prominent single institution involved in scientific discoveries about the Chesapeake Bay and its watershed. Although focusing more than 2/3 of its research on this region, the Center's activities are global, involving research from the Arabian Sea to the Yellowstone and from the poles to the tropics.
UMCES' scientists include biologists, ecologists, physicists, chemists, geologists, engineers, and economists who work together in a truly trans-disciplinary community.

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URS Corporation [BOOTH #3]
WEBSITE: www.urscorp.com
REPRESENTATIVE: Michael Donahue (michael.donahue@urs.com)

URS Corporation is a leading provider of engineering, construction and technical services for public agencies and private sector companies around the world. The company offers a full range of program management; planning, design and engineering; systems engineering and technical assistance; construction and construction management; operations and maintenance; information technology; and decommissioning and closure services. URS provides services for federal, oil and gas, infrastructure, power, and industrial projects and programs.

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REPRESENTATIVE: Tom Slowinski (tslowinski@v3co.com)

V3 utilizes a comprehensive Design-Build-Manage approach for ecological restoration projects. The following Chicago area restoration projects were designed and/or built by V3's construction and ecological restoration team: McDowell Grove Dam Removal, Springbrook Creek Remeandering, Messenger Woods Restoration, Churchill Dam Removal, Manhattan Creek Restoration, Hadley Valley Preserve, Fort Sheridan Ravine, and Burnham Prairie.

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The Water Institute of the Gulf [BOOTH #34]
WEBSITE: www.thewaterinstitute.org
REPRESENTATIVE: Nick Speyrer (nspeyrer@thewaterinstitute.org)

The Water Institute of the Gulf is a not-for-profit, independent research institute dedicated to advancing the understanding of coastal, deltaic, river, and water resource systems, both within the Gulf Coast and around the world. Based in Baton Rouge, LA, our mission supports the practical application of innovative science and engineering, providing solutions that benefit society.

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Weston Solutions, Inc. [BOOTH #1]
WEBSITE: www.westonsolutions.com
REPRESENTATIVE: Cheryl Ulrich (cheryl.ulrich@westonsolutions.com)

Weston Solutions delivers integrated and sustainable solutions for environmental restoration, property redevelopment, design/build construction, green buildings, and clean energy. Weston can help develop solutions to maximize the value of your resources and turn environmental responsibility into economic growth. We help clients restore productive assets to build a stronger economy and a healthier ecology.

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Agenda-at-a-Glance

MONDAY	Monday, July 29, 2013
7:00am-5:30pm	Conference Registration Open
7:00am-8:00am	**Early Morning Refereshments for Field Trip Participants**
8:00am-5:30pm	OPTIONAL Pre-Conference Field Trip
12:00pm-6:00pm	Poster Presenter & Exhibitor Move-In
8:00am-8:00pm daily	**IMPROMPTU MEETINGS (One small room blocked for 10-15 people each)**
TUESDAY	**Tuesday, July 30, 2013**
7:30am-5:30pm	Conference Registration Open
7:30am-9:00am	**Early Morning Refereshments**
9:00am-10:00am	OPENING PLENARY SESSION
10:00am-10:30am	**AM Break**
10:30am-12:00pm	**Concurrent Sessions**
12:00pm-1:30pm	**Lunch on Own**
1:30pm-3:00pm	**Concurrent Sessions**
3:00pm-3:30pm	**PM Break**
3:30pm-5:00pm	**RESTORATION COFFEE HOUSE ONE: *Harmful Algal Blooms***
5:00pm-7:00pm	**Poster Session ONE & Networking Reception**
WEDNESDAY	**Wednesday, July 31, 2013**
7:30am-5:30pm	Conference Registration Open
7:30am- 9:00am	**Early Morning Refereshments**
9:00am-10:00am	Plenary Session
10:00am-10:30am	**AM Break**
10:30am-12:00pm	**Concurrent Sessions**
12:00pm-1:30pm	**Lunch on Own**
1:30pm-3:00pm	**Concurrent Sessions**
3:00pm-3:30pm	**PM Break**
3:30pm-5:00pm	**Concurrent Sessions**
5:00pm	**Evening on Own**
THURSDAY	**Thursday, August 1, 2013**
7:30am-5:30pm	Conference Registration Open
7:30am- 9:00am	**Early Morning Refereshments**
9:00am-10:00am	Plenary Session
10:00am-10:30am	**AM Break**
10:30am-12:00pm	**Concurrent Sessions**
12:00pm-1:30pm	**Lunch on Own**
1:30pm-3:00pm	**Concurrent Sessions**
3:00pm-3:30pm	**PM Break**
3:30pm-4:10pm	Plenary Session
4:15pm - 5:30pm	**RESTORATION COFFEE HOUSE TWO: *Asian Carp Case Study***
5:30pm-7:30pm	**Poster Session TWO & Networking Reception**
FRIDAY	**Friday, August 2, 2013**
7:30am-12:00pm	Conference Registration Open
7:30am- 9:00am	**Early Morning Refereshments**
9:00am-10:30am	**Concurrent Sessions**
10:30am-10:45am	**AM Break and Poster Removal**
10:45am-12:00pm	CLOSING PLENARY SESSION
12:00pm	**Conference Concludes**
12:00pm-2:00pm	Exhibitor Move-Out and Registration Strike

Detailed Program Agenda

	Monday, July 29, 2013
7:00am-5:30pm	**Conference Registration Opens** *[Schaumburg Foyer North]*
7:00am - 8:00am	**Early Morning Refreshments for Field Trip Participants** *[Schaumburg Foyer North]*
8:00am-5:30pm	**OPTIONAL Pre-Conference Technical Training Field Trip** The bus departs promptly at 8am; please arrive at the bus loading area no later than 15 minutes prior to departure. A detailed itinerary is outlined in your program booklet and on the conference web site.
12:00pm-6:00pm	**Poster Presenter & Exhibitor Move-In** *[Exploration Hall A]* NOTE: Exhibits and ALL posters move in on Monday and will be on display throughout the duration of the conference. Half of the poster presenters will be asked to stand at their poster during the Formal Poster Session One and Networking Reception on Tuesday. The other half will be asked to stand at their poster during Formal Poster Session Two and Networking Reception on Thursday. [Please consult the Poster Session Directory for a detailed schedule of poster presentations.]
8am-8pm Daily	**IMPROMPTU MEETINGS** If you wish to gather with colleagues and hold impromptu meetings during NCER, a meeting room is blocked to accommodate up to 15 people. A sign up sheet to reserve the room is stationed at the entrance of the Poster Display Area of the Exhibit Hall.

	Tuesday, July 30, 2013					
7:30am-5:30pm	**Conference Registration** *[Schaumburg Foyer North]*					
7:30am - 9:00am	**Early Morning Refreshments in the Exhibit Hall and Poster Display Area** *[Exploration Hall A]*					
9:00am - 10:00am	**OPENING PLENARY SESSION** *[Schaumburg West]* **Rachel Jacobson,** Acting Assistant Secretary for Fish and Wildlife and Parks, US Department of the Interior **SESSION MODERATOR: Don Scavia**, Graham Family Professor of Environmental Sustainability, University of Michigan					
10:00am - 10:30am	**AM Networking Break in the Exhibit Hall and Poster Display Area** *[Exploration Hall A]*					
	Schaumburg A&B	**Schaumburg C&D**	**Innovation**	**Imagination**	**Connection**	**Knowledge**
	Session 1	**Session 2**	**Session 3**	**Session 4**	**Session 5**	**Session 6**
10:30am - 12noon	**Incorporating Climate Adaptation into Large-Scale Ecosystem Restoration**	**Monitoring and Assessment**	**Restoring Streams and Rivers in an Urban Environment**	**Toward Environmentally Beneficial Conservation Practices in Great Lakes Agricultural Watersheds**	**Policy & Partnership for Ecosystem Restoration**	**Near-Shore Ecosystem Restoration**
Moderator	**Victoria Pebbles**	**Tom Slowinski**	**Terry Doss**	**Joseph DePinto**	**Timothy Feather**	**David Hanson**
10:30am-10:40am	**Session Overview**	**Session Overview**	**Session Overview**	**Session Overview**	**Session Overview**	**Session Overview**
10:40am-11:00am	**Dawn Shirreffs** Rising Tide - Adapting Everglades Ecosystem Restoration to Climate Change	**Mike Habberfield** Comparison of Rapid Stream Assessment Techniques across a Gradient of Disturbance	**Scott Estergard** The Los Angeles River and Large-Scale Urban Ecosystem Restoration	**Dennis McGrath** Sustaining Aquatic Ecosystems in Agricultural Watersheds	**Joe Pfeiffer** Ecosystem Restoration with Gorilla Tactics: Restoration of Grand Lake St. Marys Ecosystem Through Economic Development	**Ray Dennis** A New Approach to Seagrass Restoration through Landscape Manipulation
11:00am-11:20am	**Don Boesch** Incorporating Climate Change Adaptation into Chesapeake Bay Ecosystem Restoration	**H. Lee Case III** Development of a Monitoring and Assessment Plan for the Salton Sea, CA	**Michael Homza** River Enhancements and Levee Repairs in an Urban Setting	**Amanda Flynn** Application of an Enhanced, Fine-Scale SWAT Model to Target Land Management Practices for Maximizing Pollutant Reduction and Conservation Benefits	**Angela Larsen** Northeast Illinois Ravine Restoration, Monitoring & Policy Program	**Matthew Lybolt** Defining a Path to Achievable and Historically Relevant Goals for Restoration of Coral Reef Ecosystems
11:20am-11:40am	**Scudder Mackey** Climate Adaptation and Great Lakes Restoration: Implementing GLRI, GLWQA, and the IUGLS	**Martin Boote** Cost-Effective Monitoring of Fish Passage and Biological Responses to Dam Removal	**Heather Schwar** Daylighting of Schoonmacher Creek as Part of the Western Milwaukee Flood Management Project	**Leah Harris** Evaluating Incentives for Crop Farmers to Provide Aquatic Ecosystem Benefits	**Wendy Katagi** Partnerships Bolstering Implementation of National Marine Fisheries Service Southern Steelhead Recovery Plan in Southern California	**Jon Risinger** Bioengineered Oyster Reefs for Sustainable Shoreline Protection & Ecosystem Restoration in the Gulf of Mexico
11:40am-12:00pm	**Denise Reed** Restoring Coastal Louisiana in the Face of an Uncertain Future	**Althea Hotaling** Creating a Habitat Sustainability Index to Plan for Future Seagrass Restoration	**Thomas Sear** Sheboygan River Area of Concern Habitat Restoration Projects	**Carrie Vollmer-Sanders** Groups Don't Act, Individuals Do: Building a Certification Program	**Joe Shisler** Outside the Box in Habitat Restoration for Hazardous Site Remediation	**Russell Burke** Craney Island Eastern Expansion (CIEE) Oyster Mitigation Oyster Shellstring Survey
12noon - 1:30pm	**Lunch on Own**					

	Tuesday, July 30, 2013					
	Schaumburg A&B	Schaumburg C&D	Innovation	Imagination	Connection	Knowledge
	Session 7	Session 8	Session 9	Session 10	Session 11	Session 12
1:30pm - 3:00pm	**Climate Change & Sea Level Rise**	**Restoration in Coastal Louisiana**	**Implementing Great Lakes Coastal Wetland Monitoring**	**Stream and Watershed Restoration**	**Common Approaches among Successful Regional Ecosystem Management Initiatives**	**Accomplishments in Regional & Large-Scale Restoration**
Moderator	**Cassondra Thomas**	**Scott Slocum**	**Donald Uzarski**	**Lynette Cardoch**	**Mark Gorman**	**Erin Hague**
1:30pm-1:40pm	Session Overview	Session Overview	Session Overview	Session Overview	Session Overview	Session Overview
1:40pm-2:00pm	**Cassondra Thomas** Defining Coastal Marsh Restoration Success under Accelerated Sea-Level Rise Conditions	**Michael Schwar** Quantifying Potential Floodplain Restoration Benefits in the Upper Mississippi River Basin	**Donald Uzarski** A Basin-Wide Great Lakes Coastal Wetland Monitoring Program	**Jill Stachura** Stormwater BMP and Stream Restoration in a City Park	**Ken Lubinski** Old and New Challenges To Restore The Upper Mississippi River System	**John Balletto** PSEG's Estuary Enhancement Program - 20 Years Later
2:00pm-2:20pm	**Laura Moran** Climate Change and Sea Level Rise Impacts at Ports and a Consistent Methodology to Evaluate Vulnerability and Risk	**Herry Utomo** Planting Time and Aerial Application of Smooth Cordgrass Seed For Rapid Revegetation of Newly Constructed Coastal Marshes	**Matthew Cooper** Great Lakes Coastal Wetland Monitoring Program: Support of Restoration Activities Across the Basin	**Eileen Straughan** The Urban Stream Restoration of Sullivan Branch	**Patrick Nunnally** City and Region: Ecosystem Restoration on Urban Rivers	**Ida Wenefrida** Pelleting and Chemical Amending Seed Treatments for Improved Versatility and Success Rates of Aerial Seeding in Coastal Restoration and Erosion
2:20pm-2:40pm	**Rob Daoust** Sea Level Rise Adaptation in San Francisco Bay	**Syed Khalil** A Regional Geological Approach to a Sustainable Ecosystem Restoration of the Mississippi River Delta Plain	**Valerie Brady** Ecological Restoration Efforts in the St. Louis River Estuary: Application of Great Lakes Monitoring Data	**Thomas Slowinski** Remeandering/ Restoring Three Miles of Spring Creek within 650 Acres of Hadley Valley Preserve	**Patrick McGinnis** A Case for an Adaptive Management Approach to Ecosystem Management for the Mississippi River: Moving From Compliance Driven Outputs	**Thomas Teets** An Everglades Restoration Success Story: The C-111 West Spreader Canal Project, from Concept to a Working Restoration Project
2:40pm-3:00pm	**Roselle Henn** Ecosystem Restoration and Regional Resilience: A Post-Sandy Perspective	**Bill Hanson** Use of a Long-Distance Sediment Pipeline for Restoration of Scoffield Island, LA	**Dennis Albert** Great Lakes Coastal Monitoring Provides Baseline Plant Data for Sustainable Wetland Restoration Project	**Matthew Grabau** Salinity Management for Floodplain Riparian Restoration	**Discussion Period**	**Delia Ivanoff** Long-term Success of a Large Constructed Treatment Wetland in the Everglades Agricultural Area Basin and its Benefits to the Downstream Natural Marsh
3:00pm-3:30pm	**PM Networking Break in the Exhibit Hall and Poster Display Area** *[Exploration Hall A]*					
3:30pm - 5:00pm	**PLENARY SESSION: Restoration Coffee House One** *[Schaumburg West]* **Harmful Algal Blooms: Prevention, Prediction, Management, and Control** Harmful algal blooms are impacting human and ecological health across the globe in both freshwater and marine systems. In some cases, they can be prevented or controlled, but in others they can only be predicted and managed. The panel will discuss various approaches for dealing with this increasingly intractable problem. **Session Organizer & Moderator:** **Don Scavia**, Graham Sustainability Institute, University of Michigan **Session Panelists:** **Don Anderson**, Senior Scientist, Woods Hole Oceanographic Institution **Dan Ayres**, Coastal Shellfish Lead Biologist, Washington Department of Fish and Wildlife **Alina Corcoran**, Research Scientist, Florida Fish & Wildlife Conservation Commission **Gail Hesse**, Executive Director, Ohio Lake Erie Commission **Kevin G. Sellner**, Executive Director, Chesapeake Research Consortium					
5:00pm-7:00pm	**Poster Session ONE & Networking Reception in the Exhibit Hall and Poster Display Area** *[Exploration Hall A]*					

	Wednesday, July 31, 2013
7:30am-5:30pm	**Conference Registration Open** *[Schaumburg Foyer North]*
7:30am - 9:00am	**Early Morning Refreshments in the Exhibit Hall and Poster Display Area** *[Exploration Hall A]*
9:00am-10:00am	**PLENARY SESSION** *[Schaumburg West]* **Drought, Flooding and Coastal Storms: Creating Landscapes and Communities Resilient to Weather Extremes** **Jason Weller**, Acting Chief, USDA, NRCS **Robert Bendick**, Director, U.S. Government Relations, The Nature Conservancy **SESSION MODERATOR: Andy Buchsbaum**, Regional Executive Director for the National Wildlife Federation's Great Lakes Office
10:00am-10:30am	**AM Networking Break in the Exhibit Hall and Poster Display Area** *[Exploration Hall A]*

	Wednesday, July 31, 2013					
	Schaumburg A&B	Schaumburg C&D	Innovation	Imagination	Connection	Knowledge
	Session 13	Session 14	Session 15	Session 16	Session 17	Session 18
10:30am-12:00pm	**Science, Governance and Action: One Year into the Amended Great Lakes Water Quality Agreement**	**Louisiana Coastal Restoration: Federal, State, NGO and Private Sector Perspectives and Roles**	**Thinking Like a Watershed: Using the Watershed Approach to Improve Wetland and Stream Restoration Project Outcomes**	**Planning of Ecosystem Restoration Programs**	**The Renaissance of Ecosystem Integrity in North American Large Rivers**	**Ecosystem Goods and Services**
Moderator	**T. Kevin O'Donnell and Brad Bass**	**Mark Wingate**	**Mark P. Smith**	**Mark Jaworski**	**Robin DeBruyne**	**Raed El-Farhan**
10:30am-10:40am	Session Overview	Session Overview	Session Overview	Session Overview	Session Overview	Session Overview
10:40am-11:00am	**Elizabeth Hinchey Malloy** Working under the Updated Agreement: The Great Lakes Restoration Initiative	**Bren Haase** Louisiana Coastal Restoration: The State Perspective and Role	**Mark P Smith** Thinking Like a Watershed: Using a Watershed Approach to Improve Wetland and Stream Restoration Outcomes	**Michael Hooper** Restoration and Conservation Planning Based On Carbon Sequestration and Greenhouse Gas Flux under Current and Projected Future Scenarios	**Elizabeth Holmes-Gaar** Common Themes for Restoring the Columbia Basin Ecosystem through Salmon and Steelhead Recovery	**Joe Berg** Simulating Natural Resource Functions in Green Infrastructure
11:00am-11:20am	**Michael Moorman** GREAT LAKES RESTORATION INITIATIVE – Progress to Date	**Steven Peyronnin** An NGO Perspective of the Evolving Role of NGOs in Louisiana Coastal Restoration	**Nicholas Miller** Matching Multiple Stakeholder Goals to Restoration Opportunities in a Great Lakes Coastal Watershed	**Jill Chomycia** The San Joaquin River Restoration Program: Achieving Large-Scale River Restoration while Minimizing Water Supply Impacts to Agricultural Users	**Bryan Piazza** The Atchafalaya River Basin: Conservation and Restoration in America's Largest Swamp	**David Coffman and Rebecca Griffith** Exploring the Possible Role of Watershed-Scale Sediment Management in Expanding Water Supply and Enhancing Ecological Function: Sulphur River Basin, TX
11:20am-11:40am	**Gail Hesse** The Ohio Lake Erie Phosphorus Task Force II	**David Richard** Louisiana Coastal Restoration: Private Sector Perspective	**Joy Zedler** Larger-scale and Longer-term Planning to Restore Wetland Ecosystem Services, including Biodiversity Support and Resilience	**John Shuey** Large-Scale, High-Diversity Restoration as a Threat-Reduction Strategy in a High-Priority, Fragmented Conservation Landscape	**Justin Kozak** A Structured Decision-Making Process for Restoring the Atchafalaya River Basin, Louisiana: Developing a Process to Bridge the Boundaries between Scientists, Managers and Stakeholders	**Carol Mansfield** Valuing Changes in Aquatic Ecosystem Services from Reductions in Nutrient Loadings: A Methodology for Linking Environmental Benefits and Economic Valuation
11:40am-12:00pm	**Brad Bass** Working under the Updated Agreement: The Great Lakes Nutrient Initiative	**Mark Wingate** USACE Perspective and Evolving Role in Louisiana Coastal Restoration	**Nelwyn McInnis** Large Scale Ecosystem Restoration using Wetland Mitigation Banking in MS and LA	**Jeff Trulick** S.M.A.R.T. Planning in USACE Restoration Planning	**David Bennion** Restoration of Spawning Habitat for Native Fish in the Central Great Lakes	**Cheryl Essex** Recreation Proposal for the Sacramento-San Joaquin Delta and Suisun Marsh
12noon - 1:30pm	**Lunch on Own**					

	Wednesday, July 31, 2013					
	Schaumburg A&B	Schaumburg C&D	Innovation	Imagination	Connection	Knowledge
	Session 19	Session 20	Session 21	Session 22	Session 23	Session 24
1:30pm-3:00pm	**Great Lakes Areas of Concern**	**River Restoration**	**Louisiana Coastal Restoration - Integrating multiple programs through Louisiana's Comprehensive Master Plan for a Sustainable Coast**	**Hydrodynamic & Water Quality Modeling**	**Case Study: Using Monitoring Results to Design and Adaptively Manage Large Habitat Restoration Projects in the Middle Rio Grande Floodplain, New Mexico**	**Real-time Evaluation and Reporting of Ecosystem Restoration Part 1**
Moderator	**T. Kevin O'Donnell**	**Russ Sanford**	**Alisha Renfro**	**Al Cofrancesco**	**Todd Caplan**	**Paul Conrads**
1:30pm-1:40pm	Session Overview	Session Overview	Session Overview	Session Overview	Session Overview	Session Overview
1:40pm-2:00pm	**David Cowgill** Sediment Remediation and Habitat Restoration in Areas of Concern	**Andy Selle** Brown Bridge Dam Removal and River Restoration, Traverse City, Michigan	**Natalie Peyronnin** Louisiana's 2012 Coastal Master Plan: Moving from Planning to Implementation	**Andrew Stoddard** Hydrodynamic and Water Quality Model Framework to Support Resource Management Planning for the Sacramento San Joaquin Delta	**Todd Caplan** Site Attributes and Planting Techniques for Growing Dense Willow Habitat from Cuttings along the Middle Rio Grande, New Mexico	**Sarai Piazza** Report Cards and Multi-scale Assessments using Louisiana's Coastwide Reference Monitoring System
2:00pm-2:20pm	**Caitie McCoy** Three Tips for Successful Community Engagement: Insights from the Great Lakes	**Martin Melchior** Riverine Habitat Restoration for the Sheboygan River Area of Concern	**Carol Parsons Richards** LCA Mississippi River Hydrodynamic and Delta Management Feasibility Study	**Jill Kostel** Increasing Conservation Practice Enrollments through Modeling and Targeted Outreach in an Agricultural Watershed	**Steven Albert** Applying Biotic Functional Assessment Techniques to Guide Adaptive Management of Habitat Restoration along the Middle Rio Grande, NM	**Mary Khoury** The Great Lake Information Management and Delivery System: Fostering Shared Goals and Collaborative Solutions
2:20pm-2:40pm	**Stacy Hron** Accelerating Management Actions in the Sheboygan River Area of Concern (AOC)	**Stuart Trabant** Multidisciplinary Stream Restoration of North Clear Creek	**Jerry Carroll** Utilizing Mississippi River Sediments to Restore Coastal Wetlands	**Gaurav Savant** 3-Dimensional Hydrodynamic Numerical Modeling of Galveston Bay Using the 3-Dimensional Adaptive Hydraulics (3D-ADH) Code	**Chad McKenna** Adaptive Management Strategies for Controlling Exotic Plant Species	**Daniel Sullivan** Tributary and Nearshore Monitoring for Real-Time Evaluation of Great Lakes Restoration
2:40pm-3:00pm	**Bruce Manny** The Use of Science for Fisheries Restoration in the Huron-Erie Corridor	**James Webster** Floodplain Restoration Using a Rivervision Approach in Meacham Creek, Oregon USA	**Derek Brockbank** Restore the Mississippi River Delta	**Al Cofrancesco** Partnerships and Collaboration: A Strategy for Success	**Trevor Fetz** Avian Response to Restoration Efforts in the Middle Rio Grande Bosque: Wetland Creation and Potential Impacts of Restoration Activitiy on the Avian Community	**Heather Henkel** Real-Time Evaluation of the Water-Control Plan and its Impacts on Tree Islands in the Florida Everglades
3:00pm-3:30pm	**PM Networking Break in the Exhibit Hall and Poster Display Area** *[Exploration Hall A]*					

	Wednesday, July 31, 2013					
	Schaumburg A&B	Schaumburg C&D	Innovation	Imagination	Connection	Knowledge
	Session 25	Session 26	Session 27	Session 28	Session 29	Session 30
3:30pm-5:00pm	Invasive Species	Restoring the Connection: Great Lakes Ecosystem Restoration through Dam Removal and Modification	Innovative Floodplain Restoration and Adaptive Management on Large Rivers	Leveraging Our Bucks-n-Acres: Maximizing the Outcomes from Marine Habitat Restoration	Ecosystem Modeling	Real-time Evaluation and Reporting of Ecosystem Restoration Part 2
Moderator	Cynthia Henderson	Michael Donahue	Brad Thompson	Kameran Onley	Chris Wallen	Heather Henkel
3:30pm-3:40pm	Session Overview	Session Overview	Session Overview	Session Overview	Session Overview	Session Overview
3:40pm-4:00pm	**Richard Lance** Asian Carp eDNA: Evolution and Calibration	**Michael Donahue** Ecosystem Restoration via Dams Disposition on the Boardman River System	**Chad Smith** Implementation of the Platte River Elm Creek Complex Flow-Sediment-Mechanical Adaptive Management Experiment	**Dwayne Minton** Reef Flat Recovery following Large-scale Removal of Invasive Algae	**Jeffrey Edstrom** Using a Wiki to Develop a Coastal Watershed Plan	**Laura Brandt** Integrating Ecological Models with Real-time Hydrologic Data in the Florida Everglades
4:00pm-4:20pm	**Cynthia Henderson** Hurricane Impacts on a Coastal Ecosystem Restoration Project: Plant Community, Invasive Species and Adaptive Management	**Jesse Waldrip** Ecosystem Restoration via Passage of Lake Sturgeon at Five Hydroelectric Dams on the Menominee River	**Merri Martz** Restoration Of Gravel Mined Floodplains, Willamette River, OR	**Jeff McCreary** Napa Sonoma Marshes Restoration Project – Coastal Ecosystem Restoration through Collaborative Partnerships	**John Monahan** River, Floodplain and Other - Habitat Optimization Models for Ecosystems (HOME)	**Sarai Piazza** The Development and Implementation of Dynamic Reporting through the Coastwide Reference Monitoring System Website
4:20pm-4:40pm	**Lindsay Teunis** Santa Ana River Arundo Removal Project: One Piece of a Much Larger Invasive Species Puzzle	**Scott Dierks** Restoring Fish Passage Between Lake Erie and the River Raisin	**Kate Buenau** Lessons From the Development and Use of Numerical Models in Restoration Planning on the Missouri and Columbia Rivers	**Mike Burton** Successes and Challenges in Restoring Oligohaline Marsh And Coastal Uplands in the Tampa Bay Region	**Shaye Sable** A Lower Trophic Level Food Web Model to Support Understanding and Evaluation of Ecological Responses within the Low Salinity Zone of the San Francisco Estuary	**Paul Conrads** An Approach for Real-time Evaluation of Savannah Harbor Deepening Mitigation Effectiveness for the Protection of Freshwater Tidal Marshes
4:40pm-5:00pm	**Donald Hagan** Rapid Recovery of the Mycorrhizal Fungal Community Following Cogongrass *(Imperata Cylindrica)* Eradication	**Troy Naperala** Restoring Aquatic Habitat in the Little Rapids Area of the St. Marys River	**Brad Thompson** Envisioning a New River Future with Levee Setbacks for Greater Societal and Wildlife Benefits	**James Byrne** Taking Restoration to Scale: *Acropora* Restoration, Florida and the USVI	**Mark McKelvy** Visualizing Upper Trophic and Ecosystem Modeling Outputs with EverVIEW to Inform the Decision Process in Coastal Louisiana	**Dan Sullivan** Real-time Modeling and Reporting of Beach Water Quality on the Great Lakes
5:00pm	Evening on Own					

	Thursday, August 1, 2013					
7:30am-5:30pm	**Conference Registration Open** *[Schaumburg Foyer North]*					
7:30am - 9:00am	**Early Morning Refreshments in the Exhibit Hall and Poster Display Area** *[Exploration Hall A]*					
9:00am - 10:00am	**PLENARY SESSION** *[Schaumburg West]* **Binational Action to Restore the Great Lakes** **Cameron Davis,** Senior Advisor to the Administrator (Great Lakes), U.S. Environmental Protection Agency, Great Lakes National Program Office **Michael Goffin,** Regional Director General for Ontario, Environment Canada **SESSION MODERATOR: Robert Daoust**, ARCADIS U.S., Inc., Manager, Ecosystem Restoration					
10:00am-10:30am	**AM Networking Break in the Exhibit Hall and Poster Display Area** *[Exploration Hall A]*					
	Schaumburg A&B	Schaumburg C&D	Innovation	Imagination	Connection	Knowledge
	Session 31	Session 32	Session 33	Session 34	Session 35	Session 36
10:30am - 12:00pm	**Friend or Foe? Do Regional Large-Scale Ecosystem Restoration Programs Help or Hurt One Another at a National Level?**	**Adaptive Management**	**Engineering with Nature to improve Resiliency and Function of Restoration Projects**	**Cutting Red Tape: A Central Everglades Experiment To Expedite Ecosystem Restoration Planning**	**Integrated Assessment and Environmental Report Cards as Tools for Ecosystem Restoration - Part 1**	**The Columbia River Estuary Ecosystem Restoration Program: Strategic Prioritization and Implementation**
Moderator	**Bill Hinsley**	**Karen Appell**	**David Moore**	**Dawn Shirreffs**	**Heath Kelsey**	**Blaine Ebberts**
10:30am-10:40am	Session Overview	Session Overview	Session Overview	Session Overview	Session Overview	Session Overview
10:40am-11:00am	**John Hankinson,** Former Executive Director, Gulf Coast Ecosystem Restoration Task Force **Kameran Onley**, Former Acting Assistant Secretary for Water and Science, Dept. of Interior **Steve Thompson,** Former Manager of the California-Nevada Operations Office, USFWS **Rob Vining,** Former Chief, Programs Management Division, USACE This panel will compare and contrast experiences of the Sacramento-San Joaquin River Delta, Louisiana Coastal Area, and Florida Everglades ecosystem restoration programs, and will explore the crafting and sustaining of a federal policy and funding frameworks to sustain each. Panelists will discuss what it will take to advance a national resource management and ecosystem restoration agenda - including policy and funding requirements for creating a collaborative, instead of competitive, framework at a national level.	**Ian Jewell** Climate Change Adaptation and Adaptive Environmental Management Integration	**William Holman** Applying Engineering Solutions to the Science of Protection and Enhancement of Aquatic Environments	**Eric Bush** The Central Everglades Planning Project: Planning the Next Generation of Everglades Restoration Projects	**Scott Sowa** Wildlife Component of the Conservation Effects Assessment Project (CEAP) – Great Lakes and Western Lakes Erie Basin Efforts	**Gary Johnson** Columbia Estuary Ecosystem Restoration Program: Adaptive Management Strategy Report and Action Plan for Program Execution
11:00am-11:20am		**Matthew Harwell** Lessons Learned from the Everglades Collaborative Adaptive Management Program	**David Heinze** Streambank Stabilization in the Midwest – Lessons Learned	**Matthew Morrison** Central Everglades Planning ProjectCentral Everglades Planning Project	**Mark Monaco** Utilization of a Biogeographic Assessment Framework to Characterize and Quantify Ecosystem Condition	**Charles ("Si") Simenstad** Landscape Planning Framework for Restoration and Protection of Juvenile Salmon Habitat using the Columbia River Estuary Ecosystem Classification
11:20am-11:40am		**Fred Sklar** Everglades Restoration 2000-2012: Lessons Learned	**David McGehee** Using Organic Engineering Principles to Address Ecosystem Values in the Bottom Line	**Stephen Davis** Integrating Sound Science and Adaptive Management into a Truncated Timeline for Central Everglades Restoration	**Wes Tunnell** A Report Card to Assess Ecosystem Health in the Gulf of Mexico	**Julie Doumbia** Columbia Estuary Ecosystem Restoration Program: Integrated Approach for Habitat Action Effectiveness Monitoring and Research
11:40am-12:00pm		**Tom St. Clair** The Role of Independent Science Review in the Adaptive Management Process for Large-Scale Restoration Programs	**Dan Veriotti** Regional Sediment Budget and Shoreline Restoration Alternatives	**Discussion**	**Harald "Jordy" Jordahl** Developing America's Watershed Initiative Basin Report Card	**Ron Thom** Ecosystem Restoration in the Lower Columbia River and Estuary: The Role of the Expert Regional Technical Group
12noon - 1:30pm	**Lunch on Own**					

	Thursday, August 1, 2013					
	Schaumburg A&B	Schaumburg C&D	Innovation	Imagination	Connection	Knowledge
	Session 37	Session 38	Session 39	Session 40	Session 41	Session 42
1:30pm-3:00pm	**Strategies to Locate and Prioritize Ecosystem Restoration Actions: Why Here and Why Now?**	**Independent Science on a Large Scale - A Panel Discussion**	**Wetland/Marsh Restoration**	**Great Waters Flow Through Them: Protecting & Enhancing America's National Parks through Restoration**	**Integrated Assessment and Environmental Report Cards as Tools for Ecosystem Restoration - Part 2**	**Lessons Learned in Urban Ecosystem Restoration: Adjusting Expectations and Determining Success**
Moderator	**Russell Strach**	**Chad Smith**	**Jill Kostel**	**Sarah Barmeyer**	**Dave Nemazie**	**Brook Herman**
1:30pm-1:40pm	Session Overview	Session Overview	Session Overview	Session Overview	Session Overview	Session Overview
1:40pm-2:00pm	**Matthew Andersen** A National Perspective on the US Geological Survey's Restoration Strategies, Priorities, Accomplishments, and Challenges	**David Marmorek** **Philip Dixon** **David Galat** **Robb Jacobson** **Kent Loftin** **John Nestler** Panel discussion of members of the Platte River Recovery Implementation Program's Independent Scientific Advisory Committee (ISAC) on the role of independent science in large-scale recovery programs and the relationships between adaptive management, independent science, and decision-making.	**Michael Mak** ABC's of Freshwater Wetland Design: Concept to Construction	**Sarah Barmeyer** Great Waters and National Parks – A National Overview	**Ann Hijuelos** Who's Keeping Score? Developing a Report Card for Coastal Louisiana	**Joe Roth** Restoration Lessons from Bartel Grassland and Tinley Creek Wetlands
2:00pm-2:20pm	**Heather Braun** Linking Ecological Restoration and Economic Recovery at a Great Lakes Area of Concern: Muskegon Lake, Michigan		**Jason Doll** Using a Living Shoreline Approach to Prevent Erosion and Restore Marsh Habitat on Ocracoke Island	**Aida Arik** Restoring the Heart of the Everglades	**Laura Brandt** Using Ecological Indicators to Evaluate Progress toward Restoration: An Example from the Everglades	**Frank Veraldi** Change is Hard: Restoring Structure and Function in Urban Landscapes
2:20pm-2:40pm	**Howard Brown** The Need for Fish Passage above Rim Dams in California's Central Valley		**Lorie Staver** Sustainability in the Created Marshes at Poplar Island Restoration Project in Mid-Chesapeake Bay	**Jeffrey Duda** Evaluating Ecosystem Restoration During and Following Dam Removal on the Elwha River	**Brandy Siedlaczek** Riverine Wetland Habitat Restoration using a full Management Tool Box	**Joel Tillery** Advancing Urban Watershed Renewal through the Benefits of Multi-Purpose Stream and Riverine Restoration Projects
2:40pm-3:00pm	**Karen Rodriguez** Prioritizing Habitat Projects in Areas of Concern (AOC) throughout the Great Lakes		**Dilip Trivedi** After a Decade of Planning, Bair Island Restoration at Full Steam	**Lilo Stainton** Open Space in the Urban Jungle Post-Sandy: National Parks, Ecosystem Restoration and Storm Resiliency in the NY-NJ Harbor Region	**Merrie Carlock** Local Benefit from the Rouge River National Wet Weather Demonstration Project Ecosystem Assessments	**Kyle Spicer** Developing Creative Partnerships in the Maumee AOC to Restore Habitat in an Urban Watershed
3:00pm-3:30pm	**PM Networking Break in the Exhibit Hall and Poster Display Area** *[Exploration Hall A]*					

	Thursday, August 1, 2013
3:30pm	**PLENARY SESSION** *[Schaumburg West]* **Rick Snyder,** Governor, State of Michigan **SESSION MODERATOR: Don Scavia**, Graham Family Professor of Environmental Sustainability, University of Michigan
4:15pm - 5:30pm	**Restoration Coffee House Two** *[Schaumburg West]* **Invasive Species: Asian Carp Case Study** Invasive species cost $120 billion annually and cause enormous impacts to native species and ecosystems. The introduction of a relatively small number of non-native organisms can quickly over-run native species as the newcomers reproduce and feed with little or no competition. Once they become established, non-native species are usually impossible to eradicate and often difficult to control, creating permanent changes to ecosystems. Prevention is the primary method to protect native ecosystems from invasive organisms. The panel will describe the history, extent and possible impact on the Great Lakes of the Asian carps; the measures currently being employed to address them; and potential future actions, including re-establishing a subcontinental divide between the Mississippi River system and the Great Lakes. **Session Organizer & Moderator:** **Andy Buchsbaum**, Healing Our Waters Coalition and Great Lakes Office of National Wildlife Federation **Session Panelists:** **Marc Gaden**, Communications Director & Legislative Liaison, Great Lakes Fishery Commission **John Goss**, Asian Carp Director at the White House Council on Environmental Quality and Chair, Asian Carp Regional Coordinating Committee **Tim Eder**, Executive Director, Great Lakes Commission
5:30pm-7:30pm	**Poster Session TWO & Networking Reception in the Exhibit Hall and Poster Display Area** *[Exploration Hall A]*

	Friday, August 2, 2013					
7:30am-12:00pm	**Conference Registration Open** *[Schaumburg Foyer North]*					
7:30am - 9:00am	**Early Morning Refreshments in the Exhibit Hall and Poster Display Area** *[Exploration Hall A]*					
	Schaumburg A&B	**Schaumburg C&D**	**Innovation**	**Imagination**	**Connection**	**Knowledge**
	Session 43	**Session 44**	**Session 45**	**Session 46**	**Session 47**	**Session 48**
9:00am - 10:30am	**Governance Challenges to Addressing Algal Blooms in the Great Lakes**	**Novel Ecosystems Concept – It's Time To Get Real!**	**Everglades Restoration**	**Large-scale Ecosystem Restoration in the Great Lakes Basin: A Whole System Approach**	**Quality Assurance in Habitat Restoration and Invasive Species Programs**	**Restoration as Behavior Change: Using Communications Campaigns to Reach Restoration Goals**
Moderator	**Lyman Welch**	**Cheryl Ulrich**	**Robert Daoust**	**Rebecca Smith**	**Craig Palmer and Louis Blume**	**Jennifer Browning**
9:00am - 9:10am	**Session Overview**	**Session Overview**	**Session Overview**	**Session Overview**	**Session Overview**	**Session Overview**
9:10am - 9:30am	**Michael Murray** **Joseph Logan** **T. Kevin O'Donnell** **Lyman Welch** This panel will discuss governance challenges to reducing phosphorus sources into the Great Lakes, including recent updates to the binational Great Lakes Water Quality Agreement. Presentations will include a review of past efforts to reduce phosphorus input and new challenges presented by ecosystem changes.	**Joe Berg** **Bethany Cutts** **Matt Harwell** **Richard Hobbs** This interactive panel discussion will define the concept of "novel ecosystems", discuss application/lessons learned of the concept in several case studies and promote dialogue on our path forward as an ecosystem restoration community.	**Barry Rosen** An Adaptive Management Example from the Everglades: The Decompartmental-ization Physical Model	**James Cole and Nicole Van Helden** Restoring Great Lakes Coastal Systems for Nature and People: Toward New Approaches in Green Bay and Western Lake Erie	**Louis Blume** Quality Assurance Guidance for Environmental Data Collection Associated with Habitat Restoration and Invasive Species Projects	**Rebeca Bell** Words Matter: Tips for Using Communications to Improve Restoration Efforts
9:30am - 9:50am			**Subodh Acharya** Pattern and Flow in the Everglades: Defining Landscape-scale Hydraulic Geometry	**Darran Crabtree** Research in Support of Restoration of Cisco in Lake Ontario	**Louis Blume** Development of a Graded Approach to Project-Level Quality Documentation for Habitat Restoration Projects	**Lisa Cotner** Millennium Reserve: Organizing Multiple and Diverse Stakeholders
9:50am - 10:10am			**Stuart Appelbaum** Ingredients for Success: Building a Robust Adaptive Management Program	**Thomas Neeson** Prioritizing In-stream Barrier Removal in Great Lakes Tributaries	**Martin Stapanian** A Prototype Splitter Apparatus for Dividing Large Catches of Small Fish	**Linda Masters** Restoring a Ravine Ecosystem: Outreach to Homeowners
10:10am - 10:30am			**Andres Rodriguez** Man-Made Tree Islands for Restoration Purposes in the Everglades	**Jon Fosgitt** Adapting Great Lakes Forest Management and Restoration Strategies in Light of Climate Change	**Discussion**	**Arthur Pearson** A Funder's Perspective on the Value of Communications
10:30am-10:45am	**AM Break in the Exhibit Hall and Poster Display Area** *[Exploration Hall A]* **[POSTER PRESENTERS TO REMOVE DISPLAYS DURING BREAK]**					

	Friday, August 2, 2013
10:45am-12:00pm	**CLOSING PLENARY SESSION** *[Schaumburg West]* **David Doig,** President, Chicago Neighborhood Initiatives — **"The Closing of Meigs Field"** **David Donnenfield** and **Kevin White,** Full Frame Productions — **"The Legacy and Promise of Restoration: A Storyteller's Perspective"** **CLOSING REMARKS** **SESSION MODERATOR: Cameron Davis**, Senior Advisor to the Administrator (Great Lakes), US EPA Great Lakes National Program Office
12:00pm-2:00pm	**Exhibitor Move-Out and Registration Strike**
12:00pm	**Conference Concludes**

Updated: July 16, 2013

Plenary Speaker Biographies

<u>OPENING PLENARY SESSION:</u> *Tuesday, July 30, 9:00-10:00am*

Rachel Jacobson, Acting Assistant Secretary for Fish and Wildlife and Parks, U.S. Department of the Interior

Rachel Jacobson is the lead official in the office of Assistant Secretary for Fish and Wildlife and Parks, where she oversees policy, planning, and regulatory actions for the National Park Service and U.S. Fish and Wildlife Service. In this capacity, Ms. Jacobson is also responsible for historic and cultural preservation and management of protected species. Prior to joining the Assistant Secretary's office, Ms. Jacobson served as Interior's Principal Deputy Solicitor where she was in a leadership role working with the Solicitor to oversee all legal matters within the authority of the Department of the Interior and manage an office of over 400 professionals. Notably, Ms. Jacobson was interior's lead negotiator for the $1 billion "early restoration" settlement with British Petroleum arising out of the Deepwater Horizon Oil Spill in the Gulf of Mexico. Before joining Interior in 2009, Ms. Jacobson served as Director of the Impact-Directed Environmental Accounts Program at the National Fish and Wildlife Foundation, where she managed a mitigation fund for environmental restoration and habitat conservation. The majority of Ms. Jacobson's career was spent with the U.S. Department of Justice, Environment and Natural Resources Division.

<u>PLENARY SESSION:</u> *Wednesday, July 31, 9:00-10:00am*
Drought, Flooding and Coastal Storms: Creating Landscapes and Communities Resilient to Weather Extremes

Jason Weller, Acting Chief, USDA, NRCS

Jason Weller has served as Acting Chief of NRCS since December 2012. As Acting Chief, he oversees programs that help protect the environment, preserve our natural resources and improve agricultural sustainability through voluntary, private-lands conservation. He leads a staff of 11,500 employees across the country and manages a budget of about $4 billion.

Before assuming this role, Jason served as NRCS's Acting Associate Chief for Conservation and as Chief of Staff where he worked alongside Chief Dave White and the agency's national and state leaders to plan and implement strategic conservation initiatives and conduct the annual business operations of the agency.

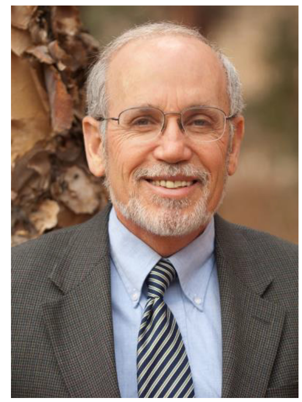
Prior to joining NRCS, Jason served as a staff member for the U.S. House Appropriations Subcommittee on Agriculture where he provided oversight and crafted bills to fund USDA programs and activities. He also served on the U.S. House Budget Committee where he helped construct the annual congressional budget for agriculture, environment and energy programs. Before that, Jason worked with the White House Office of Management and Budget where he assisted with the development and implementation of the budget for USDA conservation programs.

Before coming to Washington, DC, Jason worked for several years with the California State Legislature where he provided fiscal and policy recommendations on a variety of natural resource conservation and environmental protection issues.

Jason is a native of northern California. He earned his undergraduate degree from Carleton College in Northfield, Minnesota, and a graduate degree in public policy from the University of Michigan.

Jason and his wife have two young daughters and live in Maryland.

Robert Bendick, Director, U.S. Government Relations, The Nature Conservancy



Since 2008, Bob Bendick has been the Director of U.S. Government Relations at The Nature Conservancy. In this position he supervises the Conservancy's relationships with Congress and the Obama Administration over a wide range of policy activities. In September, 2013, Bob will become Director, Gulf of Mexico Program.

Before coming to Washington, D.C., Bob was Vice-President and Managing Director of the ten-state Southern U.S. Region of the Conservancy.

He has been with The Nature Conservancy since 1995, first as Florida Chapter Director and, then, also in the dual role as Florida Director and as director of previous southeastern U.S. groups of state chapters.
Prior to working for TNC, Bob was Deputy Commissioner for Natural Resources of the New York State Department of Environmental Conservation (1990-1995) where he managed the natural resources functions in New York State government. During this time he also served as Chair for three years of the Northern Forest Lands Council which proposed actions to protect the future of the northern forests of New York and New England.

Prior to working for TNC, Bob was Deputy Commissioner for Natural Resources of the New York State Department of Environmental Conservation (1990-1995) where he managed the natural resources functions in New York State government. During this time he also served as Chair for three years of the Northern Forest Lands Council which proposed actions to protect the future of the northern forests of New York and New England.

Prior to coming to New York, he was Director of the Rhode Island Department of Environmental Management (1982-1990) where he supervised all conservation and environmental functions of Rhode Island State government and twice chaired the Committee on the Environment of the New England Governors' Council.

He has Bachelor's Degree from Williams College and a Masters in Urban and Regional Planning from New York University.

<u>PLENARY SESSION:</u> *Thursday, August 1, 9:00-10:00am*
Binational Action to Restore the Great Lakes

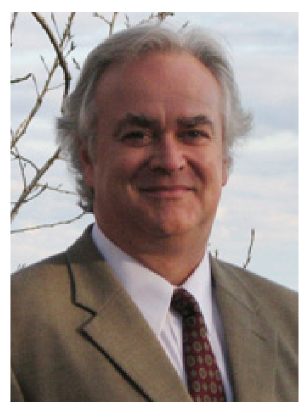
Cameron Davis, Senior Advisor to the Administrator (Great Lakes), U.S. Environmental Protection Agency, Great Lakes National Program Office

Cameron Davis is Senior Advisor to the U.S. Environmental Protection Agency Administrator. In that capacity he provides counsel to Administrator Lisa Jackson on the Obama Administration's Great Lakes Restoration Initiative. His job includes coordinating Great Lakes policy and funding initiatives with more than one dozen federal agencies and with state, municipal, tribal, business and civic stakeholders. The focus of this work involves restoring habitat, reducing pollution, preventing the introduction of invasive species, reducing runoff and enhancing coastal health for people, fish and wildlife.

For more than two decades, Mr. Davis has worked to develop and implement water quality and quantity policy. Starting as a volunteer, he served as a litigating attorney and law teacher at the University of Michigan Law School before serving as president and CEO of the Alliance for the Great Lakes. Under his leadership, the organization won the American Bar Association's Distinguished Award in Environmental Law & Policy, the first time for a public interest organization in the honor's history. He earned his law degree, including certification in environmental and energy law, from the Chicago-Kent College of Law and a B.A. from Boston University in International Relations.

While working in Chicago, Washington, D.C. and throughout the eight Great Lakes states, Cam lives across the street from Lake Michigan with his wife Katelyn, a child psychologist, and young son, where they try to swim in the lake several times a week, but only when it's warm enough.

Michael Goffin, Regional Director General for Ontario, Environment Canada



Michael Goffin is the Regional Director General for Environment Canada in Ontario.

Over the course of his more than thirty year career in the Public Service of Canada, Mr. Goffin has been engaged in policy development and program delivery in multiple areas including environmental protection, wildlife management, meteorology, water and ecosystem management, intergovernmental affairs and community outreach and engagement.

For more than a decade, Mr. Goffin has been responsible for leading Canada's efforts to restore and protect the water quality and ecosystem health of the Great Lakes. In 2012, he was lead negotiator for Canada responsible for the negotiation of the Amended Canada-United States Great Lakes Water Quality Agreement.

Mr. Goffin received his undergraduate training in environmental studies from the University of Toronto, and a Master of Science degree in Geomorphology, also from the University of Toronto.

KEYNOTE SPEAKER: *Thursday, August 1, 3:30pm – 4:10pm*

Rick Snyder, Governor of Michigan

Three years ago, businessman Rick Snyder was a virtual unknown in the political world. When he first decided to run for governor, his standing in the polls was so low that taking the margin of error into account, he theoretically could have had negative numbers. Political pundits said there was no way he could compete against the better known field of experienced political rivals.

The pundits were wrong.

Governor Rick Snyder won in a landslide victory after running as "One Tough Nerd" ready to make the tough decisions career politicians refused to make. The tactic led one particularly snarky pundit to quip "I guess nerd tested better in the focus groups than dork."

As a candidate, Gov. Snyder pledged to eliminate the job-killing Michigan Business Tax and replace it with a flat, 6-percent corporate income tax that is simple, fair and efficient. He pledged to structurally balance the budget without using accounting gimmicks or quick fixes. He pledged to create an environment where small businesses can grow and create jobs.

The businessman-turned-politician has delivered. As promised, he eliminated the job-killing Michigan Business Tax. He ended the unfair double tax on small business owners. Working together with lawmakers, the governor eliminated the state's $1.5 billion deficit. And in stark contrast to the partisan fighting that led to two government shutdowns under his predecessor, Gov. Snyder got the budget done by the earliest date it has been completed in 30 years.

When Gov. Snyder came into office, Michigan barely had enough money saved in the rainy day fund to run the state for approximately 30 minutes. Under Gov. Snyder, the state is doing the responsible thing by saving for the future and paying down its long term debt.

Gov. Snyder earned his undergraduate degree, MBA and law degree from the University of Michigan - all by the age of 23. After teaching at the University of Michigan, he went to work as a tax accountant at Coopers & Lybrand - now PriceWaterhouseCoopers - where he made partner after only six years. He then joined the fledgling computer company Gateway and helped it grow from a little over 700 employees to a Fortune 500 company with more than 10,000 employees before leaving to form his own successful venture capital firm.

Serving as an elected official brings challenges that are different than working as a CEO in the private sector. Now that he is the making tough decisions needed to Reinvent Michigan, Gov. Snyder is encountering resistance from entrenched special interests, protestors and recall efforts.

But anyone who has had an opportunity to hear the governor speak knows that he is not interested in being negative or getting bogged down by unproductive partisan fighting. It's this same spirit of "relentless positive action" that has him working on an accelerated schedule of "dog years" as governor. As the governor said during his inauguration, we can only achieve extraordinary things if we aspire beyond traditional thinking. Do not shy away from high expectations - deliver on high expectations.

<u>CLOSING PLENARY SESSION:</u> *Friday, August 2, 10:45am-12pm*

David Doig, President, Chicago Neighborhood Initiatives — "The Closing of Meigs Field"

David Doig is a seasoned professional in community development, real estate, finance, and government. With over 20 years of experience, Doig is President of Chicago Neighborhood Initiatives (CNI). CNI is a not-for-profit community development corporation focused on mixed-use real estate developments on Chicago's Far South Side and is a Community Development Entity investing New Market Tax Credits in high impact neighborhood projects.

Doig leads CNI and its partner US Bank in the development of Pullman Park, a 200-acre mixed-use redevelopment of a former Ryerson Steel site. Currently under construction, the first phase of Pullman Park is a $30 million, 50 acre, Wal-Mart anchored retail center. Overall the project will bring over 1000 new jobs, much-needed retail, affordable housing, and recreation to Chicago's Pullman neighborhood. In addition, CNI has successfully completed investing $50 million of New Market Tax Credits into a community center, a neighborhood hospital, a new Charter School, and a community health center, creating several hundred new jobs – all within less than a year.

Prior to leading CNI, Doig worked in a variety of capacities within Mayor Daley's administration, most recently as General Superintendent and CEO of the Chicago Park District. As Park District Superintendent, Doig oversaw a $350 million operating budget and a staff of over 3000. Under his leadership the Park District's bond rating improved and the District issued its first revenue bonds. He led major improvements to park facilities, most notably the $650 million renovation of Soldier Field, the $300 million shoreline revetment project, and a host of neighborhood park improvements. These included a new golf course at Douglas Park, a new bowling alley and roller rink in Englewood, and tens of millions of dollars in fieldhouse renovations over his four and half year tenure at the parks. Doig worked hard to increase green space in the parks and launched a variety of innovative beautification initiatives. Under his leadership, the Park District won the prestigious America in Bloom award, and in 2002 the U.S. Conference of Mayors honored the city and park district with its City Livability Award for *Chihuly in a Park: A Garden of Glass* at the Garfield Park Conservatory.

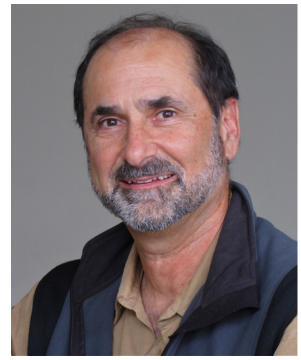
Before being tapped by Mayor Daley in 1999 for the parks job, Doig was First Deputy Commissioner in the City of Chicago Department of Planning and Development. Between 1997 and 1999, Doig managed its neighborhood division which operates city programs to spur economic development and job growth in neighborhoods throughout the city. Under his leadership the city created over sixty Tax Increment Financing districts and acquired hundreds of acres for neighborhood revitalization.

David Doig joined Chicago government in 1994 as Deputy Commissioner of Real Estate Services for the Housing Department, where he oversaw initiatives to redevelop abandoned properties and expand home ownership and rental opportunities for low-income and moderate-income families. Before that he spent five years as development director for the Lawndale Christian Development Corporation, a community-based organization on Chicago's West Side. In 1993 and 1994 he was a Leadership Greater Chicago fellow.

In over twenty years of living and working in the city of Chicago, David Doig has become an expert on how cities and neighborhoods work. From real estate development to government finance, Doig has provided leadership and expertise at all levels. When announcing Doig's appointment as Park District Superintendent, Mayor Daley said, "David cares about neighborhoods and understands what it takes to make them thrive. He has spent time in every neighborhood in the city, talking with residents, listening to their concerns and developing programs to improve their quality of life."

Doig graduated from Wheaton College and received a master's degree in social science, with an emphasis on urban policy, from the University of Chicago. He and his wife Tami live in the Chicago West Side Austin neighborhood with their two children, Olivia, 19 and Clarke, 16.

David Donnenfield, Producer/Director/Writer, Full Frame Productions — "A Hero's Calling"



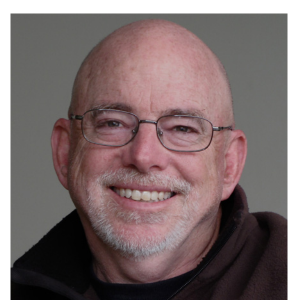
David Donnenfield is a writer, producer, and instructional designer for digital media at Full Frame Productions, a video production company in San Francisco. He is also Director of Acquisitions for The Video Project, a distributor of environmental documentaries to the educational and institutional market.

David has worked with numerous environmental organizations and agencies over the years such as CALFED Bay Delta Program, U.S. Army Corps of Engineers, CA Audubon, CA Native Grass Association, and CA Academy of Sciences in crafting memorable messaging for public outreach. He is skilled in presenting complex concepts in ways that are coherent and interesting to lay audiences. Besides his creative contributions, David provides guidance in matters of dissemination so that video programming is broadly seen, whether via the web, TV broadcast, DVD or other viewing technologies. Otherwise, what's the point?

Along with his partner, Kevin White, David has been developing stories on environmental restoration for their broadcast series, "How On Earth." Many of these stories deal with habitat restoration and species recovery. One such program, "A Simple Question," showcases a nationally-recognized student-initiated project to restore the riparian habitat of the endangered CA freshwater shrimp. Working with private landowners, biologists, agency personnel, and other stakeholders, students have led the way in restoring over 23 miles of streamside habitat and bringing back the shrimp. The video program has garnered over a dozen film festival awards worldwide, been nominated for an Emmy, and is credited with helping to save the project itself in this era of funding shortfalls.

Donnenfield holds a B.A. in film from UCLA and a Masters in Educational Technology/Instructional Design from San Francisco State University. His films have won the CINE Golden Eagle, the Silver Telly, film festival awards, and have been broadcast on PBS. In 2010, he received the Harold Gilliam Excellence in Environmental Journalism Award from The Bay Institute.

Kevin White, Producer/Director/Writer, Full Frame Productions — "A Hero's Calling"



Kevin is an award-winning producer, director and writer who has worked in media since 1982. After graduate school at Stanford and San Francisco State University, Kevin free-lanced for ITV, CBS News, Nightly Business Reports, and several syndicated shows in various production capacities. He founded Full Frame Productions in 1984, and the nonprofit, Filmmakers Collaborative SF, in 1988 with filmmaking colleague Michal Aviad.

Kevin has produced dozens of independent and sponsored films for broadcast, corporate communications, advertising, and other distribution venues. His work has been broadcast internationally on PBS, CBS, ABC, Discovery, National Geographic, Bravo, BBC, ZDF, and featured at dozens of film festivals, including the Berlin Film Festival, Hot Springs Documentary Film Festival, US Film Festival (Sundance), The San Francisco International Film Festival (Golden Gate Award Recipient) and many others.

In 2010, Kevin and his colleague, David Donnenfield, were the recipients of the Harold Gilliam Excellence in Environmental Reporting Award for their work on the "How On Earth" project.

Coffee House Descriptions and Speaker Biographies

SESSION ONE: Tuesday, July 30, 2013 – 3:30pm – 5:00pm
Harmful Algal Blooms: Prevention, Prediction, Management, and Control

Harmful algal blooms are impacting human and ecological health across the globe in both freshwater and marine systems. In some cases, they can be prevented or controlled, but in others they can only be predicted and managed. The panel will discuss various approaches for dealing with this increasingly intractable problem.

Session Organizer & Moderator:
Don Scavia, Graham Sustainability Institute, University of Michigan

Session Panelists:
Don Anderson, Senior Scientist, Woods Hole Oceanographic Institution
Kevin G. Sellner, Executive Director, Chesapeake Research Consortium
Gail Hesse, Executive Director, Ohio Lake Erie Commission
Dan Ayres, Coastal Shellfish Lead Biologist, Washington Department of Fish and Wildlife
Alina Corcoran, Research Scientist, Florida Fish & Wildlife Conservation Commission

Session Panelist Biographies:

Don Anderson is a Senior Scientist in the Biology Department of the Woods Hole Oceanographic Institution. He earned three degrees from MIT – a BS in Mechanical Engineering in 1970, and a MS (1975) and PhD in Civil and Environmental Engineering in 1977. He joined the scientific staff at WHOI in 1978. In 1993, he was awarded the Stanley W. Watson Chair for Excellence in Oceanography, in 1999 was named a NOAA Environmental Hero, and in 2006 received the Yasumoto Lifetime Achievement Award from the International Society for the Study of Harmful Algae (ISSHA). Anderson is the former director of WHOI's Coastal Ocean Institute (COI), and presently serves as Director of the NOAA Cooperative Institute for North Atlantic Research (CINAR). Anderson also serves as Director of the U.S. National Office for Harmful Algal Blooms. Anderson's research focus is on toxic or harmful algal blooms (HABs), commonly called "red tides", utilizing approaches ranging from molecular and cellular studies of toxin genetics and regulation to the large-scale oceanography and ecology of the "blooms" of these microorganisms. He is also heavily involved in national and international program development for research, monitoring, and training on red tides, marine biotoxins, and harmful algal blooms (HABs). Anderson is the author, co-author, or editor of over 250 scientific papers and 14 books.

Kevin G. Sellner serves as Executive Director of the Chesapeake Research Consortium. His primary role in this position is to encourage active research programs across the six Consortium member institutions (www.chesapeake.org) and their extended partners from agencies, other institutions, and NGOs in the Chesapeake watershed focusing on fundamental basic and applied air, land, and water-related research to inform science-based management in the region. He strives to insure that the Consortium is considered a source of unbiased scientific information for most groups, organizations, and agencies across the basin, providing topic-specific workshops, conferences, fora, and reviews on critical regional issues. As part of that role, Sellner serves as the Executive Secretary of the Chesapeake Bay Program's Scientific and Technical Advisory Committee, member of the MD Harmful Algal Task Force, and organizer of the Chesapeake Community Modeling Program. Sellner is also a plankton ecologist active for the past 30+ years, with a primary focus on harmful algal blooms (HAB), examining fate and impacts of cyanobacteria and dinoflagellate bloom production in regional systems as well as waters of the Baltic and Peru. He has served on the National Harmful Algal Bloom Committee (NHC), was the initial program officer for the Federal interagency research program ECOHAB (Ecology and Oceanography of Harmful Algal Blooms), co-written several national HAB reports, and has briefed Congress members and staff on these problem taxa several times in the past decade, and has served as an Associate Editor for several oceanographic and watershed management, journals. He also leads a graduate seminar HAB course in the UMD Marine Estuarine Environmental Science program. He mentored and Honors undergraduate research team from the UMD GEMSTONE Program that has yielded a field mitigation technology for reducing algal blooms in the natural environment which has now been expanded into a NOAA-funded 3-yr research program; the goal of the project is to develop an inexpensive state-administered mitigation technique for routine use in MD and other coastal areas to remove these blooms and reduce citizen and animal exposures to these toxic algal accumulations.

Gail Hesse is the Executive Director of the Ohio Lake Erie Commission, a consortium of six state agencies established for the purpose of preserving Lake Erie's natural resources, protecting the quality of its waters and ecosystem and promoting economic development in the region. Prior to her appointment to the Commission, Gail was with Ohio EPA and responsible for administering Ohio EPA's Lake Erie restoration and protection and inland lakes programs. She serves as chair for the Ohio Lake Erie Phosphorus Task Force, a multi-stakeholder effort that analyzes the causes and issues related to algal blooms in Lake Erie. She also served as administrator of the Ohio Water Resources Council, a consortium of state agencies and commissions established to promote collaboration on water policy and program development.

She has a master's degree in environmental studies and a bachelor's degree in geography both from Ohio University. She is also a graduate of the Ohio Certified Public Manager program, a nationally accredited two year leadership development program for management in the public sector. Gail is a former president of Hostelling International-USA, a national nonprofit organization dedicated to cultural understanding through travel. She also served eight years as an internationally elected board of trustee member for the International Youth Hostel Federation.

Dan L. Ayres is a Shellfish Biologist who leads the Washington Department of Fish and Wildlife's coastal shellfish unit based in Montesano and Willapa Bay. He manages Washington's very popular razor clam fishery and oversees the unit's work managing the coastal Dungeness crab, pink shrimp and spot prawn fisheries, the Willapa Bay oyster reserves and research projects in Willapa Bay.

These fisheries are the backbone of the economies of the small coastal communities that are found on Washington State's outer coast. The coastal commercial Dungeness crab fishery is the largest commercial fishery in the state with seasonal ex-vessel values that exceed $50 million. The recreational razor clam fishery can seasonally draw up to 350,000 diggers, who spend an estimated $33 million in tourist-related income. Pristine Willapa Bay, located on the south Washington coast, produces 10 percent of the nation's oysters. All of these fisheries have either been threatened by or directly affected by harmful algal blooms. As a result, Dan has worked closely with other state and federal agencies on harmful algal bloom issues since the marine toxin domoic acid was first found along the Washington Coast in 1991. He just completed two terms on the National Harmful Algal Bloom Committee. He has represented WDFW in testimony on this topic at both the Washington State Legislature and the U.S. Congress. He has collaborated on several national HAB plans including the *Harmful Algal Research and Response: A National Environmental Science Strategy*. He also worked to organize the recently held *West Coast HAB Summit (2009)* and is co-chair of the team working to developing a West Coast HAB Monitoring Network plan.

Dan was born and raised on the Washington coast and was first introduced to razor clam digging by his parents at a very young age. He is a graduate the University of Washington. Dan first met his wife Gail when she was a news reporter assigned to do a story on the razor clam fishery. They live in Montesano with their two daughters aged 11 and 13.

Alina Corcoran is a phytoplankton ecologist who directs the Harmful Algal Bloom (HAB) Program of the Fish and Wildlife Research Institute (FWRI), the research arm of the Florida Fish and Wildlife Conservation Commission. Under Corcoran's oversight, the HAB program has expanded its focus from the red tide organism, Karenia brevis, to entire phytoplankton communities in the coastal waters of southwest Florida. She has also set up a long-term phytoplankton monitoring program in Pinellas County, which serves as a pilot study for other monitoring stations throughout the state.

Corcoran's research interests are extremely diverse, but there is a common thread that connects her projects – clear applications to ecosystem management and sustainability. As a graduate student, Corcoran studied the effects of stormwater runoff and wastewater discharge on phytoplankton in the Southern California Bight. As a postdoctoral researcher, she used ecological principles to engineer stable and productive biofuel systems in the deserts of New Mexico. Corcoran is currently investigating the effects of nutrient limitation on toxicity of the red tide organism, Karenia brevis.

Corcoran earned a B.A. in Biology at Boston University, M.S. in Marine Science at the University of Alabama, and Ph.D. in Biology at the University of California Los Angeles. She joined FWRI in June 2011.

SESSION TWO: Thursday, August 1, 2013 - 3:30pm – 5:00pm

Invasive Species: Asian Carp Case Study

Invasive species cost $120 billion annually and cause enormous impacts to native species and ecosystems. The introduction of a relatively small number of non-native organisms can quickly over-run native species as the newcomers reproduce and feed with little or no competition. Once they become established, non-native species are usually impossible to eradicate and often difficult to control, creating permanent changes to ecosystems. Prevention is the primary method to protect native ecosystems from invasive organisms.

The Great Lakes and the Mississippi River system, connected via canals that over a century ago reversed the flow of the Chicago River and erased the continental subdivide that separated the two watersheds, each have been victims of invasive species that originated in the other. Twenty-nine species from the

Great Lakes are at high risk to invade the Mississippi system, and ten species from the Mississippi are at high risk to reach breeding populations in the lakes. Those include several species of Asian carps. These carps already have colonized much of the Mississippi River system and moved close to the Great Lakes via the Chicago canal system and other pathways. State and federal governments have taken short and long term actions, including major infrastructure investments, to slow their progress. One option they are considering is re-reversing the flow of the Chicago River to re-create a physical divide between the Mississippi River system and the Great Lakes. If this multi-billion dollar project is undertaken, it would stop the flow of invasive species in both direction between the Great Lakes and the Mississippi River system.

The panel will describe the history, extent and possible impact on the Great Lakes of the Asian carps; the measures currently being employed to address them; and potential future actions, including re-establishing a subcontinental divide between the Mississippi River system and the Great Lakes.

Session Organizer & Moderator:
Andy Buchsbaum, Healing Our Waters Coalition and Great Lakes Office of National Wildlife Federation

Session Panelists:
Marc Gaden, Communications Director & Legislative Liaison, Great Lakes Fishery Commission
John Goss, Asian Carp Director at the White House Council on Environmental Quality
and Chair, Asian Carp Regional Coordinating Committee
Tim Eder, Executive Director, Great Lakes Commission

Session Panelist Biographies:

Marc Gaden grew up in southeastern Michigan and has spent most of his professional career working to protect and improve the Great Lakes. He serves as Communications Director and Legislative Liaison for the Great Lakes Fishery Commission, a US/Canadian agency established by treaty to improve and perpetuate the Great Lakes fishery. He has held this position since 1995. He has worked extensively on issues involving regional coordination of fisheries policies, invasive species, and ecosystem restoration. Prior to joining the Great Lakes Fishery Commission secretariat, Dr. Gaden worked as a Legislative Assistant for the U.S. House of Representatives' Great Lakes Task Force, researching, proposing, and advocating legislation of benefit to the Great Lakes region. Dr. Gaden also worked as a Legislative Assistant and Caseworker for U.S. Congressman Dennis M. Hertel (D-MI), specializing in Great Lakes, environment, transportation, immigration, and Social Security issues.

Dr. Gaden is an adjunct assistant professor at the School of Natural Resources and Environment, University of Michigan, and an adjunct associate professor at the Department of Fisheries and Wildlife, Michigan State University. He teaches courses in environmental and water policy and has written about environmental governance, Great Lakes policy, and cooperative fishery management. Currently, he teaches the course "Global Water" at the University of Michigan. He received a Ph.D. from the University of Michigan's School of Natural Resources and Environment in 2007, a Master of Arts degree in United States Foreign Policy from The American University in 1993, and a Bachelor of Arts degree in History and Political Science from the University of Michigan in 1991.

John Goss serves as the principal advisor to The White House Council on Environmental Quality (CEQ) Chair Nancy Sutley on Asian carp issues.

Goss is chair of the Asian Carp Regional Coordinating Committee (ACRCC), which is a team of Federal, state and local agencies working together to prevent Asian carp from establishing populations in the Great Lakes.

Goss previously served as Director of the Indiana Department of Natural Resources and as Vice-Chair of the Great Lakes Commission.

Tim Eder serves as Executive Director of the Great Lakes Commission. In that position he is responsible for all aspects of the operation of the Commission including policy development and advocacy, fundraising, communications and staff leadership. Mr. Eder is accountable to a Board of Directors appointed largely by Great Lakes Governors and he leads them in formulating policies to advance consensus views on matters of Great Lakes conservation, protection, restoration and sound economic development. In this capacity, Mr. Eder regularly develops and presents to Congress and the federal government the views of the Great Lakes states on a wide range of budget and policy issues, including implementation of federal programs such as the Great Lakes Restoration Initiative. Mr. Eder manages a staff of 20 and an organizational budget of over $5 million.

Prior to his position with the Great Lakes Commission, Mr. Eder served the National Wildlife Federation from 1989 to 2006 as Director of Water Resources, Director of the Great Lakes Regional Office, Regional Executive and Water Quality Project Manager. He led the development of the aquatic invasive species plan for the Great Lakes Regional Collaboration and served as chair of the Organisms in Trade section. He also served on the Virtual Elimination Task Force of the International Joint Commission in 1994-95. Mr. Eder served on the Board of Directors of the Great Lakes Fishery Trust and on the Board of Commissioners of the Washtenaw County Road Commission. He served with Great Lakes United from 1986 to 1989. He received a Bachelor of Science degree in water resources management from Michigan State University.

Pre-Conference Field Trip

Monday, July 29, 2013 | 8:00am – 5:30pm
Combined Fish Passage and Chicago Metro Field Trip

STOP 1: Hofmann Dam Removal

Des Plaines River between Riverside and Lyons, IL; Millbridge Road and Fairbank Road, Lyons, IL

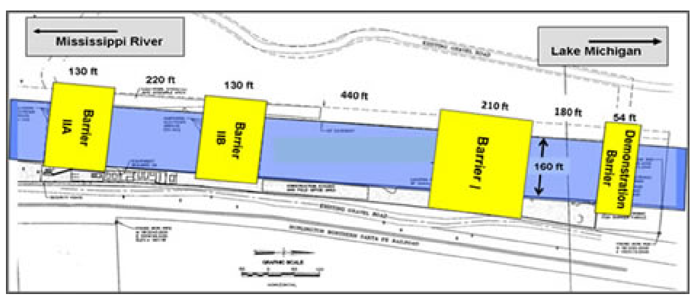
The goals of this project were to restore 57 miles of free flowing river by removing 2 dams and notching a 3rd dam; stabilize and re-vegetate 1,200 feet of shoreline; and construct a channel from Swan Pond Park.

- At this restoration project site, field trip participants discussed how the dam was removed and the impacts of dams on hydrology, hydraulics, geomorphology, sediment transport, habitat connectivity, and ultimately aquatic organisms.

STOP 2: Electric Dispersal Barrier (Asian Carp)

Chicago Sanitary & Ship Canal, Romeoville, IL

The dispersal barriers are located in the Chicago Sanitary and Ship Canal, a man-made waterway that creates the only continuous connection between Lake Michigan and the Mississippi River basin. The dispersal barrier system was developed to deter the spread of invasive fish species between these watersheds. It consists of three electric barriers which have steel electrodes mounted across the bed of the canal. On-land equipment sends a pulsing DC current through the electrodes, creating an electric field in the water that discourages fish from swimming through.



- At this stop on the field trip tour, participants discussed the importance of the Chicago Sanitary & Ship Canal for the inter-basin movement of aquatic invasive species between the Great Lakes and Mississippi River basins, as well as the objectives and history of the barriers project. They also toured the three operational barriers in order to better understand how they work and how USACE evaluates their effectiveness. Finally, they discussed an upcoming barrier (for which construction will begin summer 2013) and future plans for barrier operations and monitoring.

STOP 3: South Shore Nature Sanctuary

7059 S. South Shore Drive, Chicago, IL

The Sanctuary consists of a three and a half acre prairie, small wetland, and emerging sand dune that serve migratory birds and butterflies. This site celebrates a legacy of community advocacy and landscape architect Jens Jensen's vision of "Prairie style" community meeting spaces.

- Field trip participants toured and discussed this site just before stopping for lunch.

STOP 4: 63rd Street Dune and Beach
6300 S. Lake Shore Drive, Downtown Chicago, IL

This project involved restoring 14 acres of dune and beach and 7 acres of aquatic habitat along the Lake Michigan shoreline. The 63rd Street Dune restoration project was approximately 21-acres in size and included lacustrine, beach, and dune habitat. The lacustrine portion included natural cobble pockets along the existing jetty as habitat for invertebrates, fish, and mudpuppies. Placed on top of the cobble pockets were sunken trees to increase the vertical habitat structure for fish. Two coastal plant communities were restored, one along the existing beach area and one landward of the beach, with native dune grasses including marram grass and little bluestem grass. Prickly pear cactus was also found in the restored dune area. The state endangered sea rocket established colonies in the area between the water and the dune. This natural area was used during the migration seasons by waterfowl, and several species of shorebirds were observed, including the Tricolored Heron and the federally endangered Piping Plover.

- At this site, participants toured the 63rd Street Dune and Beach area and discussed the restoration activities that took place there.

STOP 5: Burnham Wildlife Corridor
McCormick Place and Lake Shore Drive, Downtown Chicago, IL

The Burnham Wildlife Corridor includes 100 acres of planned and existing natural areas in Burnham Park. The corridor includes prairie, savanna, and woodland sections. When complete, it will be the largest contiguous natural area along the Chicago lakefront. The length of the corridor stretches over two miles, from McCormick Place to East 47th Street. The Chicago lakefront is a tremendous recreational asset to the city, but it also has crucial value to migratory bird routes.

- At the Corridor, field trip participants discussed the importance of lakefront bird and wildlife habitat, as well as the process of transforming human-oriented turfgrass into a human- and wildlife-friendly natural area.

STOP 6: Northerly Island
1300 S. Lynn White Drive, Downtown Chicago, IL

Forty acres of wetland, pond, prairie, savanna, and lacustrine habitats are being recreated on the island, and pond is being connected to Lake Michigan for fish spawning habitat.

- At this field trip stop, participants toured the early construction stages of recreating coastal habitats on 40 acres of a manmade island, which includes connecting a pond and wetlands to Lake Michigan for native fish spawning and mudpuppy habitat. Participants discussed the site's importance for recreation and migratory bird routes, as well as plans to construct additional islands, dunes, and reefs lakeward of the existing project.

Directory of Poster Presentations

Poster Session One
Tuesday, July 30, 2013 | 6:00pm-7:00pm
(Alphabetical by presenting author's last name)

Poster Number

50 **J. George Athanasakes,** Stantec Consulting Services Inc., Louisville, KY -- EVOLUTION OF STRUCTURES FOR HABITAT AND STABILITY ON STREAM RESTORATION PROJECTS

37 **Martin Boote,** ECT, Inc., Ann Arbor, MI -- THE APPLICATION OF NATURAL CHANNEL DESIGN METHODS FOR RESTORING WATERSHED HYDROLOGY AND FUNCTIONAL RIPARIAN ECOSYSTEMS AFTER MINING

41 **Michael Dema,** Michael Dema Esq., St Petersburg, FL -- THE STATUS OF ISOLATED WETLANDS IN POST-SWANCC FLORIDA: THE CASE FOR A STATEWIDE PRIORITY WETLANDS PROGRAM

20 **Jeffrey Edstrom,** Environmental Consulting & Technology, Inc. (ECT), Chicago, IL -- RARE SPECIES PROTECTION STRATEGIES FOR CORRIDOR RESTORATION

21 **Jeffrey Edstrom,** Environmental Consulting & Technology, Inc. (ECT), Chicago, IL -- TRANSFORMING THE ROUGE AOC FROM MOWED DOWN TO GROWN UP

33 **Jeffrey Edstrom,** Environmental Consulting & Technology, Inc. (ECT), Chicago, IL -- PEOPLE, PLACES & POWER LINES: HABITAT RESTORATION & EDUCATION IN UTILITY RIGHTS-OF-WAY

30 **Cheryl Essex,** California State Parks, Sacramento, CA -- CALIFORNIA STATE PARKS GATEWAY>BASE CAMP>ADVENTURE STRATEGY

36 **Matthew Grabau,** GeoSystems Analysis, Inc., Tucson, AZ -- IRRIGATION AND SOIL MOISTURE ANALYSIS FOR FLOODPLAIN RIPARIAN RESTORATION

44 **Matthew Grabau,** GeoSystems Analysis, Inc., Tucson, AZ -- SALINITY MANAGEMENT FOR FLOODPLAIN RIPARIAN RESTORATION

39 **Mike Habberfield,** SUNY at Buffalo, Buffalo, NY -- FEASIBILITY STUDIES OF BENTHIC ALGAE CULTIVATION FOR NUTRIENT RECAPTURE AND NEARSHORE WATER QUALITY RESTORATION IN THE LOWER GREAT LAKES

34 **Erin Hague,** Tetra Tech, Inc., Boynton Beach, FL -- RESTORATION OF GUACHINANGA ISLAND AND SAN JOSÉ LAGOON, PUERTO RICO

16 **David Hanson,** HansonRM, Sammamish, WA -- RESTORATION SCALING IN THE FACE OF A CHANGING ENVIRONMENT AND UNCERTAINTY

6 **Mary Khoury,** The Nature Conservancy, Chicago, IL -- "MAKE NO LITTLE PLANS": DEVELOPING BIODIVERSITY CONSERVATION STRATEGIES FOR THE GREAT LAKES

35 **Richard Lance,** U S Army Corps of Engineers, Vicksburg, MS -- BREAKING EDAWN: EDNA, CURRENT CHALLENGES, AND THE FUTURE

10 **Mark Laska,** Great Ecology, New York, NY -- INCREASING ECOLOGICAL UPLIFT USING ECOLOGICAL MODELING: A NOVEL APPROACH WITH A CASE STUDY IN WOODBRIDGE, NEW JERSEY

52 **Ken Mierzwa,** GHD Inc., Eureka, CA -- RESTORATION MINIMALISM

22 **John O'Meara,** Environmental Consulting & Technology, Inc. (ECT), Ann Arbor, MI -- IMPROVING THE ROUGE RIVER GREAT LAKES AREA OF CONCERN (AOC) - FISH AND WILDLIFE HABITAT IMPROVEMENT THROUGH DAM REMOVAL

Poster Number

45 **Corey Palmer,** Northwestern University and the Chicago Botanic Garden, Glencoe, IL -- SOIL RECOVERY IN PRAIRIE RESTORATION: IS LAND MANAGEMENT WORKING?

48 **Stephen Reiling,** DDOE, Washington, DC -- USING REGENERATIVE STORMWATER CONVEYANCE SYSTEMS TO RESTORE STREAM CHANNELS AND CREATE AQUATIC AND TERRESTRIAL HABITAT

49 **Doug Schnoebelen,** University of Iowa, Iowa City, IA -- HYDRODYNAMIC MODELS AS TOOLS FOR ECOLOGICAL RESTORATION ON THE UPPER MISSISSIPPI RIVER, POOL8: A TALE OF TWO MODELS--HISTORIC AND MODERN

3 **Paul Sokoloff,** Battelle, Duxbury, MA -- BENTHOS AND PLANKTON WITHIN WAUKEGAN AREA OF CONCERN: POTENTIAL FOR FURTHER LOCAL RESTORATION

46 **John Stark,** The Nature Conservancy - Ohio Freshwater Cons. Dir, Dublin, OH -- INNOVATIVE APPROACH FOR USING BUILT WATER RESOURCES INFRASTRUCTURE FOR ECOSYSTEM RESTORATION

40 **Gary Sullivan,** The Wetlands Initiative, Chicago, IL -- EVALUATING A STRATEGY TO ENHANCE BIODIVERSITY OVER A 426-HA PRAIRIE RESTORATION AFTER 10 YEARS

42 **Dan Sullivan,** U.S. Geological Survey, Middleton, WI -- ADAPTIVE MANAGEMENT AND MONITORING PROGRAM DEVELOPMENT FOR THE LOUISIANA COASTAL AREA PROGRAM: PROGRESS, CHALLENGES AND OPPORTUNITIES

47 **Sophie Taddeo,** Great Lakes Commission, Ann Arbor, MI -- INNOVATIVE IN-STREAM CONTROL METHODOLOGIES FOR REDUCING NONPOINT SOURCE POLLUTION, REDUCING SEDIMENT AND ABATING PHOSPHORUS LOADINGS TO THE GREAT LAKES

51 **Mike Thompson,** Wetlands Forever, Inc., Bartelso, IL -- THE WALK-A-WAY SYSTEM: A MULTI-BENEFIT PLANTING REGIME FOR RIVERINE RESTORATION SITES.

43 **Georgia Vince,** Tetra Tech, Inc, Stuart, FL -- ADAPTIVE MANAGEMENT: LOXAHATCHEE MITIGATION BANK, A PUBLIC PRIVATE CONTRACTUAL RELATIONSHIP

Poster Session Two
Thursday, August 1, 2013 | 6:00pm-7:00pm
(Alphabetical by presenting author's last name)

Poster Number

23 **David Brown,** Eastern Kentucky University, Richmond, KY -- RESTORATION OF THE BLUEGRASS ECOSYSTEM

26 **Paul Conrads,** USGS, Columbia, SC -- EDEN-SYN – MOVING FROM "WHAT WAS" TO "WHAT IF"

17 **Donald Deis,** Atkins North America, Jacksonville, FL -- THE CAÑO MARTÍN PEÑA ECOSYSTEM RESTORATION PROJECT

7 **Michael Donahue,** URS Corporation, Southfield, MI -- ECOSYSTEM RESTORATION BENEFITS OF LOW-HEAD DAM REMOVAL: LESSONS LEARNED FROM THE DEXTER MILL POND DAM EXPERIENCE

4 **Dwight Dunk,** CDM Smith Inc., Cambridge, MA -- EMPIRICAL MODEL TO DETERMINE NATURAL RESOURCE DAMAGE CLAIMS PER THE OIL POLLUTION ACT OF 1990

25 **Matthew Harwell,** U.S. Environment Protection Agency, Gulf Breeze, FL -- INDICATORS, METRICS AND TOOLS FOR INFORMING THE SCIENCE AND VISION OF GULF COAST ECOSYSTEM RESTORATION

18 **Heather Henkel,** U.S. Geological Survey,, FL -- EVERGLADES DEPTH ESTIMATION NETWORK (EDEN): INTEGRATING REAL-TIME NETWORKS TO PROVIDE HYDROLOGIC DATA FOR THE RESTORATION OF THE EVERGLADES

32 **Peter Hill,** DDOE, Washington, DC -- SETTING MEANINGFUL RESTORATION TARGETS FOR URBAN RIVER RESTORATION EFFORTS

27 **Yongseok Hong,** Daegu University, Gyeongsan -- SIGNIFICANT SPATIAL VARIABILITY OF BIOAVAILABLE PAHS IN THE WATER COLUMN AND SEDIMENT POREWATER IN THE GULF OF MEXICO ONE YEAR AFTER THE DEEPWATER HORIZON OIL SPILL

12 **Althea Hotaling,** The University of Florida, Gainesville, FL -- WORKING WITH STAKEHOLDERS TO CREATE A VISION FOR ESTERO BAY

1 **Medina Kadiri,** University of Benin, Benin City -- SEASONAL TREND IN THE ECOLOGICAL VARIABLES OF A TIDAL CREEK IN NIGER DELTA, NIGERIA

28 **Lawerence Malizzi,** Matrix New World Engineering, Inc., Wilmington, DE -- GULF SAVERS® BAG: A NOVEL APPROACH FOR *SPARTINA ALTERNIFLORA* IN MARSH ECOSYSTEMS RESTORATION

14 **Lucieta Martorano,** Embrapa Eastern Amazon, Belem -- ECO-AGRO-CLIMATIC CONDITIONS TO EXPANSION OF PALM OIL IN THE STATE OF PARA

9 **Mark McKelvy,** U.S. Geolgical Survey, Lafayette, LA -- JOINT ECOSYSTEM MODELING (JEM) STANDARDS-DRIVEN SOFTWARE DEVELOPMENT: BENEFITING GREATER EVERGLADES AND THE NATION

11 **Martin Melchior,** Interfluve, Madison, WI -- MODELS FOR CRANBERRY BOG STREAM AND WETLAND RESTORATION

5 **Lilia del Carmen Mendizábal Hernández,** Universidad Veracruzana, Xalapa -- IMPORTANCE OF VARIATION IN FOREST RESTORATION

13 **Laura Moran,** ENVIRON International Corporation, Novato, CA -- CLIMATE CHANGE AND SEA LEVEL RISE IMPACTS AT PORTS AND A CONSISTENT METHODOLOGY TO EVALUATE VULNERABILITY AND RISK

2 **Bill Precht,** Dial Cordy & Associates, Inc, Miami Lakes, FL -- DO THE CARIBBEAN CORALS ACROPORA PALMATA, ACROPORA CERVICORNIS AND THE MONTASTRAEA ANNULARIS SPECIES COMPLEX WARRANT LISTING AS ENDANGERED ON THE ESA: A SCIENCE-BASED EVALUATION FROM THE FLORIDA KEYS

Poster Number

29 **Lucila Silva,** Brown and Caldwell, Baton Rouge, LA -- STRATEGIC COMMUNICATIONS

38 **Amanda Stone,** W.F. Baird and Associates, Madison, WI -- A SAND BUDGET FOR THE SOUTHWEST SHORE OF LAKE ONTARIO

31 **Stuart Trabant,** Tetra Tech, Inc., Fort Collins, CO -- KINNICKINNIC RIVER: REHABILITATION IN AN URBAN WATERSHED

24 **Nadine Trahan,** Gaia Spatial, Baton Rouge, LA -- LINKING MULTI-SCALAR STREAM MONITORING EFFORTS AND ANALYSES WITHIN A BIOPHYSICAL CONTEXT TO INFORM HABITAT RESTORATION

8 **Martin Weber,** Stanley Consultants, Minneapolis, MN -- NEW LONDON DAM RECONSTRUCTION

15 **James Webster,** Confederated Tribes of the Umatilla Indian Reservation, Pendleton, OR -- APPLYING A RIVER VISION TO GUIDE RESTORATION OF TRIBAL FIRST FOODS IN WATERSHEDS OF NORTHEAST OREGON AND SOUTHEAST WASHINGTON USA

Area Information

Public Transportation

There are a variety of public transportation options to choose from within the Village of Schaumburg. The Regional Transportation Authority (RTA) has a convenient online guide that will describe how to use the train and bus services in the city and suburbs. Simply put in the beginning and ending address, and the guide will describe which bus routes and train routes to take, along with times and locations. The Metra train service has a station located at the southwest end of the village, at 2000 S. Springinsguth Road. Pace Bus has a major hub location near the Streets of Woodfield (The Northwest Transportation Center), where seven scheduled routes make stops. Pace has over a dozen scheduled and special event routes that pass through the village.

The Chicago Transit Authority (CTA) runs a network of trains and buses that service nearly every corner of the city. The trains fall under two categories – subway and elevated trains (the "L"). You may purchase a transit card or visitor pass in order to access the trains and buses for transportation. Transit cards can be loaded with any amount from $2 to $100 and are available from vending machines located at all train stations. Visitor passes offer unlimited rides in a specific time period and are available at select locations.

For a list of mobile app suggestions from the Chicago Transit Authority, visit: www.transitchicago.com/apps/#mobile.

Top-Rated Restaurants & Attractions

Portillo's Hot Dogs
1950s and 60s themed family-friendly restaurant with award-winning hot dogs, Italian beef, Maxwell Street Polish sandwiches, burgers, and salads.
611 E. Golf Rd., Schaumburg, IL 60173
Phone: 847-884-9020
Website: www.portillos.com/portillos/

Wildberry Pancakes and Café
Breakfast and lunch options – with a twist! Open daily until 2:30pm.
1383 N. Meacham Rd., Schaumburg, IL 60173
Phone: 847-517-4000
Website: www.wildberrycafe.com/schaumburg

Lou Malnati's Pizzeria
Home of some of the BEST Chicago-style deep dish pizza in the world!
1 S. Roselle Rd., Schaumburg, IL 60193
Phone: 847-985-1525
Website: www.loumalnatis.com

Woodfield Shopping Center
The finest collection of department stores, specialty shops, dining, and entertainment in the Great Lakes region.
Golf Rd. at Route 53, 5 Woodfield Shopping Center, Schaumburg, IL 60173
Phone: 847-330-1537
Website: www.simon.com/mall/woodfield-mall

Medieval Times
Exciting dinner attraction inspired by an 11th century feast and tournament. Fun for the family!
2001 N. Roselle Road, Schaumburg, IL 60195
Phone: 1-888-543-9637
Website: www.medievaltimes.com/chicago

Chicago Improv
Stop in for some laughs!
5 Woodfield Rd., Woodfield Mall, Schaumburg, IL 60173
Phone: 847-240-2001
Website: www.chicago.improv.com

Spring Valley
An outdoor living museum with over three miles of handicapped-accessible hiking trails, a nature center, and an 1880s farm on 135 acres of fields, forests, marshes, and streams. Admission is free!
1111 E Schaumburg Rd, Schaumburg, IL 60193
Phone: 847-985-2100
Website: www.parkfun.com/spring-valley

Go Chicago Card

The Go Chicago Card is a great way to save money if you plan to embark on a tour of Chicago attractions. The Card allows you to skip long lines at most of Chicago's top attractions and museums, provides savings at select restaurants and stores, includes several walking and bus sightseeing tours, and even comes with a free guidebook. You may purchase a Card for either 1, 2, 3, 5, or 7 days and within whatever time frame you choose. Keep in mind that multiple-day passes are only good for consecutive days.

To purchase a Go Chicago Card from Smart Destinations, call 866-628-9031, or visit www.smartdestinations.com, choose Chicago as your destination, and click the Go Chicago Card link.

Travel Information

O'Hare International Airport (ORD) - General Information

O'Hare International Airport provides connections to more cities, more often than any other airport in the world. On the outskirts of the city and connected to Chicago city limits by a thin strip of land, over 190,000 people travel through O'Hare every day, and the airport was voted "Best Airport in North America" by Business Traveler International for seven years in a row.

Airport Transportation Options

Taxi Service
The average rate for taxi service between Chicago's O'Hare International Airport and Schaumburg is $35. Between Midway and Schaumburg, it is $60. If you want to make an advance reservation for taxi service, visit www.mypersonaltaxi.com or simply hail a cab outside of the airport or hotel.

GO Airport Express Airport Shuttle Service to O'Hare (ORD) Airport
GO Airport Express offers airport shuttle services between Chicago area locations and O'Hare and Midway Airports. Efficient, safe, and economical airport shuttles depart from O'Hare and Midway Airports every 15 minutes for downtown Chicago and many suburban locations. Ground transportation is arranged by making a reservation.
Visit airportexpress.hudsonltd.net/res?USERIDENTRY=UFNC&LOGON=GO to make your airport shuttle reservation(s), or call 1-800-284-3826 and use your 10% discount code: "UFNC" (all one word).

Visit Choose Chicago for More Area Information
As the official Chicago visitors' site, Choose Chicago (www.choosechicago.com) is dedicated to helping you figure out what to do during your stay. Use the events calendar to see when the Cubs and Sox are in town or view the business listings to see where to catch a river boat tour. Explore this site to discover the best of what Chicago has to offer, but be forewarned: you won't want to leave.

List of Participants

Subodh Acharya
Univ of Florida
119 Phelps Lab
Gainesville, FL 32611
PH: 352-392-0840
Email: sacharya@ufl.edu

Michael Affeldt
Bureau of Engineering Los Angeles River Project
1149 S Broadway 6th Floor
Los Angeles, CA 90015
PH: 213-485-5733
Email: michael.affeldt@lacity.org

Dennis Albert
Oregon State University
4017 ALS
Corvallis, OR 97331
PH: 541-737-7557 | FX: 541-737-3479
Email: albertd@hort.oregonstate.edu

Steven Albert
Parametrix
8801 Jefferson NE Bldg B
Albuquerque, NM 87113
PH: 505-821-4700 | FX: 505-821-7131
Email: hjones@parametrix.com

Matthew Andersen
US Geological Survey
12201 Sunrise Valley Dr MS 300
Reston, VA 20192
PH: 703-648-4064
Email: mandersen@usgs.gov

Don Anderson
Woods Hole Oceanographic Institute
266 Woods Hole Rd MS#32
Woods Hole, MA 02543
PH: 508-289-2351
Email: danderson@whoi.edu

Stu Appelbaum
ARCADIS
1650 Prudential Drive Suite 400
Jacksonville, FL 32207
PH: 904-616-5358 | FX: 904-861-2450
Email: stuart.appelbaum@arcadis-us.com

Karen Appell
AECOM
71 West 23rd Street 12th Floor
New York, NY 10010
PH: 646-708-3288
Email: karen.appell@aecom.com

Aida Arik
Everglades Foundation
18001 Old Cutler Rd Suite 625
Palmetto Bay, FL 33157
Email: aarik@evergladesfoundation.org

George Athanasakes
Stantec Consulting Services Inc
10509 Timberwood Circle Suite 100
Louisville, KY 40245
PH: 502-212-5008 | FX: 502-212-5055
Email: george.athanasakes@stantec.com

Dan Ayres
Washington Dept of Fish & Wildlife
48 Devonshire Road
Montesano, WA 98563
PH: 360-249-4628 x209 | FX: 360-249-1229
Email: Daniel.Ayres@dfw.wa.gov

Dave Baasch
Platte River Recovery Implementation Program
4111 4th Avenue
Kearney, NE 68845
PH: 308-237-5728
Email: baaschd@headwaterscorp.com

Sarah Barmeyer
National Parks Conservation Association
777 6th Street NW Suite 700
Washington, DC 20001
PH: 202-454-3311
Email: sbarmeyer@npca.org

Dennis Barnett
Tetra Tech Inc
2110 Powers Ferry Road SE Suite 202
Atlanta, GA 30339
PH: 770-738-6039 | FX: 770-850-0950
Email: dennis.w.barnett@tetratech.com

Jamie Bartel
CDM Smith
445 North Blvd Suite 850
Baton Rouge, LA 70802
PH: 225-663-3044
Email: barteljm@cdmsmith.com

Brad Bass
Environment Canada
4905 Dufferin Street
Toronto, ON M3H 5T4
Canada
PH: 416-739-4588 | FX: 416-739-4241
Email: brad.bass@ec.gc.ca

Rebeca Bell
Biodiversity Project
4507 N Ravenswood Ave Suite 106
Chicago, IL 60640
PH: 773-754-8902
Email: rbell@biodiverse.org

Bob Bendick
The Nature Conservancy
4245 N Fairfax Drive
Arlington, VA 22203
PH: 703-841-4582
Email: rbendick@tnc.org

Gretchen Benjamin
The Nature Conservancy
2526 State Street
La Crosse, WI 54601
PH: 608-397-1140
Email: gbenjamin@tnc.org

David Bennion
US Geological Survey
1451 Green Rd
Ann Arbor, MI 48105
PH: 734-214-7262
Email: dbennion@usgs.gov

Joe Berg
Biohabitats Inc
2081 Clipper Park Road
Baltimore, MD 21211
PH: 410-554-0156
Email: jberg@biohabitats.com

Louis Blume
US EPA
77 W Jackson Blvd
Chicago, IL 60604
PH: 312-353-2317 | FX: 312-385-5411
Email: blume.louis@epa.gov

Don Boesch
Univ of Maryland
PO Box 775
Cambridge, MD 21613
PH: 410-221-2000 | FX: 410-228-3843
Email: boesch@umces.edu

Marty Boote
ECT Inc
2200 Commonwealth Blvd Suite 300
Ann Arbor, MI 48105
PH: 734-769-3004
Email: mboote@ectinc.com

Steven Bosak
The Society for Ecological Restoration
1017 O St NW
Washington, DC 20001
PH: 202-299-9518 | FX: 270-626-5485
Email: steve@ser.org

Valerie Brady
Univ of Minnesota Duluth
5013 Miller Trunk Hwy
Duluth, MN 55811
PH: 218-720-4353
Email: vbrady@d.umn.edu

Laura Brandt
US Fish & Wildlife Service
3205 College Ave
Davie, FL 33314
PH: 954-577-6343
Email: laura_brandt@fws.gov

Leah Bregman
Society for Ecological Restoration
1017 O Street NW
Washington, DC 20001
PH: 202-299-9518 x4
Email: leah@ser.org

Derek Brockbank
Restore the Mississippi River Delta
901 E Street NW Suite 400
Washington, DC 20004
PH: 202-797-6666
Email: brockbankd@nwf.org

David Brown
Eastern Kentucky University
521 Lancaster Ave
Richmond, KY 40475
PH: 859-622-2283
Email: david.brown@eku.edu

Jennifer Browning
Biodiversity Project
4507 N Ravenswood Ave Suite 106
Chicago, IL 60640
PH: 773-754-8901
Email: jbrowning@biodiverse.org

Andy Buchsbaum
National Wildlife Federation
213 W Liberty Suite 200
Ann Arbor, MI 48105
PH: 734-887-7100
Email: buchsbaum@nwf.org

Kate Buenau
Pacific Northwest National Laboratory
1529 W Sequim Bay Rd
Sequim, WA 98382
PH: 360-681-4590
Email: kate.buenau@pnnl.gov

Josh Burch
District Dept of the Environment
1200 First St NE 5th FL
Washington, DC 20002
PH: 202-535-2247 | FX: 202-535-1364
Email: josh.burch@dc.gov

Russell Burke
Christopher Newport University
1 Avenue of the Arts
Newport News, VA 23606
PH: 757-594-7970
Email: russell.burke@cnu.edu

Mike Burton
Stantec Consulting Services Inc
6900 Professional Parkway E
Sarasota, FL 34240
PH: 941-907-6900
Email: mike.burton@stantec.com

Eric Bush
US Army Corps of Engineers
701 San Marco Blvd
Jacksonville, FL 32207
PH: 904-232-1517
Email: Eric.L.Bush@usace.army.mil

Lewis Bush
US Army Corps of Engineers
6920 Holiday Rd N
Jacksonville, FL 32216
PH: 904-673-6223
Email: L.autry.bush@gmail.com

James Byrne
The Nature Conservancy
127 Industrial Road Suite D
Big Pine Key, FL 33403
PH: 305-872-7071 | FX: 305-872-7072
Email: jbyrne@tnc.org

Laura Calvache
Student
4545 N Monticello
Chicago, IL 60625
PH: 321-339-0021
Email: laura.calvache@cbexchange.com

Todd Caplan
GeoSystems Analysis Inc
3150 Carlisle Blvd NE Suite 107
Albuquerque, NM 87110
PH: 505-830-6039
Email: todd@gsanalysis.com

Lynette Cardoch
MWH
370 Interlock Blvd
Broomfield, CO 80021
PH: 786-553-6633
Email: lynette.cardoch@mwhglobal.com

Merrie Carlock
City of Southfield
26000 Evergreen Rd
Southfield, MI 48076
PH: 248-796-4618
Email: mcarlock@cityofsouthfield.com

Jerry Carroll
Coastal Protection & Restoration
Authority
PO Box 44021
Baton Rouge, LA 70804
PH: 225-342-1346 | FX: 225-342-6801
Email: jerry.carroll@la.gov

Eddy Carter
GEC Inc
8282 Goodwood Blvd
Baton Rouge, LA 70806
PH: 225-612-4103 | FX: 225-612-4270
Email: ecarter@gecinc.com

Lee Case
US Geological Survey
3020 State University Dr E Suite 3008
Sacramento, CA 95819
PH: 916-278-9565
Email: hlcase@usgs.gov

Jill Chomycia
MWH Americas
175 W Jackson Blvd Suite 1900
Chicago, IL 60513
PH: 312-831-3140
Email: jill.chomycia@mwhglobal.com

Larissa Clarke
Clemson University
297 Huntley Drive
Charleston, SC 29407
PH: 843-847-7769
Email: larissc@g.clemson.edu

David Coffman
Freese and Nichols Inc
4055 International Plaza Suite 200
Fort Worth, TX 76109
PH: 817-735-7582
Email: dkc@freese.com

James Cole
The Nature Conservancy
10420 Old Stateline Rd
Swanton, OH 43558
PH: 419-705-1003
Email: jbcole@tnc.org

Paul Conrads
US Geological Survey
720 Gracern Road
Columbia, SC 29210
PH: 803-750-6140 | FX: 803-750-6181
Email: pconrads@usgs.gov

Matthew Cooper
Univ of Notre Dame
290 Galvin Life Sciences
Notre Dame, IN 46556
PH: 574-631-0580 | FX: 574-631-7413
Email: mcooper3@nd.edu

Alina Corcoran
Florida Fish & Wildlife Conservation
Commission
100 8th Ave SE
Saint Petersburg, FL 33710
PH: 727-892-4156
Email: alina.corcoran@myfwc.com

Lisa Cotner
Illinois Dept of Natural Resources
160 N La Salle Suite S-703
Chicago, IL 60601
PH: 312-814-6414
Email: lisa.cotner@illinois.gov

Dave Cowgill
US EPA
77 West Jackson Blvd
Chicago, IL 46321
PH: 312-353-3576
Email: cowgill.david@epa.gov

Darran Crabtree
The Nature Conservancy
301 Chestnut St
Meadville, PA 16335
PH: 814-332-2946
Email: dcrabtree@tnc.org

Bethany Cutts
University of Illinois at Urbana-
Champaign
Dept of Natural Resources &
Environmental Sciences
Urbana, IL 61821
PH: 217-898-1921
Email: bcutts@illinois.edu

Rob Daoust
ARCADIS
8201 Peters Road Suite 3400
Plantation, FL 33324
PH: 954-414-9016 | FX: 954-761-7939
Email: robert.daoust@arcadis-us.com

Cameron Davis
US EPA
Email: Davis.Cameron@epa.gov

Nedra Davis
Atkins North America
1 Galleria Blvd Suite 1516
Metairie, LA 70001
PH: 504-841-2226 | FX: 504-841-2229
Email: nedra.davis@atkinsglobal.com

Steve Davis
Everglades Foundation
18001 Old Cutler Rd Suite 625
Palmetto Bay, FL 33157
PH: 305-251-0001
Email: sdavis@evergladesfoundation.org

Robin DeBruyne
US Geological Survey
1451 Green Rd
Ann Arbor, MI 48105
PH: 734-994-3331
Email: rdebruyne@usgs.gov

Don Deis
Atkins North America
7406 Fullerton Street Suite 350
Jacksonville, FL 32256
PH: 904-363-8442 | FX: 904-363-8442
Email: don.deis@atkinsglobal.com

Michael Dema
Dema Law Group
1034 27th St N
Saint Petersburg, FL 33713
PH: 727-410-2236
Email: michaeldema@yahoo.com

Ray Dennis
CSA Ocean Sciences Inc
8502 SW Kansas Avenue
Stuart, FL 34997
PH: 772-219-3000 | FX: 772-219-3010
Email: rdennis@conshelf.com

Joe DePinto
LimnoTech
501 Avis Drive
Ann Arbor, MI 48108
PH: 734-332-1200 | FX: 734-332-1212
Email: jdepinto@limno.com

Scott Dierks
Cardno JFNew
605 South Main Street Suite 1
Ann Arbor, MI 48104
PH: 734-222-9690 | FX: 734-222-9655
Email: scott.dierks@cardno.com

Philip Dixon
Iowa State University
Snedecor Hall
Ames, IA 50011
PH: 515-294-2142
Email: pdixon@iastate.edu

David Doig
Chicago Neighborhood Initiatives
1000 East 111th Street 10th Floor
Chicago, IL 60628
PH: 773-341-2060
Email: ddoig@cnigroup.org

Jason Doll
Moffatt & Nichol
1616 E Millbrook Rd Suite 160
Raleigh, NC 27609
PH: 919-781-4626
Email: jdoll@moffattnichol.com

Mike Donahue
URS Corporation
27777 Franklin Road Suite 2000
Southfield, MI 48034
PH: 248-204-4953 | FX: 248-204-5901
Email: michael.donahue@urs.com

David Donnenfield
Full Frame Productions
145 Ninth Street #101
San Francisco, CA 94103
PH: 415-546-0155
Email: david@fullframeprod.com

Terry Doss
Biohabitats Inc
855 Bloomfield Avenue
Glen Ridge, NJ 07028
PH: 973-748-9800
Email: tdoss@biohabitats.com

Julie Doumbia
Bonneville Power Administration
PO Box 3621 - KEWR-4
Portland, OR 97208
PH: 503-230-7641
Email: jadoumbia@bpa.gov

Jeff Duda
US Geological Survey
6505 NE 65th St
Seattle, WA 98115
PH: 206-526-6282 x233
Email: jduda@usgs.gov

Dwight Dunk
CDM Smith
50 Hampshire Street
Cambridge, MA 02050
PH: 617-452-6601
Email: dunkdr@cdmsmith.com

Blaine Ebberts
US Army Corps of Engineers
333 SW 1st Ave
Portland, OR 97204
PH: 503-808-4763
Email: blaine.d.ebberts@usace.army.mil

Tim Eder
Great Lakes Commission
2805 S Industrial Hwy Suite 100
Ann Arbor, MI 48104
PH: 734-971-9135 | FX: 734-971-9150
Email: teder@glc.org

Jeff Edstrom
Environmental Consulting & Technology Inc
125 S Wacker Dr Suite 300
Chicago, IL 60606
PH: 312-421-0444
Email: jedstrom@ectinc.com

Raed El-Farhan
The Louis Berger Group Inc
1250 23rd Street NW
Washington, DC 20037
PH: 202-331-7775
Email: relfarhan@louisberger.com

Cheryl Essex
California State Parks
PO Box 942896
Sacramento, CA 94296
PH: 916-651-0386
Email: cheryl.essex@parks.ca.gov

Scott Estergard
Tetra Tech Inc
4801 E Washington Suite 260
Phoenix, AZ 85034
PH: 602-682-3363 | FX: 602-682-3315
Email: scott.estergard@tetratech.com

Tim Feather
CDM Smith
1050 North Reed Station Rd Suite D
Carbondale, IL 62902
PH: 618-303-2325
Email: feathertd@cdmsmith.com

Aaron Feggestad
Stantec Consulting Services Inc
209 Commerce Parkway
Cottage Grove, WI 53527
PH: 608-839-1998 | FX: 608-839-1995
Email: aaron.feggestad@stantec.com

Trevor Fetz
Hawks Aloft Inc
6715 Eagle Rock Ave NE
Albuquerque, NM 87113
PH: 505-828-9455
Email: tfetz@hawksaloft.org

Amanda Flynn
LimnoTech
501 Avis Drive
Ann Arbor, MI 48108
PH: 734-332-1200
Email: aflynn@limno.com

Jon Fosgitt
Compass Land Consultants
E5539 Woodland Ave
Au Train, MI 49806
PH: 906-892-8665
Email: jon@compasslandconsultants.com

Marc Gaden
Great Lakes Fishery Commission
2100 Commonwealth Blvd Suite 100
Ann Arbor, MI 48105
PH: 734-669-3012
Email: marc@glfc.org

David Galat
Univ of Missouri - Columbia
3951 County Road 259
Fulton, MO 65251
PH: 573-303-6914
Email: galatd@missouri.edu

Brian Glenzinski
Ducks Unlimited
4511 Helgesen Dr
Madison, WI 53718
PH: 262-347-6962
Email: bglenzinski@ducks.org

Michael Goffin
Environment Canada
4905 Dufferin Street
Toronto, ON M3H 5T4
Canada
PH: 416-739-4666
Email: michael.goffin@ec.gc.ca

Dean Goodin
Tetra Tech Inc
748 Main Street Suite B
Baton Rouge, LA 70802
PH: 225-383-1780
Email: dean.goodin@tetratech.com

Mark Gorman
Northeast-Midwest Institute
50 F St NW Suite 950
Washington, DC 20001
PH: 202-464-4015
Email: mgorman@nemw.org

John Goss
Asian Carp Director at the White House
Council on Environmental Quality
Chair Asian Carp Regional Coordinating
Committee
Washington, DC

Matt Grabau
GeoSystems Analysis Inc
3393 N Dodge Blvd
Tucson, AZ 85716
PH: 520-628-9330 | FX: 520-628-1122
Email: matt@gsanalysis.com

Becky Griffith
Freese and Nichols Inc
4055 International Plaza Suite 200
Fort Worth, TX 76020
PH: 817-996-0709 | FX: 817-735-7491
Email: becky.griffith@freese.com

Bren Haase
Coastal Protection & Restoration
Authority
PO Box 44027
Baton Rouge, LA 70804
PH: 225-342-1475
Email: bren.haase@la.gov

Mike Habberfield
Univ at Buffalo
105 Wilkeson
Buffalo, NY 14261
PH: 716-645-2722
Email: michael.habberfield@gmail.com

Don Hagan
Clemson University
212 Lehotsky Hall
Clemson, SC 29634
PH: 352-359-9038
Email: dhagan@clemson.edu

Jake Hagelow
Pizzo & Associates Ltd
136 Railroad Street
Leland, IL 60531
PH: 815-495-2300 | FX: 815-498-4406
Email: jakeh@pizzo.info

Erin Hague
Tetra Tech Inc
1901 S Congress Ave Suite 200
Boynton Beach, FL 33426
PH: 561-414-7565
Email: erin.hague@tetratech.com

Bill Hanson
Great Lakes Dredge & Dock Company
2122 York Road Suite 200
Oak Brook, IL 60523
PH: 630-574-3000 | FX: 630-574-2909
Email: WHHanson@gldd.com

Dave Hanson
HansonRM
704 228th Ave NE No 571
Sammamish, WA 98074
PH: 425-208-1586
Email: dhanson@hansonrm.com

Leah Harris
Michigan State University
446 W Circle Dr Room 202
East Lansing, MI 48910
PH: 804-357-8510
Email: leahmh@msu.edu

Matt Harwell
US EPA
Gulf Ecology Division; 1 Sabine Island
Drive
Gulf Breeze, FL 32561
PH: 850-934-9206 | FX: 850-934-2403
Email: harwell.matthew@epa.gov

David Heinze
ENVIRON International Corp
303 E 17th Ave Suite 400
Denver, CO 80203
PH: 303-382-5460
Email: dheinze@environcorp.com

Cindy Henderson
Cypress Environmental Services
PO Box 1168
Biloxi, MS 39533
PH: 228-596-2708
Email: chenderson@cypress-
environmental.com

Heather Henkel
US Geological Survey
600 Fourth St South
Saint Petersburg, FL 33778
PH: 727-803-8747
Email: hhenkel@usgs.gov

Brook Herman
US Army Corps of Engineers
231 S LaSalle Street Suite 1500
Chicago, IL 60604
PH: 312-846-5559
Email: brook.d.herman@usace.army.mil

Gail Hesse
Lake Erie Commission
111 Shoreline Drive
Sandusky, OH 44870
PH: 419-621-2040 | FX: 419-621-2042
Email: gail.hesse@lakeerie.ohio.gov

Ann Hijuelos
The Water Institute of the Gulf
301 N Main Street Suite 2000
Baton Rouge, LA 70825
PH: 225-448-2813
Email: ahijuelos@thewaterinstitute.org

Pete Hill
District Dept of the Environment
1200 First St NE 5th FL
Washington, DC 20002
PH: 202-535-2241
Email: peter.hill@dc.gov

Elizabeth Hinchey
US EPA
77 W Jackson Blvd
Chicago, IL 60604
PH: 312-886-3451 | FX: 312-697-2606
Email: hinchey.elizabeth@epa.gov

Bill Hinsley
ARCADIS
1100 Olive Way Suite 800
Seattle, WA 98101
PH: 206-653-5440 | FX: 206-325-8218
Email: william.hinsley@arcadis-us.com

Dan Hitchings
ARCADIS
1650 Prudential Drive Suite 400
Jacksonville, FL 32207
PH: 904-721-2991
Email: daniel.hitchings@arcadis-us.com

Richard Hobbs
Univ of Western Australia
School of Plant Biology
Crawley, WA 6009
Australia
PH: 61-864884691
Email: richard.hobbs@uwa.edu.au

Manja Holland
Univ of Michigan
625 East Liberty Suite 300
Ann Arbor, MI 48104
PH: 734-647-6226
Email: manja@umich.edu

Bill Holman
Stanley Consultants Inc
5775 Wayzata Blvd Suite 300
Minneapolis, MN 55416
PH: 952-738-4331 | FX: 952-546-4279
Email: holmanbill@stanleygroup.com

Elizabeth Holmes-Gaar
NOAA
1201 NE Lloyd Blvd Suite 1100
Portland, OR 97232
PH: 503-230-5434
Email: elizabeth.gaar@noaa.gov

Mike Homza
GeoEngineers Inc
1525 South David Lane
Boise, ID 83705
PH: 208-841-3537
Email: mhomza@geoengineers.com

Yongseok Hong
Daegu University
Engineering Building 6601 Jillyang-eup
Gyeongsan-si, Gyeongsangbuk-do 712-714
Korea-Republic of (KOR)
PH: 82-0538506694
Email: hongzang77@gmail.com

Mike Hooper
US Geological Survey
4200 New Haven Rd
Columbia, MO 65201
PH: 573-441-2985
Email: mhooper@usgs.gov

Thea Hotaling
Univ of Florida
Building 107 Mowry Road
Gainesville, FL 32611
PH: 352-392-6233
Email: theah@ufl.edu

Stacy Hron
Wisconsin Dept of Natural Resources
1155 Pilgrim Road
Plymouth, WI 53073
PH: 920-892-8756 x3051
Email: stacy.hron@wisconsin.gov

Bill Hubbard
Univ of Georgia
4-402 Forest Resources Building
Athens, GA 30602
PH: 706-340-5070 | FX: 706-542-7672
Email: whubbard@uga.edu

Delia Ivanoff
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33405
PH: 561-682-2681
Email: divanoff@sfwmd.gov

Rachel Jacobson
US Department of the Interior
1849 C Street NW
Washington, DC 20240
PH: 202-208-4416 | FX: 202-208-4684
Email: Rachel_Jacobson@ios.doi.gov

Robb Jacobson
US Geological Survey
4200 New Haven Road
Columbia, MO 65201
PH: 573-876-1844
Email: rjacobson@usgs.gov

Ian Jewell
AECOM
701 Corporate Center Dr
Raleigh, NC 27607
PH: 919-854-6254
Email: ian.jewell@aecom.com

Gary Johnson
Pacific Northwest National Laboratory
620 SW 5th Ave Suite 810
Portland, OR 97204
PH: 503-417-7567
Email: gary.johnson@pnnl.gov

Mike Johnson
Metro Parks Summit County
975 Treaty Line Road
Akron, OH 44313
PH: 330-865-8057
Email:
mjohnson@summitmetroparks.org

Jordy Jordahl
The Nature Conservancy
2253 Rugby Row
Madison, WI 53726
PH: 608-445-8543
Email: hjordahl@tnc.org

Medina Kadiri
Univ of Benin
Depart of Plant Biology & Biotechnology
Benin City, Edo State 300001
Nigeria
PH: 234-8023404118
Email: mokadiri@hotmail.com

Wendy Katagi
CDM Smith
523 W 6th St Suite 400
Los Angeles, CA 90014
PH: 213-457-2132 | FX: 213-457-2132
Email: katagiwr@cdmsmith.com

Dan Keesee
USDA NRCS
101 S Main St
Temple, TX 76501
PH: 254-742-9833
Email: dan.keesee@tx.usda.gov

Heath Kelsey
Univ of Maryland
Center for Env Sci, Box 775
Cambridge, MD 21613
PH: 410-221-2045
Email: hkelsey@umces.edu

Syed Khalil
Coastal Protection & Restoration Authority
PO Box 44027
Baton Rouge, LA 70804
PH: 225-342-1641 | FX: 225-242-3553
Email: syed.khalil@la.gov

Mary Khoury
The Nature Conservancy
8 S Michigan Ave Suite 2301
Chicago, IL 60610
PH: 312-580-2172
Email: mkhoury@tnc.org

Scott Knaus
GEC Inc
8282 Goodwood Blvd
Baton Rouge, LA 70806
PH: 225-612-3000
Email: rsknaus@gecinc.com

Jill Kostel
The Wetlands Initiative
53 W Jackson Blvd Suite 1015
Chicago, IL 60604
PH: 312-922-0777
Email: jkostel@wetlands-initiative.org

Justin Kozak
Southern Illinois University Carbondale
Parkinson Lab Rm 207, Mail Code 4325, 1259 Lincoln Dr
Carbondale, IL 62901
PH: 630-805-1575
Email: jkozak@siu.edu

Richard Lance
US Army ERDC
3909 Halls Ferry Rd
Vicksburg, MS 39180
PH: 601-634-3971 | FX: 601-634-4017
Email: richard.f.lance@us.army.mil

Sarah Laroque
EarthBalance
2579 N Toledo Blade Blvd
North Port, FL 34289
PH: 941-628-6515 | FX: 941-426-8778
Email: slaroque@earthbalance.com

Angela Larsen
Alliance for the Great Lakes
17 N State St Suite 1390
Chicago, IL 60602
PH: 312-445-9736
Email: alarsen@greatlakes.org

Mark Laska
Great Ecology
1020 Prospect Street Suite 310
La Jolla, CA 92037
PH: 858-750-3201
Email: sstevens@greatecology.com

Albert Liau
Lesley University
29 Everett St
Cambridge, MA 02138
PH: 617-283-1411
Email: aliau@lesley.edu

Kent Loftin
HydroPlan LLC
8949 SE Bridge RD #301
Hobe Sound, FL 33455
PH: 772-546-1269
Email: kloftin@hydroplanllc.com

Joe Logan
The Ohio Environmental Council
1207 Grandview Avenue
Columbus, OH 43212
PH: 614-487-7506
Email: joe@theoec.org

Bo Lovelace-Young
Forrest Keeling Nursery
PO Box 135
Elsberry, MO 63343
PH: 636-358-0132
Email: kyoung@fknursery.com

Kim Lovelace-Young
Forrest Keeling Nursery
PO Box 135
Elsberry, MO 63343
PH: 573-898-5571 | FX: 573-898-5830
Email: kyoung@fknursery.com

Ken Lubinski
US Geological Survey
2630 Fanta Reed Road
La Crosse, WI 54603
PH: 608-781-6297
Email: klubinski@usgs.gov

Matt Lybolt
Tetra Tech Inc
759 SE Federal Hwy Suite 314
Stuart, FL 34994
PH: 772-781-3420
Email: matthew.lybolt@tetratech.com

Scudder Mackey
Ohio Department of Natural Resources
105 W Shoreline Drive
Sandusky, OH 44870
PH: 419-626-7980 | FX: 419-609-4158
Email: scudder.mackey@dnr.state.oh.us

Kimberly Majerus
Resource Center-FHWA
Linc Mall Dr
Matteson, IL 60443
PH: 708-283-4346
Email: kimberly.majerus@dot.gov

Michael Mak
AECOM
2101 Webster St Suite 1900
Oakland, CA 94612
PH: 510-622-6639
Email: michael.mak@aecom.com

Larry Malizzi
Matrix New World Engineering Inc
1521 Concord Pike Suite 301
Wilmington, DE 19803
PH: 302-598-7553
Email: lmalizzi@matrixneworld.com

Bruce Manny
US Geological Survey
1451 Green Rd
Ann Arbor, MI 48105
PH: 734-214-7255 | FX: 734-994-8780
Email: bmanny@usgs.gov

Carol Mansfield
RTI International
3040 Cornwallis Rd PO Box 12194
Research Triangle Park, NC 27713
PH: 919-541-8053
Email: carolm@rti.org

Adrienne Marino
Univ of Michigan
625 E Liberty Street Suite 300
Ann Arbor, MI 48014
PH: 734-763-0662
Email: almarino@umich.edu

David Marmorek
ESSA Technologies Ltd
Suite 600 2695 Granville St
Vancouver, BC V6H 3H4
Canada
PH: 604-733-2996 | FX: 604-733-4657
Email: dmarmorek@essa.com

Maggie Marquis
Delta Institute
35 E Wacker
Chicago, IL 60601
PH: 312-554-0900
Email: mmarquis@delta-institute.org

Margarita Marte Marine
Fundqacion de Ayuda Para Los Pobres de la Republica Dominicana
Calle Gregorio Garcia Castro No 96
Espaillat
Santo Domingo, Distrito Nacional 10100
Dominican Republic
PH: 809-435-5555
Email: fundapobres@hotmail.com

Lucieta Martorano
Embrapa Amazônia Oriental
Tv Dr Eneas Pinheiro
Belém, 66095100
Brazil
PH: 55-9132041185
Email: martorano.lucietta@gmail.com

Merri Martz
Tetra Tech Inc
1420 5th Avenue Suite 550
Seattle, WA 98101
PH: 206-728-9655
Email: merri.martz@tetratech.com

Linda Masters
Openlands
25 E Washington St Suite 1650
Chicago, IL 60602
PH: 312-863-6278
Email: lmasters@openlands.org

Caitie McCoy
Illinois-Indiana Sea Grant
77 W Jackson Blvd (G-17J)
Chicago, IL 60604
PH: 312-886-1430
Email: cmccoy2@illinois.edu

Jeff McCreary
Ducks Unlimited
3074 Gold Canal Drive
Rancho Cordova, CA 95670
PH: 916-852-2000
Email: jmccreary@ducks.org

David McGehee
Emerald Ocean Engineering LLC
107 Ariola Drive
Pensacola Beach, FL 32561
PH: 850-232-4111
Email: bigwave@emeraldoe.com

Pat McGinnis
The Horinko Group
2300 N Street NW Suite 2130
Washington, DC 20037
PH: 618-520-7060
Email:
patrick.mcginnis@thehorinkogroup.org

Dennis McGrath
The Nature Conservancy
101 East Grand River
Lansing, MI 48906
PH: 517-316-2251
Email: dmcgrath@tnc.org

Nelwyn McInnis
The Nature Conservancy
PO Box 1657
Abita Springs, LA 70420
PH: 985-320-9284
Email: NMCINNIS@TNC.ORG

Mark McKelvy
US Geological Survey
7920 NW 71 Street
Gainesville, FL 32653
PH: 337-240-6498
Email: mckelvym@usgs.gov

Chad McKenna
GeoSystems Analysis Inc
3150 Carlisle Blvd NE
Albuquerque, NM 87110
PH: 505-274-0126
Email: chad@gsanalysis.com

Kathryn Meaux
Sarasota County Government
1001 Sarasota Center Blvd
Sarasota, FL 34240
PH: 941-650-1640 | FX: 941-861-6267
Email: kmeaux@scgov.net

Marty Melchior
Inter-Fluve Inc
301 S Livingston St Suite 200
Madison, WI 53703
PH: 608-441-0342 | FX: 608-441-0218
Email: mmelchior@interfluve.com

Lilia del Carmen Mendizábal Hernández
Universidad Veracruzana
Lomas del Estadio s/n
Xalapa, Veracruz, 91000
Mexico
PH: 52-012288185728
Email: lmendizabal@uv.mx

Ken Mierzwa
GHD
718 Third Street
Eureka, CA 95501
PH: 707-499-5794
Email: ken.mierzwa@ghd.com

Dan Miller
Stanley Consultants Inc
225 Iowa Ave
Muscatine, IA 52761
PH: 563-264-6304 | FX: 563-264-6658
Email: millerdaniel@stanleygroup.com

Nick Miller
The Nature Conservancy
633 W Main Street
Madison, WI 53703
PH: 608-333-2155
Email: nmiller@tnc.org

Dwayne Minton
The Nature Conservancy
923 Nu'uanu Ave
Honolulu, HI 96817
PH: 808-729-1789
Email: dminton@tnc.org

Mark Monaco
NOAA
1305 East West Highway
Silver Spring, MD 20910
PH: 301-713-3028 | FX: 301-713-4388
Email: mark.monaco@noaa.gov

John Monahan
GeoEngineers Inc
600 Dupont St
Bellingham, WA 98225
PH: 360-647-1510 | FX: 360-647-5044
Email: jmonahan@geoengineers.com

David Moore
ENVIRON International Corp
18100 Von Karman Ave Suite 600
Irvine, CA 92612
PH: 949-798-3604
Email: dmoore@environcorp.com

Mike Moorman
USDA NRCS
1400 Independence Ave SW Rm 5214S
Washington, DC 20250
PH: 202-205-7703 | FX: 202-720-5256
Email: michael.moorman@wdc.usda.gov

Oscar Moquete Cuevas
Suprema Corte de Justicia Republica Dominicana
Av Sabana Larga No 46 Suite 1-9 Plaza Sabana Larga
Santo Domingo Este, Santo Domingo 11506
Dominican Republic
PH: 809-788-4478
Email: moquete24@hotmail.com

Laura Moran
ENVIRON International Corp
773 San Marin Drive Suite 2115
Novato, CA 94998
PH: 415-899-0731 | FX: 415-899-0707
Email: lmoran@environcorp.com

Tim Moritz
Pizzo & Associates Ltd
136 Railroad Street
Leland, IL 60531
PH: 815-495-2300 | FX: 815-498-4406
Email: timm@pizzo.info

Matt Morrison
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406
PH: 561-722-0013
Email: mjmorris@sfwmd.gov

Angie Morrow
Cardno ENTRIX
1000 Hart Road Suite 130
Barrington, IL 60010
PH: 847-277-2850
Email: angie.morrow@cardno.com

Juan Moya
Atkins North America
4409 Sarasota Dr
Austin, TX 78749
PH: 512-342-3234 | FX: 512-327-2453
Email: Juan.moya@atkinsglobal.com

Wayne Munns
US EPA
27 Tarzwell Dr
Narragansett, RI 02882
PH: 401-782-3017
Email: munns.wayne@epa.gov

Carol Murray
ESSA Technologies Ltd
600-2695 Granville Street
Vancouver, BC V6H 3H4
Canada
PH: 604-733-2996
Email: cmurray@essa.com

Michael Murray
National Wildlife Federation
213 W Liberty St Suite 200
Ann Arbor, MI 48104
PH: 734-887-7110
Email: murray@nwf.org

Bob Mussetter
Tetra Tech Inc
3801 Automation Way Suite 100
Fort Collins, CO 80525
PH: 970-223-9600 | FX: 970-223-7171
Email: bob.mussetter@tetratech.com

Troy Naperala
URS Corporation
10850 Traverse Highway
Traverse City, MI 49686
PH: 231-922-4301
Email: troy.naperala@urs.com

Tom Neeson
The University of Wisconsin-Madison
680 North Park Street
Madison, WI 53706
PH: 608-265-2340
Email: thomas.neeson@gmail.com

John Nestler
Platte River Recovery Implementation Program
102 Lakewood Circle
Vicksburg, MS 39180
PH: 601-529-3740 | FX: 601-634-3129
Email: john.m.nestler@gmail.com

Pat Nunnally
University of Minnesota
1954 Buford Ave
Saint Paul, MN 55108
PH: 612-626-7014 | FX: 612-626-5555
Email: pdn@umn.edu

Kevin O'Donnell
US EPA
77 West Jackson Blvd (G-17J)
Chicago, IL 60604
PH: 312-886-0813
Email: odonnell.thomas@epa.gov

John O'Meara
Environmental Consulting & Technology Inc
2200 Commonwealth Blvd Suite 300
Ann Arbor, MI 48105
PH: 734-769-3004
Email: jomeara@ectinc.com

Kameran Onley
The Nature Conservancy
4245 N Fairfax Drive Suite 100
Arlington, VA 22203
PH: 703-841-4229
Email: konley@tnc.org

Tyler Ortego
Wayfarer Technologies/ ORA Estuaries
263 Third Street Suite 709
Baton Rouge, LA 70801
PH: 225-627-1365
Email: Tyler@wayfarertech.com

Dana Otto
The Louis Berger Group Inc
1250 23rd Street NW
Washington, DC 20037
PH: 202-331-7775
Email: dotto@louisberger.com

Corey Palmer
Northwestern University and the Chicago Botanic Garden
1000 Lake Cook Road
Glencoe, IL 60022
PH: 773-909-8937
Email: coreypalmer2013@u.northwestern.edu

Craig Palmer
CSC
6361 Walker Lane Suite 300
Alexandria, VA 22310
PH: 702-895-1797 | FX: 702-895-3094
Email: cpalmer22@csc.com

Carol Parsons Richards
Coastal Protection & Restoration Authority
450 Laurel Street Suite 1200
Baton Rouge, LA 70801
PH: 225-342-9430
Email: carol.richards@la.gov

Arthur Pearson
Gaylord and Dorothy Donnelley Foundation
35 E Wacker Drive Suite 2600
Chicago, IL 60601
PH: 312-977-2709
Email: apearson@gddf.org

Victoria Pebbles
Great Lakes Commission
2805 S Industrial Hwy
Ann Arbor, MI 48104
PH: 734-971-9135 | FX: 734-971-9150
Email: vpebbles@glc.org

Chuck Perrodin
Coastal Protection & Restoration Authority
450 Laurel Street Suite 1501
Baton Rouge, LA 70801
PH: 225-342-7615 | FX: 225-242-3773
Email: chuck.perrodin@la.gov

Shelton Perry
GEC Inc
8282 Goodwood Boulevard
Baton Rouge, LA 70806
PH: 225-612-4143
Email: sperry@gecinc.com

Natalie Peyronnin
Coastal Protection & Restoration Authority
450 Laurel Street 12th Floor
Baton Rouge, LA 70801
PH: 225-342-8786
Email: natalie.peyronnin@la.gov

Steven Peyronnin
Coalition to Restore Coastal Louisiana
6160 Perkins Road Suite 225
Baton Rouge, LA 70808
PH: 225-767-4181
Email: stevenp@crcl.org

Joe Pfeiffer
KCI Technologies Inc
Landmark Center II, Suite 220 4601 Six Forks Road
Raleigh, NC 27609
PH: 919-614-3615
Email: Joe.Pfeiffer@kci.com

Bryan Piazza
The Nature Conservancy
PO Box 4125
Baton Rouge, LA 70806
PH: 225-338-1040
Email: bpiazza@tnc.org

Sarai Piazza
US Geological Survey
c/o Livestock Show Office LSU
Baton Rouge, LA 70803
PH: 225-578-7044
Email: piazzas@usgs.gov

Jack Pizzo
Pizzo & Associates Ltd
136 Railroad Street
Leland, IL 60531
PH: 815-495-2300 | FX: 815-498-4406
Email: jack@pizzo.info

Bill Precht
Dial Cordy & Associates Inc
7310 Poinciana Court
Miami lakes, FL 33014
PH: 305-924-4274
Email: Bprecht@dialcordy.com

Bridget Radcliff
Udall Foundation, US Institute for Environmental Conflict Resolution
130 S Scott Avenue
Tucson, AZ 85701
PH: 520-901-8572
Email: radcliff@ecr.gov

Anne Rea
US EPA
109 TW Alexander Drive
Durham, NC 27711
PH: 919-541-0053 | FX: 919-541-5485
Email: rea.anne@epa.gov

Denise Reed
The Water Institute of the Gulf
301 N Main Street Suite 2000
Baton Rouge, LA 70825
PH: 225-227-2712
Email: dreed@thewaterinstitute.org

Stephen Reiling
District Dept of the Environment
1200 First St NE 5th FL
Washington, DC 20002
PH: 202-442-7700 | FX: 202-535-1364
Email: stephen.reiling@dc.gov

Alisha Renfro
National Wildlife Federation
8222 Maple St
New Orleans, LA 70118
PH: 504-512-1014
Email: renfroa@nwf.org

David Richard
Stream Companies
PO Box 40
Lake Charles, LA 70602
PH: 337-515-0855 | FX: 337-439-2170
Email: drichard@streamcompany.com

Jon Risinger
MWH Global Inc
7742 Office Park Blvd C-2
Baton Rouge, LA 70808
PH: 225-926-3991 | FX: 225-926-4886
Email: jon.d.risinger@mwhglobal.com

Andres Rodriguez
Florida International University
11200 SW 8th Street
Miami, FL 33191
PH: 305-348-1284
Email: arodr760@fiu.edu

Karen Rodriguez
US EPA
77 West Jackson
Chicago, IL 60604
PH: 312-353-2690
Email: rodriguez.karen@epa.gov

Tina Romaneh
Environment Canada
4905 Dufferin Street
Toronto, ON M3H5T4
Canada
PH: 416-739-4964 | FX: 416-739-5767
Email: Tina.Romaneh@ec.gc.ca

Barry Rosen
US Geological Survey
12703 Research Parkway
Orlando, FL 32779
PH: 407-738-0669
Email: Brosen@usgs.gov

Joe Roth
Openlands
25 E Washington Suite1650
Chicago, IL 60602
PH: 312-863-6275 | FX: 312-863-6251
Email: jroth@openlands.org

Karen Rouse
MO Dept of Natural Resources
PO Box 176
Jefferson City, MO 65102
PH: 573-751-2867 | FX: 573-751-8475
Email: karen.rouse@dnr.mo.gov

Amanda Roussel
GEC Inc
8282 Goodwood Boulevard
Baton Rouge, LA 70806
PH: 225-252-1796
Email: aroussel@gecinc.com

Shaye Sable
Dynamic Solutions LLC
450 Laurel Street
Baton Rouge, LA 70801
PH: 225-490-0090
Email: ssable@dsllc.com

Ed Samanns
The Louis Berger Group Inc
412 Mount Kemble Avenue
Morristown, NJ 07962
PH: 202-331-7775
Email: esamanns@louisberger.com

Russ Sanford
Kleinschmidt Associates
204 Caughman Farm Lane
Lexington, SC 29072
PH: 803-462-5620
Email:
russ.sanford@kleinschmidtusa.com

Gaurav Savant
Dynamic Solutions LLC
Water Resources
Vicksburg, MS 39180
PH: 601-634-3213
Email: gsavant79@yahoo.com

Don Scavia
Graham Institute, Univ of Michigan
625 E Liberty St Suite 300
Ann Arbor, MI 48104
PH: 734-615-4860
Email: scavia@umich.edu

Doug Schnoebelen
Univ of Iowa
300 S Riverside Drive
Iowa City, IA 52245
PH: 319-335-6061
Email: douglas-schnoebelen@uiowa.edu

Heather Schwar
HNTB
11414 West Park Place Suite 300
Milwaukee, WI 53224
PH: 414-410-6827
Email: hschwar@hntb.com

Michael Schwar
Montgomery Associates
119 South Main Street
Cottage Grove, WI 53527
PH: 414-380-1044
Email: mike@ma-rs.org

Tom Sear
Short Elliott Hendrickson Inc
5395 North 118th Court
Milwaukee, WI 53225
PH: 414-465-1214
Email: tsear@sehinc.com

Andy Selle
Inter-Fluve Inc
301 S Livingston Suite 200
Madison, WI 53703
PH: 608-441-0342
Email: aselle@interfluve.com

Kevin Sellner
Chesapeake Research Consortium
645 Contees Wharf Road
Edgewater, MD 21037
PH: 410-798-1283 | FX: 410-798-0816
Email: sellnerk@si.edu

Alexandra Serna
Florida International University
11200 SW 8th Street OE 147C
Miami, FL 33199
PH: 305-348-0226
Email: asernasa@fiu.edu

Jason Shackelford
SWCA Environmental Consultants
5745 Essen Lane Suite 105
Baton Rouge, LA 70810
PH: 225-572-1655 | FX: 225-663-3831
Email: jshackelford@swca.com

Pervaze Sheikh
Congressional Research Service
423 Madison Bldg 101 Independence SE
Washington, DC 20054
PH: 202-707-6070
Email: psheikh@crs.loc.gov

Dawn Shirreffs
National Parks Conservation Association
450 N Park Rd #301
Hollywood, FL 33021
PH: 954-961-1280 x402
Email: dshirreffs@npca.org

Joe Shisler
ARCADIDS
8 South River Road
Cranbury, NJ 08512
PH: 609-366-9091 | FX: 609-860-0491
Email: joseph.shisler@arcadis-us.com

John Shuey
The Nature Conservancy
620 E Ohio Street
Indianapolis, IN 46202
PH: 317-951-8818
Email: jshuey@TNC.org

Brandy Siedlaczek
City of Southfield
26000 Evergreen Rd
Southfield, MI 48034
PH: 248-796-4806
Email: bsiedlaczek@cityofsouthfield.com

Luci Silva
Brown and Caldwell
451 Florida St Suite 1050
Baton Rouge, LA 70801
PH: 225-456-2505
Email: lsilva@brwncald.com

Si Simenstad
Univ of Washington
School of Aquatic & Fishery Sciences,
1122 NE Boat Street
Seattle, WA 98105
PH: 206-543-7185 | FX: 206-685-7471
Email: simenstd@u.washington.edu

Sanjiv Sinha
Environmental Consulting & Technology Inc
2200 Commonwealth Blvd Suite 300
Ann Arbor, MI 48103
PH: 734-769-3004
Email: ssinha@ectinc.com

Fred Sklar
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406
PH: 561-682-6504
Email: fsklar@sfwmd.gov

Robbie Sliwinski
US Army Corps of Engineers
231 S Lasalle St Suite 1500
Chicago, IL 60604
PH: 312-846-5486
Email: robbie.sliwinski@usace.army.mil

Scott Slocum
Weston Solutions Inc
5599 San Felipe Suite 700
Houston, TX 77056
PH: 334-728-0124 | FX: 713-985-6703
Email: S.Slocum@westonsolutions.com

Tom Slowinski
V3 Companies Ltd
7325 Janes Avenue
Woodridge, IL 60517
PH: 630-729-6285 | FX: 630-724-9202
Email: tslowinski@v3co.com

Bill Sluis
Trine U
One University Ave
Angola, IN 46703
PH: 630-484-9515
Email: wsluis2@yahoo.com

Brian Smith
Federal Highway Administration
4749 Lincoln Mall Drive Suite 600
Matteson, IL 60423
PH: 708-283-3553 | FX: 708-283-3501
Email: bsmith@dot.gov

Chad Smith
Headwaters Corporation
4111 4th Avenue Suite 6
Kearney, NE 68845
PH: 402-261-3185
Email: smithc@headwaterscorp.com

Mark Smith
The Nature Conservancy
99 Bedford Street
Boston, MA 02111
PH: 617-532-8361
Email: mpsmith@tnc.org

Rebecca Smith
The Nature Conservancy
633 W Main Street
Madison, WI 53703
PH: 608-316-6430 | FX: 608-251-8535
Email: mobrien@tnc.org

Stephanie Smith
ARCADIS
6723 Towpath Road
Syracuse, NY 13214
PH: 315-671-9440 | FX: 315-449-0017
Email: stephanie.smith@arcadis-us.com

Paul Sokoloff
Battelle
397 Washington St
Duxbury, MA 02332
PH: 781-952-5367 | FX: 614-458-0864
Email: sokoloffp@battelle.org

Scott Sowa
The Nature Conservancy
101 East Grand River
Lansing, MI 48906
PH: 517-316-2255
Email: ssowa@tnc.org

Nick Speyrer
The Water Institute of the Gulf
301 N Main Street Suite 2000
Baton Rouge, LA 70825
PH: 225-227-2712
Email: nspeyrer@thewaterinstitute.org

Kyle Spicer
Partners For Clean Streams
PO Box 203
Perrysburg, OH 43552
PH: 419-874-0727 | FX: 419-874-0727
Email: kyle@partnersforcleanstreams.org

Tom St Clair
RESPEC
484 Tivoli Dr
Jacksonville, FL 32259
PH: 904-303-0919
Email: Tom.StClair@respec.com

Jill Stachura
Brown and Caldwell
990 Hammond Drive Suite 400
Atlanta, GA 30328
PH: 770-673-3679 | FX: 770-396-9495
Email: jstachura@brwncald.com

Lilo Stainton
NY-NJ Harbor Coalition
241 Water Street
New York, NY 10038
PH: 917-370-6607
Email: Lilo@harborcoalition.org

John Stark
The Nature Conservancy
6375 Riverside Drive Suite 100
Dublin, OH 43015
PH: 614-717-2770 x138
Email: jstark@tnc.org

Lorie Staver
Univ of Maryland
PO Box 775
Cambridge, MD 21613
PH: 410-221-8446
Email: lstaver@umces.edu

Andy Stoddard
Dynamic Solutions LLC
112 Orchard Circle
Hamilton, VA 20158
PH: 540-338-3642 | FX: 540-338-3649
Email: astoddard@dsllc.com

Amanda Stone
Baird and Associates
2981 Yarmouth Greenway Dr
Madison, WI 53705
PH: 608-273-0592
Email: astone@baird.com

Russ Strach
US Geological Survey
1451 Green Road
Ann Arbor, MI 48105
PH: 734-214-7200
Email: rstrach@usgs.gov

Eileen Straughan
Straughan Environmental Inc
10245 Old Columbia Road
Columbia, MD 21046
PH: 301-362-9200
Email:
estraughan@straughanenvironmental.com

Dan Sullivan
US Geological Survey
8505 Research Way
Middleton, WI 53562
PH: 608-821-3869
Email: djsulliv@usgs.gov

Gary Sullivan
The Wetlands Initiative
53 W Jackson Blvd Suite 1015
Chicago, IL 60604
PH: 312-922-0777 | FX: 312-922-1823
Email: gsullivan@wetlands-initiative.org

Larry Surkan
Western Landscapers Ltd
2299 Gale Ave
Coquitlam, BC V3K 2Z2
Canada
PH: 604-937-7272 | FX: 604-937-7292
Email: westernlandscapers@telus.net

Jenny Ta
UC Davis
77 Appleton Street
Arlington, MA 02476
PH: 415-609-6872
Email: jennyta@me.com

Sophie Taddeo
Great Lakes Commission
2805 S Industrial Hwy Suite 100
Ann Arbor, MI 48104
PH: 734-971-9135
Email: Sophie.taddeo@mail.mcgill.ca

Tom Teets
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406
PH: 561-248-0494
Email: tteets@sfwmd.gov

Lindsay Teunis
AECOM
1420 Kettner Blvd Suite 500
San Diego, CA 92101
PH: 619-684-6943
Email: lindsay.teunis@aecom.com

Ronald Thom
Pacific Northwest National Laboratory
1529 W Sequim Bay Road
Sequim, WA 98382
PH: 360-681-3657 | FX: 360-681-3681
Email: ron.thom@pnnl.gov

Cassondra Thomas
Cardno ENTRIX
3850 N Causeway Blvd
Metairie, LA 70002
PH: 504-526-1104 | FX: 504-526-1080
Email: cassondra.thomas@cardno.com

Brad Thompson
US Army Corps of Engineers
1616 Capitol Avenue
Omaha, NE 68102
PH: 402-995-2678 | FX: 402-995-2758
Email:
bradley.e.thompson@usace.army.mil

Mike Thompson
Forrest Keeling Nursery
PO Box 135
Elsberry, MO 63343
PH: 573-898-5571 | FX: 573-898-5803
Email: info@fknursery.com

Joel Tillery
CH2M HILL
3900 N Causeway Blvd
Metairie, LA 70002
PH: 504-832-9508
Email: joel.tillery@ch2m.com

Chris Tomichek
Kleinschmidt Associates
35 Pratt Street Suite 201
Essex, CT 06426
PH: 207-487-3328
Email:
chris.tomichek@kleinschmidtusa.com

Stu Trabant
Tetra Tech Inc
3801 Automation Way Suite 100
Fort Collins, CO 80525
PH: 970-223-9600
Email: stu.trabant@tetratech.com

Nadine Trahan
Gaia Spatial
1004 Houston Ave
Takoma Park, MD 20912
PH: 337-255-6952
Email: ntrahan@gaiaspatial.com

Dilip Trivedi
Moffatt & Nichol
2185 N California Blvd Suite 500
Walnut Creek, CA 94596
PH: 925-944-5411 | FX: 925-944-4732
Email: dtrivedi@moffattnichol.com

Jeff Trulick
US Army Corps of Engineers
441 G Street NW
Washington, DC 20314
PH: 202-761-1380
Email: jeff.trulick@usace.army.mil

Wes Tunnell
Texas A&M University- Corpus Christi
6300 Ocean Drive Unit 5869
Corpus Christi, TX 78412
PH: 361-825-2055 | FX: 361-825-2050
Email: wes.tunnell@tamucc.edu

Cheryl Ulrich
Weston Solutions Inc
329 8th Street
Atlantic Beach, FL 32233
PH: 904-248-8275
Email:
cheryl.ulrich@westonsolutions.com

Herry Utomo
Louisiana State University
1373 Caffey Rd
Rayne, LA 70578
PH: 337-296-5939
Email: hutomo@agcenter.lsu.edu

Don Uzarski
Central Michigan University
127 Brooks Hall
Mount Pleasant, MI 48859
PH: 989-774-2504
Email: uzars1dg@cmich.edu

Nicole Van Helden
The Nature Conservancy
242 Michigan St Suite B103
Sturgeon Bay, WI 54235
PH: 920-333-1752
Email: nvanhelden@tnc.org

Frank Veraldi
US Army Corps of Engineers
231 S LaSalle St Suite 1500
Chicago, IL 60604
PH: 312-846-5589
Email: Frank.M.Veraldi@usace.army.mil

Dan Veriotti
Baird & Associates
125 S Wacker Drive Suite 300
Chicago, IL 60606
PH: 312-893-5442 | FX: 312-893-5505
Email: dveriotti@baird.com

Georgia Vince
Tetra Tech Inc
759 S Federal Highway Suite 314
Stuart, FL 34994
PH: 772-281-3441
Email: georgia.vince@tetratech.com

Rob Vining
Dawson & Associates
43315 N Heritage Palms Drive
Indio, CA 92201
PH: 225-678-0578
Email: rfvining@hotmail.com

Ryan Vogel
Florida International University
11200 SW 8th Street, Panther Garage 120
Miami, FL 33199
PH: 305-348-3717
Email: ryan.vogel@fiu.edu

Carrie Vollmer-Sanders
The Nature Conservancy
330 Intertech Parkway
Angola, IN 46703
PH: 260-665-9141
Email: csanders@tnc.org

Jesse Waldrip
Kleinschmidt Associates
141 Main Street
Pittsfield, ME 04967
PH: 207-487-3328
Email:
jesse.waldrip@kleinschmidtusa.com

Christopher Wallen
Dynamic Solutions LLC
6421 Deane Hill Drive Suite 1
Knoxville, TN 37919
PH: 865-212-3331 | FX: 865-212-3398
Email: cmwallen@dsllc.com

Stefany Wang
Parsons Brinckerhoff
100 S Charles St Tower 1, 10th Floor
Baltimore, MD 21201
PH: 410-727-5050
Email: wangst@pbworld.com

Joe Wanielista
Tetra Tech Inc
65 Cadillac Square Suite 3400
Detroit, MI 48226
PH: 313-224-9835 | FX: 313-964-6957
Email: joe.wanielista@tetratech.com

Jennifer Wasik
MWRDGC
6001 W Pershing Rd
Cicero, IL 60647
PH: 708-588-4063
Email: jennifer.wasik@mwrd.org

Martin Weber
Stanley Consultants Inc
5775 Wayzata Blvd #300
Minneapolis, MN 55416
PH: 952-738-4332
Email: webermartin@stanleygroup.com

Jim Webster
Umatilla Tribes
46411 Timine Way
Pendleton, OR 97801
PH: 541-429-7240 | FX: 541-429-7240
Email: jameswebster@ctuir.org

Lyman Welch
Alliance for the Great Lakes
17 N State St Suite 1390
Chicago, IL 60602
PH: 312-445-9739
Email: lwelch@greatlakes.org

Jason Weller
USDA NRCS
1400 Independence Ave SW
Washington, DC 20250
PH: 202-720-7246 | FX: 202-720-7690
Email: jason.weller@wdc.usda.gov

Ida Wenefrida
Louisiana State University
1373 Caffey Rd
Rayne, LA 70578
PH: 337-315-9093
Email: iwenefrida@agcenter.lsu.edu

Kevin White
Full Frame Productions
145 Ninth Street #101
San Francisco, CA 94103
PH: 415-546-0155
Email: kevin@fullframeprod.com

Peter Wijsman
ARCADIS
100 Montgomery Street Suite 300
San Francisco, CA 94104
PH: 415-244-2118
Email: peter.wijsman@arcadis-us.com

Mark Wingate
US Army Corps of Engineers
7400 Leake Avenue
New Orleans, LA 70118
PH: 504-852-2512 | FX: 504-862-2572
Email: mark.r.wingate@usace.army.mil

Nate Winkler
Conservation Resource Alliance
10850 Traverse Highway
Traverse City, MI 49684
PH: 231-946-6817
Email: nate@rivercare.org

Jennifer Wright
Milwaukee Metro Sewerage District
260 West Seeboth Street
Milwaukee, WI 53204
PH: 414-225-2097 | FX: 414-221-6801
Email: jwright@mmsd.com

Wayne Wright
GeoEngineers Inc
600 Stewart St Suite 1700
Seattle, WA 98101
PH: 206-239-3254
Email: wwright@geoengineers.com

Eric Young
North Carolina State University
Box 7561
Raleigh, NC 27695
PH: 919-513-1746
Email: eric_young@ncsu.edu

Joy Zedler
Univ of Wisconsin
430 Lincoln Dr
Madison, WI 53706
PH: 608-262-8629 | FX: 608-262-5209
Email: jbzedler@wisc.edu

Abstracts

(Alphabetical by presenting author's last name)

PATTERN AND FLOW IN THE EVERGLADES: DEFINING LANDSCAPE-SCALE HYDRAULIC GEOMETRY

David A. Kaplan[1], ***Subodh Acharya***[2], *Matthew J. Cohen*[2], *James W. Jawitz*[3] and *James B. Heffernan*[3]

[1]University of Florida, Environmental Engineering Sciences Dept., Gainesville, FL, USA
[2]University of Florida, School of Forest Resources and Conservation, Gainesville, FL USA
[3]University of Florida, Soil & Water Science Dept., Gainesville, FL USA
[4]Duke University, Nicholas School of the Environment, Durham, NC USA

Elucidating the biophysical processes that drive ecosystem development, maintenance, and degradation in patterned peatlands is essential for guiding ecosystem management and restoration. However, the long timescales of ecological processes in peat-based systems confound empirical observation and hypothesis testing, making modeling a vital tool in the exploration of hypotheses about landscape development. Critically, different proposed mechanisms yield distinctly different (and potentially antagonistic) hydrological management recommendations, such that "getting the water right" is impossible without understanding the ecohydrological processes that drive ecosystem structure. In this work we test the hypothesis that feedbacks between landscape pattern and hydroperiod may be sufficient to explain the development of the flow-parallel ridge-slough mosaic of the Everglades (Florida, USA).

For a given set of boundary conditions, flooding dynamics in a lotic wetland are determined by topography, flow-path connectivity, and bed and vegetative friction, which together describe "landscape-scale hydraulic geometry." Metrics of hydraulic geometry driven by landscape pattern include patch prevalence (i.e., the proportion of the landscape inhabited by each patch type), patch elevation differences, and patch geometry (i.e., parallel vs. orthogonal to flow, isotropic vs. anisotropic). To understand how these landscape metrics affect hydrology, we developed steady-state rating curves for a series of 1800 real and geostatistically simulated domains using a spatially distributed numerical modeling code (SWIFT2D; USGS, 2004). These relationships were used along with a 20-yr benchmark flow record to calculate and compare resulting hydroperiods for each landscape.

Results showed patch orientation to be a good predictor of hydroperiod, with ecologically significant increases in hydroperiod (>40 days/year) in isotropic landscapes compared with areas of the Everglades with the best-conserved anisotropic patterning. Hydroperiod differences among landscapes were largest in dry years, suggesting that low flow periods may be more important for pattern development than wet years—contrary to models based on erosion and redistribution of particulates. Results were used to create a patch prevalence-anisotropy-hydroperiod response surface for simplified modeling of landscape pattern development using a state and transition model; preliminary results suggest that coupled feedbacks between landscape geometry and hydrology can drive anisotropic patterning, although the specific geometry of pattern development depends on the parameterization of the patch contagion effect.

Contact Information: David A. Kaplan, Environmental Engineering Sciences Department, University of Florida, 6 Phelps Lab, Gainesville, FL 32611-6350, Phone: 352-392-8439, Fax: 352-392-3624, Email: dkaplan@ufl.edu

GREAT LAKES COASTAL MONITORING PROVIDES BASELINE PLANT DATA FOR SUSTAINABLE WETLAND RESTORATION PROJECT

Dennis A. Albert[1], *Shane C. Lishawa*[2], *Beth A. Lawrence*[3] and *Nancy C. Tuchman*[2]
[1]Oregon State University, Corvallis, OR, USA
[2]Loyola University, Chicago, IL, USA
[3]DePaul University, Chicago, IL, USA

One of the greatest problems for land management agencies along the Great Lakes (GL) shorelines is habitat degradation resulting from the replacement of native plant communities by dense stands of invasive species, including hybrid and narrow-leaved cattails (*Typha* x *glauca* and *T*. *angustifolia*) and tall reed (*Phragmites australis*). Management agencies affected by monocultures of invasive plants include USFWS, state park and game areas, and county or city waste treatment plants, as well as NGOs such as The Nature Conservancy. One project funded by the USEPA Great Lakes Restoration Initiative is investigating harvesting large stands of invasive species and utilizing the biomass to produce biogas, thus potentially reducing habitat degradation by the invasive plants and the costs of management, as well as reducing the negative environmental impact of current herbicide treatments and burn management. This project is called *A sustainable approach for restoring wetland biodiversity* or *Cattails to methane* (CTM) for short.

The Great Lakes Coastal Monitoring (GLCM) project has collected baseline plant community data at over a hundred GL coastal wetlands, including the three sites where CTM research is being conducted. During the first year of the three-year CTM project, cattails in eighty 16m^2 plots at three sites in northern Lake Huron and the St. Marys River were treated as controls, harvested above ground with plant removal, harvesting above ground with no plant removal, or harvested both above and below ground with plant removal. Response of native plant germination and regeneration to these harvest strategies was studied during the summer of 2012 and will continue during the summer of 2013.

Initial results indicate that the seedbank contained several native species that responded well to both the above ground and complete plant removal, but not to harvest without removal. The GLCM project provides baseline plant diversity data from forty-five 1 m^2 plots studied in both 2011 and 2012 at the CTM sites, thus allowing for more detailed analysis of the affects of the various treatments on the entire flora of the sites, including native and invasive annuals, and native and invasive perennial species.

<u>Contact Information</u>: Dennis A. Albert, Horticulture Department, Oregon State University, Corvallis, OR. 97331-7304 USA, Phone: 541-737-7557, Fax: 541-737-3479, Email: albertd@hort.oregonstate.edu

APPLYING BIOTIC FUNCTIONAL ASSESSMENT TECHNIQUES TO GUIDE ADAPTIVE MANAGEMENT OF HABITAT RESTORATION ALONG THE MIDDLE RIO GRANDE, NEW MEXICO

Todd Caplan[1], ***Steven Albert***[2], *Chad Mckenna*[1] and *Ondrea Hummel*[3]
[1]GeoSystems Analysis, Inc., Albuquerque, NM, USA
[2]Parametrix, Inc., Albuquerque, NM, USA
[3]U.S. Army Corps of Engineers, Albuquerque District, Albuquerque, NM, USA

The Albuquerque District Corps of Engineers (Corps) is implementing floodplain habitat restoration projects along the Middle Rio Grande in central New Mexico with a primary objective of improving river-floodplain connectivity. Numerous projects have been constructed that involve lowering floodplain terraces to encourage overbank flooding in order to facilitate nutrient cycling, recharge the alluvial aquifer, recruit native riparian vegetation, and promote habitat development for a broad array of wildlife species. Two species of particular interest include the federally endangered Rio Grande silvery minnow (*Hybognathus amarus*) and the Southwestern willow flycatcher (*Empidonax traillii extimus*).

In addition to directly monitoring species use of the restoration projects, quantitative assessments are being performed of key physical habitat attributes considered important to the breeding life-cycles of the Southwestern willow flycatcher (SWWF) and Rio Grande silvery minnow (RGSM). The habitat attributes being measured were selected following workshops with scientists from the Corps, the New Mexico Game and Fish and the U.S. Bureau of Reclamation. Numeric rankings for presence and condition of key habitat attributes were developed to generate a site-level scoring system. Field forms were developed and site assessments were performed to assess pre-restoration (baseline) habitat functional performance and to generate baseline site scores. Post-restoration scores were projected based upon expected habitat development over time (10-year forecast) following restoration project implementation. Post-restoration monitoring will be performed every 2-3 years to evaluate if habitats are developing along the predicted trajectory. If monitoring indicates that certain site attributes are not developing or performing as predicted, the results will be used to evaluate site designs and to guide adaptive management actions.

Contact Information: Steven Albert, Parametrix, Inc. 8801 Jefferson Street, NE, Albuquerque, NM 87113, USA Phone: 505-821-4700, email: salbert@parametrix.com

A NATIONAL PERSPECTIVE ON THE DEPARTMENT OF THE INTERIOR U.S. GEOLOGICAL SURVEY'S RESTORATION STRATEGIES, PRIORITIES, ACCOMPLISHMENTS, AND CHALLENGES

William A. Lellis *Presented by:* ***Matthew Andersen***
U.S. Geological Survey, Reston, Virginia, USA

Ecosystem restoration efforts currently face enormous challenges that are likely to only increase in future years. The scope of the needed restoration and environmental degradation continue to expand while available budgets shrink. That the challenges grow larger is not a reason to abandon restoration efforts; on the contrary. Given our expanding knowledge of the services that functioning ecosystems provide to human communities, the need to prioritize, focus, and implement ecosystem restoration could not be more imperative.

This imperative, and the limited resources to conduct the work, are both recognized in recently announced programs by Department of the Interior management agencies (U.S. Fish and Wildlife Service, National Park Service, Bureau of Reclamation, and Bureau of Land Management) to manage their trust resources across broad landscapes. The U.S. Geological Survey (USGS) seeks to support her sister agencies in these efforts by providing well-founded, timely, accessible science in support of decisionmaking.

Specifically, USGS is conducting multi-disciplinary research on the following focus areas to support conservation and restoration: integrated assessment of coastal resources and resiliency; assessing combined environmental and societal risk from natural hazards; environmental flows, non-conventional energy development impacts; and innovative monitoring technologies. Scientific accomplishments and current challenges in these areas will be discussed in this presentation.

The national challenge of conducting restoration work in the face of flat or declining budgets highlights the need for all practitioners to seek ways to work together effectively. This presentation will discuss methods and forums for collaborative approaches to restoration among federal, state, and nongovernmental organizations.

Contact information: William A. Lellis, PhD, U.S. Geological Survey, Ecosystems Mission Area, MS-301, 12201 Sunrise Valley Dr., Reston, VA 20192, USA, Telephone: 703-648-4061, Fax: 703-648-4039, email: wlellis@usgs.gov

INGREDIENTS FOR SUCCESS: BUILDING A ROBUST ADAPTIVE MANAGEMENT PROGRAM

Stuart J. Appelbaum
ARCADIS, Jacksonville, FL USA

Adaptive management is a critical component of large-scale ecosystem restoration programs due to the large uncertainties involved in these programs. By their very nature, large-scale ecosystem restoration involves large spatial extent and long implementation time scales. Adaptive management provides the ability to adjust, modify, or greatly change restoration plans as new information becomes available. These adjustments are crucial for the long-term success of restoration.

Restoration of the Everglades is one of the largest ecosystem restoration efforts in the world. The Comprehensive Everglades Restoration Plan (CERP), approved by Congress in 2000, provides a framework for the Everglades restoration program. CERP consists of 68 components that will be implemented over a thirty-year period. CERP also includes an adaptive management program. Congress approved the adaptive management program and authorized an adaptive assessment and monitoring program at a cost of $100 million. In the ensuing years, a CERP adaptive management strategy has been developed, a monitoring and assessment plan has been implemented, and an adaptive management implementation guide published. In addition, four independent scientific reviews of CERP have been completed by National Academy of Sciences panels.

Using the Everglades program as a model, this presentation will focus on the ingredients for building a successful adaptive management program. Some of these key ingredients are: a statutory or regulatory mandate; funding; an adaptive management framework and linkages; a monitoring program; an assessment program; stakeholder involvement; independent scientific review; and an adjustment mechanism. The presentation will describe the CERP adaptive management program and the key ingredients for success. The ingredients of the adaptive management programs for other large-scale ecosystem restoration efforts will also be analyzed.

Contact Information: Stuart J. Appelbaum, ARCADIS, 1650 Prudential Drive, Suite 400, Jacksonville, FL 32207 USA, Phone: 904-861-2848, FAX: 904-861-2450, Email: stuart.appelbaum@arcadis-us.com

RESTORING THE HEART OF THE EVERGLADES

Thomas Van Lent[1]*, Stephen Davis*[1]*,* ***Aida Arik***[1] and *Dawn Shirreffs*[2]
[1]The Everglades Foundation, Palmetto Bay, FL, USA
[2]National Parks Conservation Association, Hollywood, FL, USA

The Comprehensive Everglades Restoration Plan (CERP) was originally conceived as 68 individual projects, spanning 38 years to complete. Each of the 68 original projects would require separate planning, Congressional authorizations and appropriations. The sponsors, the US Army Corps of Engineers and the South Florida Water Management District, were responsible for coordinating the whole to assure seamless implementation. In actual practice, however, two key obstacles arose to slow implementation, and that required a radically different approach to planning.

Firstly, the Corps of Engineers had a planning process that took years to complete; the Corps planning process took more than 7 years per project, with numerous obstacles to stakeholder participation. The state of Florida had a more open process with fewer bureaucratic obstacles, and moved quickly to plan, design and construct some of the CERP projects. To further slow progress, since Congress has passed the Water Resources Development Act (WRDA) of 2000 authorizing CERP, they have passed only one WRDA bill, creating a backlog of projects ready for authorization and appropriation. To date, the state of Florida has invested $1.2 billion more than the federal government in Everglades restoration.

Second, the projects initially designed and constructed were on the periphery of the “River of Grass”. The major ecological benefits to the Everglades ecosystem, and especially to Everglades National Park, accrue when the central Everglades is restored. Moreover, the original CERP concept had restoration of the central Everglades by implementing at least 10 separate and independent projects. This made progress on central Everglades projects difficult, as each project had so many dependencies that it was difficult to make an initial step.

In October of 2011, the Corps of Engineers and the South Florida Water Management, at the expressed request of numerous stakeholders, revamped the planning process for CERP, which they called the Central Everglades Planning Project (CEPP). They focused on an open and inclusive approach to the public, and they focused planning and analysis on resolving the issues raised by the public process. Moreover, incremental components of several CERP and non-CERP projects were combined to give an initial step that will have significant environmental benefits. This paper focuses on how the environmental stakeholders used the scientific and technical information to help build consensus among disparate stakeholders and relay concerns about key issues. We also look at the successes and failures of CEPP in overcoming the obstacles to progress in CERP.

<u>Contact Information</u>: Thomas Van Lent, The Everglades Foundation, 18001 Old Cutler Road, Suite 625, Palmetto Bay, FL, 33158, USA. Phone: 786-249-4456, Email: tvanlent@evergladesfoundation.org

EVOLUTION OF STRUCTURES FOR HABITAT AND STABILITY ON STREAM RESTORATION PROJECTS

J. George Athanasakes
Stantec Consulting Services Inc., Louisville, KY, USA

Stream restoration projects focus on providing stream stability while increasing habitat. Over the years a number of structures have been utilized within stream restoration projects to provide grade control, prevent channel downcutting, reduce streambank erosion, increase aquatic habitat, and promote bed diversity. The science behind stream restoration has been rapidly evolving with a number of advancements within the past decade. Similarly, structures utilized on stream restoration projects have also been rapidly evolving and many new and innovative structures are now commonly used within the profession.

Structures commonly used on stream restoration projects include constructed riffles, grade control structures, log and rock step pool structures, vanes structures, bioengineering treatments, and toe wood sod mats. The talk will focus on the evolution of these structures over the past decade and the latest enhancements to these structures for use in natural channel design applications. Constructed examples of each treatment will be presented and discussed.

Contact Information: J. George Athanasakes, PE, Stantec Consulting Services, Inc., 10509 Timberwood Circle, Suite 100, Louisville, KY 40223 USA, Phone: 502-212-5008, Fax: 502-212-5055, Email: george.athanasakes@stantec.com

PSEG'S ESTUARY ENHANCEMENT PROGRAM – 20 YEARS LATER

J. H. Balletto[1] and *K. A. Strait*[2]
[1]ARCADIS, Inc., Cranbury, NJ, USA (formerly with PSEG)
[2]PSEG Nuclear, LLC, Salem, NJ, USA

In response to the 1994 New Jersey Pollutant Discharge Elimination System permit for the Salem Generating Station, Public Service Enterprise Group ("PSEG") established the Estuary Enhancement Program ("EEP"). The EEP restored/preserved over 8,760 ha of degraded salt marsh and adjacent uplands along the Delaware Estuary. Designed to expand and protect the habitat for fish and other aquatic species, the EEP has restored diked salt hay farms and degraded *Phragmites australis*-dominated marshes.

Restoration construction was completed in the mid-1990s. Its controversial nature presented many challenges and opposition. This project demonstrates the efficacy of large-scale salt marsh restoration and the resulting increased estuarine fish production. The project also demonstrated the successful use of ecological engineering, adaptive management and the necessity for success criteria. The results of ongoing monitoring compared to reference marshes substantiate the projections made by scientists with the requisite expertise in hydrology, marsh and estuarine fish ecology. This award winning project is a functioning example useful to other large-scale restorations and potential mitigation banks. Discussion will include results of the ongoing restoration monitoring of the wetlands. Status of the restoration will be discussed in the context of the success criteria and the implementation of the adaptive management plan established *a priori*. In addition, results of the marsh fish production will also be discussed.

Contact Information: John H. Balletto; Principal Scientist/Vice President; ARCADIS, Inc.; 8 South River Road; Cranbury, NJ 08512-3698 FAX: 609 860 8007; CELL: 609 320 0113; EMAIL: John.Balletto@arcadis-us.com

RESTORING GREAT WATERS AND NATIONAL PARKS – A NATIONAL OVERVIEW

Sarah Gaines Barmeyer
National Parks Conservation Association, Washington, DC, USA

The health of our national parks is directly linked to the health of the waters that surround and flow through them. Often referred to as "America's Best Idea," the National Park System protects and preserves the nation's most iconic landscapes and cultural sites. From Sleeping Bear Dunes to the Statue of Liberty, Everglades to Olympic, water is central to features, wildlife, recreation, and aesthetics and is fundamental to visitor enjoyment. Yet, outside the parks, the health of these waters is being jeopardized. Demands for water use from urban, energy, agricultural, and industrial development are putting a strain on waters that flow through national parks. Similarly, pollution from activities beyond park boundaries, such as mining practices, erosion from land uses, and sewage overflows, damages the quality of park waters. Parks, once viewed as isolated and remote, are increasingly becoming threatened by activities occurring in their watersheds.

More than two-thirds of all 401 national park units are located in watersheds of Great Waters, such as the Chesapeake Bay, Puget Sound, and Colorado River. To protect waterways in and around national parks, the National Parks Conservation Association (NPCA) and partner organizations are working to protect and restore America's Great Waters. Restoration efforts, such as the Great Lakes Restoration Initiative and the Comprehensive Everglades Restoration Plan, are improving our national parks, putting people to work, and restoring our nation's Great Waters. Successful projects are leading to open beaches, safer drinking water, improved wildlife habitat, fewer invasive species, and cleaner rivers and lakes.

Restoring the lands and waters around our national parks are essential not only for wildlife, habitat, and visitor experience, but for countless American communities whose drinking water, economic well-being, and jobs depend on the goods and services provided by a sustainable, natural environment. National parks directly contribute $13.2 billion to the economy and generate nearly 270,000 private-sector jobs annually. Mather Economics found that every $1 invested in Everglades restoration generates $4 in ecosystem benefits, such as water supply, real estate, tourism, and recreational opportunities.

Although restoration efforts are making progress, they are hampered by a lack of funding, broken federal water policies, and limited political will. Our national parks can help bring attention to these problems by becoming – according to the vision of the National Parks Second Century Commission's Science and Natural Resource Committee – "epicenters for catalyzing dialog on the future American landscape" and ensuring an American landscape is managed to "sustain ecological integrity, beauty, enjoyment, and national identify." NPCA is helping realize that vision by engaging with the restoration community with the goal of making the restoration of our Great Waters a national priority.

Contact Information: Sarah Gaines Barmeyer, Great Waters Program Manager, National Parks Conservation Association, 777 6th Street NW, Suite 700, Washington, DC 20001, USA, Phone: 202-454-3311, Email: sbarmeyer@npca.org

WORDS MATTER: TIPS FOR USING COMMUNICATIONS TO IMPROVE RESTORATION EFFORTS

Rebeca Bell
Biodiversity Project, Chicago, IL, USA

Preventing stormwater pollution requires people to make specific changes in their behavior.
Just educating people on a topic by itself will not inspire most people to take an action. Instead, we must use communication techniques to reach target audiences with specific values-based messages.

Environmental educators and conservation staff must understand and consider the needs and values of their audiences in order to create compelling and motivational materials and websites. Values-based communications and social marketing tools can help move people toward making behavior changes that encourage restoration.

Biodiversity Project has created innovative and targeted environmental outreach campaigns for a variety of audiences. In this presentation, Biodiversity Project will work with participants to show how communication strategies can make or break efforts to change behaviors and promote sustainable decision-making. We will demonstrate how organizations of all sizes can strategically integrate communications into their program and restoration work to achieve their environmental goals.

Designed to increase limited staff capacity and make public education and outreach efforts more effective, this session will help participants focus campaign outcomes so they are measurable and specific.

Contact Information: Rebeca Bell, Biodiversity Project, 4507 N Ravenswood Ave, Suite 106, Chicago, IL, 60640, USA ,
Phone: 773-754-8302, Fax: 312-268-5238, Email: rbell@biodiverse.org

RESTORATION OF SPAWNING HABITAT FOR NATIVE FISH IN THE CENTRAL GREAT LAKES

David H. Bennion[1], *Edward Roseman*[1], *Bruce Manny*[1], *Greg Kennedy*[1], *James Boase*[2] and *Jacqui Craig*[1]
[1]U.S. Geological Survey, Great Lakes Science Center, Ann Arbor, MI, USA
[2]U.S. Fish and Wildlife Service, Alpena, MI, USA

Over the past 100 years, rock-rubble spawning habitat used by high-value native fish such as lake whitefish, lake sturgeon, and walleye, was systematically removed from the bottom of the St. Clair and Detroit Rivers during creation of navigation channels. Decreased diversity and abundance of many valuable, native fish populations in the St. Clair and Detroit Rivers was an environmental result of this channelization. Since 2002, restoration of this lost fish spawning habitat has been a research objective of the St. Clair-Detroit River Initiative (or Huron-Erie Corridor Initiative), and is a prime example of remediation of beneficial use impairment (BUI) 14 – Loss of fish and wildlife habitat, in these two international areas of concern. A decade of scientific investigations has produced specific information about factors which govern selection of spawning habitat by benthic, lithophilic, native fish represented by lake sturgeon, lake whitefish, and walleye. We have developed a rigorous assessment protocol that guides an adaptive management strategy to effectively remediate losses of such habitat, based on a geo-spatial model of water velocity and depth in these two rivers. To date, we have restored fish spawning habitat at Belle Isle and Fighting Island in the Detroit River and in the Middle Channel of the St. Clair River that has been used successfully used each year for spawning by over 14 species of fish. Seven additional fish spawning habitat remediation projects are planned for construction in these two rivers by 2015. Two years of pre- and post-construction assessment of fish egg deposition rates per unit area of river bottom, upstream, on, and downstream of the selected spawning reef construction sites permit scientists to quantify the extent to which each spawning habitat project has increased fish spawning habitat productivity. Ongoing scientific studies of larval fish production transport and distribution, as well as adult fish abundance and species diversity also contribute to this adaptive management process. We anticipate that remediation of these spawning habitats will measurably contribute to the abundance and resilience of numerous valuable native fish species in this central Great Lakes area. These habitat construction projects will also help enable the delisting of BUI 14 in these two areas of concern.

<u>Contact Information</u>: David H. Bennion, Great Lakes Science Center, U.S. Geological Survey, 1451 Green Rd. Ann Arbor, MI, 48105. Phone: 734-214-7262. Email: dbennion@usgs.gov

SIMULATING NATURAL RESOURCE FUNCTIONS IN GREEN INFRASTRUCTURE

Joe Berg
Biohabitats, Inc., Baltimore, MD, USA

Green infrastructure, for the purpose of this presentation, is focused on watershed hydrology in the context of stormwater management. Currently, the infrastructure associated with the collection and conveyance of stormwater runoff to receiving streams is generally failing and is one of the more expensive infrastructure maintenance activities burdening local governments. Whether relatively modern and designed with stormwqter quantity and quality control measures, or older and functioning primarily to shed rainwater, these drainage networks are failing and contributing to the degradation of our remaining streams and aquatic resources. As this failing infrastructure is repaired and/or replaced, we have an opportunity to rethink and reengineer how we manage our rainwater runoff. On a number of projects, including institutional redevelopment, new suburban development, and emergency repairs, the replacement of the old engineering practices with modern ecologically-engineered practices promises to cost less, have lower long-term operation and maintenance costs, provide superior hydro-modification functions, and protect, enhance and restore aquatic resources. As a result, ecologically engineered solutions can be a more sustainable solution.

The ecologically engineered approach described in this presentation consists of open channel collection, storage and conveyance of runoff coupled with subsurface sand-based bioreactors using principles of stream, wetland, and bioretention BMP design. Add to this the integration of ecosystem functions (e.g., floodplain storage, plant nutrient attenuation), and it is easier to imagine a system of drainage that becomes a resource-based infrastructure, rather than a less than satisfactory exercise in solving a problem of surplus water from storms.

This presentation will focus on two constructed projects using these techniques, comparing the initial 'status quo' engineering approach (e.g., pipes, ponds, etc.) with the ecologically engineered solution. A comparison of impact areas, resource enhancement areas, design and construction costs, other financial costs and benefits, and a description of ecosystem services for each project and project alternative will be presented.

Contact Information: Joe Berg, Biohabitats, Inc., 2081 Clipper Park Drive, Baltimore, MD 21211 USA, Phone: 410-554-0156, Fax: 410-554-0168, Email: jberg@biohabitats.com

DEVELOPMENT OF A GRADED APPROACH TO PROJECT-LEVEL QUALITY DOCUMENTATION FOR HABITAT RESTORATION PROJECTS

Louis J. Blume[1], *Craig J. Palmer* [2], *Justin W. Telech*[3] and *Molly Middlebrook Amos*[2]
[1]USEPA, GLNPO, Chicago, IL, USA
[2]CSC, Alexandria, VA, USA
[3]CSC, Research Triangle Park, NC, USA

The purpose of the preparation of project-level quality documentation (QD) is to identify the quality control (QC) and quality assurance (QA) activities associated with the planning, implementation, and assessment of projects that include the collection and/or use of environmental data. A graded approach is used to identify the level of detail and comprehensiveness needed for project-level QD supporting various project types (e.g., monitoring, habitat restoration and invasive species control, sediment remediation, research). The graded approach ensures the rigor of requested quality is commensurate with the importance of work, availability of resources, unique needs of the participating organizations, and consequences of potential decision errors. When implemented, the overall goal of the application of the graded approach is to assist both grantees and grantors in 1) understanding the level of rigor required for projects, 2) reducing the level of effort required to develop, review, and approve QD, and 3) streamlining the QD review and approval process.

In the development of a graded approach for habitat restoration projects, three project categories were identified. A “rigorous” category is for projects requiring significant and detailed planning of QA activities due to the intended use of the data, project scope or impact, and complexity of sampling and lab analysis activities. The second category is termed the “routine” category and is the most typical category for many projects. The third is the “simplified” category and this applies to small projects with limited environmental data collection activities. For example, a routine local restoration project may qualify for selection into the simplified category.

During this past year, the U.S. EPA Great Lakes National Program Office (GLNPO) has piloted a graded approach for projects funded by the Great Lakes Restoration Initiative (GLRI). The pilot included participation from QA staff and project officers from GLNPO and USEPA Region 2. Individuals assessed QD while conducting a review to determine the category for a specific project and to determine if the level of quality as defined in the QD review checklists was appropriate for that category using their best professional judgment. Each QD was reviewed by two or more individuals to allow for a comparison of results and to refine the methodology. This presentation will highlight the design of graded approach for projects under GLNPO’s administration, the pilot and its results, and the implementation of the graded approach as it pertains to habitat restoration projects.

Contact Information: Louis J. Blume, Great Lakes National Program Office, 77 West Jackson Blvd, Chicago, IL, 60604, USA, Phone: 312-353-2317, Fax: 312-353-3018, Email: blume.louis@epa.gov

INCORPORATING CLIMATE CHANGE ADAPTATION INTO CHESAPEAKE BAY ECOSYSTEM RESTORATION

Donald F. Boesch and *Marcus Griswold*
University of Maryland Center for Environmental Science, Cambridge, MD, USA

The Chesapeake Bay Program is seeking to restore the United States' largest estuarine ecosystem through a multifaceted effort that extends throughout the 64,000 square mile watershed, spanning six states and the District of Columbia. The Program has a central focus on water quality, but also includes aspects that deal with land use and practices, habitat restoration and living resource management.

Consideration of climate change was first brought onto the table by the regional scientific community, but has since begun to be addressed through federal interagency planning, local government initiatives and, to some extent, state adaptation strategies. Maryland has been the most progressive in the development of adaptation strategies by sector (e.g. water resources, agriculture, and human health), as well as through statutory policies for reducing greenhouse gas emissions. Adaptation has received less attention in the other states where climate change often remains a politically charged issue. Incorporation of climate change adaptation into the goals and approaches of the multistate Chesapeake Bay Program still is in its early stages.

While the needs for adaptation are clear for some highly likely changes (e.g. sea-level rise and increased flashiness in runoff), the implications for some changes (amount and timing of runoff, future agricultural cropping, etc.) are less clear. This suggests that restoration efforts involving nutrient and sediment load reductions should stay the course toward the established objectives for the year 2025, while climate change trajectories and their consequences are better resolved. Other restoration efforts dealing with tidal wetland protection and restoration and stream rehabilitation should begin to incorporate climate change adaptation now.

Contact Information: Donald F. Boesch, University of Maryland Center for Environmental Science, P.O. Box 775, Cambridge, MD 21613 USA, Phone: 410-221-2000, Fax: 410-228-3843, Email: boesch@umces.edu

THE APPLICATION OF NATURAL CHANNEL DESIGN METHODS FOR RESTORING WATERSHED HYDROLOGY AND FUNCTIONAL RIPARIAN ECOSYSTEMS AFTER MINING

Marty Boote[1], *Alice Bailey*[1] and *Lance Moody*[2]
[1]Environmental Consulting & Technology, Inc., Ann Arbor, MI, USA
[2]Mosaic Fertilizer, LLC, Lithia, FL, USA

Mosaic Fertilizer, LLC (Mosaic) mines phosphate rock in the West-Central Florida phosphate region. Following mining, Mosaic reclaims the mined land to replace natural wetland, terrestrial, and riparian systems; maintain natural hydrology; and return the land to other useful purposes such as agriculture, recreation, and community development. Successful reclamation requires establishing natural drainage and reconnection of drainage areas to off-site habitats and riparian systems. This requires careful contouring of the land surface and creation of natural stable stream channels that convey runoff while providing aquatic habitat.

Streams are the natural conduit for draining the land surface. When fully functional, streams convey water form the land surface while remaining stable, provide critical habitat for wildlife and aquatic biota, and serve as travel corridors that provide access to critical habitat and promote distribution. Streams are often interconnected with riparian wetlands. In those cases, the ecology of the riparian wetland is linked to the stream and the ecology of the stream is linked to the riparian wetland; neither component of the ecosystem is fully functional without the other.

We use a natural channel design process to design and construct natural functioning streams on reclaimed lands that are typically also associated with riparian wetlands. A total of 3,550 feet of natural stream channel were created at two different Mosaic mines in West-Central, Florida. A reference stream survey and hydrological analyses were used to estimate bankfull discharge, develop scalable morphological parameters, size the two stream channels, and design the channel planform and profile. The streams were constructed in October and December of 2009.

After two years, the morphology of the stream channels closely resembles the design. However, some adjustments have occurred in channel dimensions such that the streams now have a greater degree of morphological variability than when constructed. This result shows that the channels are remaining stable but fluvial processes are creating diversity through sediment transport processes and pool formation. Recent monitoring shows that fish and macroinvertebrates have colonized the streams. Interaction with the riparian wetlands is also occurring through overbank flows.

Contact Information: Marty Boote, Environmental Consulting & Technology, Inc., Ann Arbor, MI 48105, USA, Phone: 734-769-3004, Fax: 734-769-3164, E-mail: mboote@ectinc.com

COST-EFFECTIVE MONITORING OF FISH PASSAGE AND BIOLOGICAL RESPONSES TO DAM REMOVAL

M. Boote[1] and *Paula Bizot*[2]
[1]Environmental Consulting & Technology, Inc., Ann Arbor, Michigan, USA
[2]National Oceanic & Atmospheric Administration, Ann Arbor, Michigan, USA

The Great Lakes Restoration Initiative (GLRI) created important restoration opportunities throughout the Great Lakes Basin. Perhaps more importantly GLRI invoked a new era of accountability predicated on demonstrated restoration success through effective monitoring. The availability of funding for monitoring restoration projects was previously limited and insufficient. The National Oceanic & Atmospheric Administration (NOAA) provided a GLRI grant to the Berrien County Brownfield Redevelopment Authority (BRA) to remove two dams on the Paw Paw River in 2010, the first fiscal year GLRI funding was available. The Paw Paw River is a tributary of the St. Joseph River and Lake Michigan. Removing the dams not only restored riverine habitat and functions but provided unrestricted fish movement for the first time in more than 100 years – the period over which dams had existed at this location on the Paw Paw River. NOAA funded the project to benefit native Lake Michigan potadromous fish species such as the threatened lake sturgeon and recreationally important walleye, as well as recreationally and ecologically important resident fish species such smallmouth bass and native sucker species. The project partners developed a cost-effective project monitoring protocol that would 1) verify fish passage, 2) demonstrate fish community changes, and 3) assess habitat improvements.

The hypothesized project outcomes were confirmed through monitoring. We used both direct and indirect measures of fish passage. Indirect measures included velocity, jump height, and water surface slope measurements before and after dam removal. Direct measurement of passage was accomplished using a simple mark-recapture study. Target fish were marked by clipping the anal fin for later recapture. This technique increases the probability of capturing marked fish over 50 miles of river at a relatively low cost versus more advanced techniques such as telemetry. To further reduce costs associated with the mark-recapture effort fish collections were done during spawning runs; fishing effort was focused on habitat where spawning fish were concentrated; and only identified target fish species were marked. The number of native sucker species marked is 436, while the number of walleye marked is 25, for a total of 461. This method proved effective when a fin-clipped white sucker was recaptured one-year after being marked near the dams; this white sucker was recaptured in 2012 approximately twenty river miles downstream from where it was marked in 2011. The mark-recapture method also resulted in the recapture of a marked golden redhorse upstream of the former dam location; this individual was captured and marked downstream of the former dam location two weeks prior. Fish community changes were also studied in an abandoned historic channel using diversity indices and a t-test proposed by Hutcheson (1970) for the Shannon-Wiener Diversity Index. Sampling and data analysis showed a statistically significant change in the fish community of the historic channel from a warm-water, lentic assemblage to a cool-water, lotic assemblage.

<u>Contact Information</u>: M. Boote, Environmental Consulting & Technology, Inc., 2200 Commonwealth Blvd., Suite 300, Ann Arbor, MI 48105, Phone: 734-769-3004, Fax: 734-769-3164, Email: mboote@ectinc.com

ECOLOGICAL RESTORATION EFFORTS IN THE ST. LOUIS RIVER ESTUARY: APPLICATION OF GREAT LAKES MONITORING DATA

Valerie Brady, *George Host, Lucinda Johnson* and *Gerald Niemi*
Natural Resources Research Institute, University of Minnesota, Duluth MN 55811 USA

The St. Louis River Area of Concern (Duluth, Minnesota, and Superior, Wisconsin) is the recipient of much recent activity as part of the plan for delisting. The delisting coordination group is using the "remediation-to-restoration" model for a number of degraded sites within the estuary. This strategy specifies that a restoration plan be developed before most remediation efforts start so that remediation work is done in such a way that it leads into the restoration effort with little wasted work.

Recent monitoring of birds, fish, macroinvertebrates, and plants in estuary wetlands has aided the development of strategies for restoration in several areas, with the expectation that the same approach will be used with at least 6 more sites within the estuary. Great Lakes Coastal Wetland Project monitoring data are being used as a baseline against which to judge restoration outcomes, place restored and extant estuary wetlands' condition in context with other sites around the Great Lakes, and guard against future degradation. It is likely that some version of this monitoring program will be incorporated into a long-term estuary wetlands monitoring design.

Recently, additional intensive sampling for some taxa has been conducted at several remediation-to-restoration sites and data were incorporated into models predicting potential outcomes for several restoration scenarios for two restoration areas, each covering about 125 ha. Besides biotic information, data on sediment, water depth, and wind were incorporated into the modeling effort. With input on desired outcomes from the public, these models and scenarios will inform future planned remediation-to-restoration areas within the St. Louis River AOC.

Contact information: Valerie J. Brady, Natural Resources Research Institute, University of Minnesota Duluth, 5013 Miller Trunk Highway, Duluth, Minnesota, 55811 USA, Phone: 218-720-4353, Fax: 218-720-4251, Email: vbrady@d.umn.edu

INTEGRATING ECOLOGICAL MODELS WITH REAL-TIME HYDROLOGIC DATA IN FLORIDA'S EVERGLADES

S. Romañach[1], P. Darby[2], H. Waddle[3], D. DeAngelis[1], K. Suir[3], S. Chimmula[3] and *C. Conzelmann[3]*
Presented by: ***Laura Brandt***
[1]Southeast Ecological Science Center; U.S. Geological Survey; Davie, FL USA
[2]University of North Florida; Department of Biology; Pensacola, FL USA
[3]National Wetlands Research Center; U.S. Geological Survey; Lafayette, LA USA

Ecological modeling is being used in Florida's Everglades restoration to inform selection among alternative restoration project plans. The Central Everglades Planning Process (CEPP) was announced by the U.S. Army Corps of Engineers and the South Florida Water Management District in late 2011 to focus on the third generation of restoration projects for the central Everglades region, south of Lake Okeechobee to Florida's south coast. During the first phase of this process, ecological models were selected to be used as Ecological Planning Tools (EPT) to inform decision makers about impacts of restoration plans on wildlife species of interest in the Everglades. Two of the EPTs selected for use in the process are an apple snail (*Pomacea paludosa*) population model and an amphibian community species richness model. From wading birds and alligators to apple snails and amphibians, changes in both water depths over time and water depth patterns over the landscape are crucial for determining not only where suitable habitat may occur in the landscape but also the reproductive success of many species in the Everglades. For use in the Everglades, apple snail and amphibian ecological models were developed using hydrologic data from the Everglades Depth Estimation Network (EDEN). The fine spatial and temporal scales of EDEN have allowed ecological model development to include detail and perform with accuracy that had not previously been possible in the Everglades. The use of EDEN has allowed ecologists and modelers to quantify the relationships between species and water depth both spatially and temporally in a manner that allows for a more accurate way to predict changes across the Everglades landscape.

<u>Contact Information</u>: Stephanie S. Romañach; U.S. Geological Survey; 3205 College Ave.; Davie FL 33314; Phone: 754.264.6060; Fax: 954-475-4125; Email: sromanach@usgs.gov

USING ECOLOGICAL INDICATORS TO EVALUATE PROGRESS TOWARD RESTORATION: AN EXAMPLE FROM THE EVERGLADES

Laura A. Brandt
U.S. Fish and Wildlife Service, Davie, FL, USA

Tracking progress toward successful restoration is challenging because of complexity of natural systems and diversity of stakeholders and participants. Using ecological indicators to help to measure and communicate the state of the ecosystem is one way to deal with these complexities. Ecological indicators can be used in various phases of restoration including in planning and design for evaluation and selection of plans, in monitoring to determine status, track trends, assess project impacts and track progress toward project success and in adaptive management to increase certainty and improve decisions. Ecological indicators also can be used for communication to congress among researchers, project managers, and the public. Each of these uses and audiences have different information needs and values making it challenging to have a single set of ecological indicators that address all needs.

In the Everglades, the South Florida Ecosystem Restoration Task Force requested that the Science Coordination Group help facilitate development of a small set of system-wide ecological indicators to evaluate performance of restoration projects toward achieving Task Force Strategic Plan and Comprehensive Everglades Restoration Plan (CERP) restoration goals. Those indicators are used in a biennial report to Congress and presented in a broader System-wide Ecological Indicators for Everglades Restoration report. Initial reports were developed in 2006 with subsequent reports produced every two years. Over the years the reports have evolved with an eye toward better addressing needs of the audiences and better integration among indicators and across other reporting mechanisms including the CERP Restoration Coordination and Verification (RECOVER) System Status Report (SSR) and Interim Goals report. Some of the steps necessary for better integration and communication have been fairly straight forward and easy (having a standard format for displaying the status of indicators and coordination on reporting years) while others have been more challenging (integrating with other reports prepared for different audiences, integrating indicators in a true system-wide manner, and dealing with funding shortfalls that have changed what data are available for reporting). This presentation will provide a history of the System-wide Ecological Indicators for Everglades Restoration and discuss current challenges and opportunities in reporting on these indicators and for improvement of the reports.

Contact Information: Laura A. Brandt, U.S. Fish and Wildlife Service, Davie, FL 33314 USA, Phone: 954-577-6343, Fax: 954-475-4125, Email: laura_brandt@fws.gov

LINKING ECOLOGICAL RESTORATION AND ECONOMIC RECOVERY AT A GREAT LAKES AREA OF CONCERN: MUSKEGON LAKE, MI

Victoria Pebbles and ***Heather Braun***
Great Lakes Commission, Ann Arbor, MI, USA

Habitat restoration can enhance a suite of ecosystem services including fish production, water quality regulation, and recreation. Habitat restoration is often targeted in rural areas as opposed to urban areas for a variety of reasons including, greater habitat connectivity, larger potential project size, and lower overall costs. Yet restoration in urban areas has the potential to influence more people, and contribute more directly to economic revitalization and maximization of ecosystem services in ways not possible in more rural areas.

Human development has often been concentrated in areas that provide a rich array of ecosystem services, such as rivermouths. Intense human activity has led to substantial pressures on and degradation of the ecological services inherently provided by different ecosytems. In many cases, prolonged human development with little or poor attention to ecological health has fundamentally altered ecosystems, diminishing or degrading ecological functions and associated ecological services. The majority of Great Lakes “Areas of Concern,” for example, contain or are located within a rivermouth.

Great Lakes “Areas of Concern” (AOCs) have been a focal point for ecological restoration in the Great Lakes region for more than 25 years. The recent emphasis on habitat restoration at Great Lakes AOCs provides an opportunity to consider the link between ecological restoration and economic revitalization and to evaluate the benefits of restoring ecological function and services in degraded urban areas. This presentation will address ways that potential restoration projects should be selected, including a more robust and deliberate assessment and appreciation of ecosystem services and attendant economic outcomes. Our presentation will feature the Muskegon Lake Area of Concern as a case example of a large-scale coastal restoration that included a socio-economic assessment of the conservation investment. The results of the study suggested a greater than 6:1 return on conservation investment over the next 15 years. These are compelling figures not seen in previous analyses that have the power to shape decisions about future ecological restoration and economic revitalization as part of habitat restoration strategies. We will highlight both the challenges encountered when conducting restoration at a previously contaminated site and the role of the local community in establishing restoration targets and outcomes, and explore similar examples at other sites within the Great Lakes.

<u>Contact Information:</u> Victoria Pebbles, Great Lakes Commission, 2805 S. Industrial Hwy. Suite #100, Ann Arbor, MI 48104 USA, Phone: 734-971-9135, Fax: 734-971-9150, Email: vpebbles@glc.org

RESTORE THE MISSISSIPPI RIVER DELTA

Derek Brockbank
Restore the Mississippi River Delta, Washington, DC, USA

High rates of land loss in the Mississippi River Delta endangers one of the most ecologically and economically important natural resources in the U.S. Restore the Mississippi River Delta, a partnership between five non-governmental organizations (the National Audubon Society, Environmental Defense Fund, the National Wildlife Federation, Coalition to Restore Coastal Louisiana, and the Lake Pontchartrain Basin Foundation), works to move coastal restoration in Louisiana from plan to action. They do this by advocating the creation of a science-based comprehensive restoration plan for the delta that can be implemented by a multi-agency state and federal governance structure, and advocating for the necessary funding and community support for its completion.

The coalition has staff with expertise in science, public policy, outreach, and communication that work to together to reach the campaign's goals. The science staff provides the technical expertise that shapes and drives the policies of the campaign. The state and federal policy experts craft policies that will move delta restoration forward and have both bipartisan and stakeholder support. The communications staff translates the work of the science and policy experts into videos, fact sheets, and social media to raise awareness and educate the general public about the importance of the delta to the nation and the need for large-scale restoration. The outreach staff works locally with oystermen, fishermen, businesses, communities, and individuals to build support in Louisiana for restoration and nationally to engage businesses, hunters, anglers, and others to inform them about the economic and environmental importance of the delta and enlist their help in encouraging federal actions that support delta restoration.

In 2012, large-scale restoration of the Mississippi River Delta took two significant steps forward: Louisiana passed their 2012 State Master Plan, a bold 50-year vision for restoring the coast, and Congress passed the RESTORE Act, which will provide a funding source for restoration from the fines and penalties BP must pay for the 2010 oil spill. 2013 is a pivotal year in turning these plans and funding into actual on-the-ground restoration projects. The Mississippi River Delta Restoration Coalition will continue to engage community-stakeholders, scientists, and policy makers to expand the understanding of what is possible for restoration of a sustainable Mississippi River Delta.

Contact Information: Derek Brockbank, Mississippi River Delta Restoration Campaign, 901 E Street NW, Suite 400, Washington, DC 20004, Phone: 202-797-6666, Email: brockbankd@nwf.org

RESTORATION OF THE BLUEGRASS ECOSYSTEM

***David Brown**, Alexi Dart-Padover* and *Jennifer Koslow*
Eastern Kentucky University, Richmond, KY, USA

The Bluegrass ecosystem of central Kentucky is biologically diverse and impaired by centuries of agriculture production and development. There are no known areas that have escaped intensive human disturbance, and relatively small areas are currently protected. The historical record of the native ecosystem is poor. Thus there is a weak understanding of the appropriate targets for restoration. Currently there is no centralized effort for region-wide restoration planning. However, conservation projects focused on particular habitats within the ecosystem do exist. For instance, The Nature Conservancy has been effective in leading efforts to protect a corridor along the Kentucky River known as the palisades. Although this is a critical habitat within the Bluegrass region, the palisades represents a small portion of the actual area of the Bluegrass region. Based on the best available accounts, the Bluegrass ecosystem was historically dominated by savanna habitat with scattered woodland patches, large cane brakes, and extensive distribution of a now endangered species of clover. This deciduous savanna habitat is unique in North America.

In the recent past, some regional restoration efforts have experienced setbacks as funding for land management has been difficult to sustain. The state wildlife agency has the most reliable funding and resources, but its mission is not driven by ecosystem restoration. As an example, a disturbed savanna habitat with old-growth woodlands known as Griffiths Woods was purchased through a state conservation fund. The property ownership and management was then transferred from a state university to the state fish and wildlife agency. In the process, the management goals have shifted away from active research-based restoration.

Two models of conservation are highlighted in this report. First, a student-led restoration of a 6o acre pasture to a woodland savanna at Eastern Kentucky University has created unique partnerships driven by a typically underutilized stakeholder group, university students. The second model focusses on active management of a historically abundant but currently federally endangered species of plant through adaptive, research-based management at a Department of Defense facility. We argue that the active management strategies currently occurring at these two sites can function as a catalyst to promote scaled-up, region-wide ecosystem restoration efforts. In addition to the obvious need for regional planning, the work described here also brings attention to research needs, including a better understanding of historical ecosystem conditions.

Contact Information: David Brown, Department of Biological Sciences, Eastern Kentucky University, 521 Lancaster Dr., Richmond, KY 40475 USA, Phone: 859-622-2283, Email: david.brown@eku.edu

THE NEED FOR FISH PASSAGE ABOVE RIM DAMS IN THE CENTRAL VALLEY

Howard Brown
NOAA, NMFS, Sacramento, California, USA

Extensive extirpation of historical populations has placed Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead in danger of extinction. The proximate problem afflicting these species is that their historical spawning and initial rearing areas are largely inaccessible due to the presence of large dams. For example, 15 of the 18 or 19 historical populations of Central Valley spring-run Chinook salmon are extinct, with their entire historical spawning habitats behind various impassable dams. In addition to habitat loss, substantial habitat degradation also contributes to the dire status of these species, and anthropogenic climate change is expected to exacerbate conditions. Climate models for the Central Valley are broadly consistent in that temperatures in the future will warm, total precipitation may decline, the variation in precipitation may substantially increase (i.e., more frequent flood flows and critically dry years), and snowfall will decline. Because many anadromous salmonid populations have been extirpated in the Central Valley due to dams, and climate change is expected to further constrain the ability of resource managers to provide suitable water temperatures and flows downstream of the dams, NMFS believes it is necessary to work with co-managers and stakeholders in pursuit of reintroducing winter-run Chinook salmon, spring-run Chinook salmon, and steelhead to historical habitats upstream of some dams. The Central Valley Technical Recovery Team recommends just such an effort: "*To recover Central Valley salmon and steelhead ESUs, some populations will need to be established in areas now blocked by dams or insufficient flows. Assuming that most of these dams will remain in place for the foreseeable future, it will be necessary to move fish around the dams*." This presentation will cover why salmon and steelhead reintroductions are needed, the priority watersheds for reintroductions and some of the primary issues associated with reintroductions.

Contact Information: Howard Brown, Fishery Biologist, NOAA's National Marine Fisheries Service, 650 Capitol Mall, Suite 5-100, Sacramento, CA 95814, Phone: 916-930-3600, Fax: 916-930-3629, Email: howard.brown@noaa.gov

LESSONS FROM THE DEVELOPMENT AND USE OF NUMERICAL MODELS IN RESTORATION PLANNING ON THE MISSOURI AND COLUMBIA RIVERS

Kate Buenau
Pacific Northwest National Laboratory, Sequim, WA, USA

Decision making in large-scale restoration programs can benefit from numerical models that synthesize knowledge of the habitat and species of concern, predict the outcomes of alternative restoration actions, and identify key uncertainties. Two examples are the models developed for U.S. Army Corps of Engineers (USACE) habitat restoration programs: adaptive management of Emergent Sandbar Habitat (ESH) on the Missouri River for endangered least terns and threatened piping plovers, and tidal wetland restoration in the Lower Columbia River Estuary (LCRE) to support the recovery of threatened and endangered salmonids. The ESH model predicts population dynamics of birds nesting on habitat the USACE constructs to compensate for the lack of regular habitat-creating flows on the regulated river. The Salmon Estuarine Habitat Index (SEHI) model quantifies benefits of estuarine habitat restoration for juvenile salmon in the LCRE; specifically, it evaluates alternative hydrological reconnection actions at a restoration site by linking physical characteristics of the habitat to juvenile salmon growth. Lessons from the development and use of these models may inform the use of models for other restoration programs.

Both models were initially developed using a rapid prototyping process. Subject matter experts defined key processes to include and used best available data to estimate parameters and related uncertainties. The prototypes were then iteratively tested and refined. The most critical data need for the ESH model has been accurate monitoring of habitat and populations to parameterize and validate the model. The connection between ESH and nesting birds is relatively direct and observable, but the large scale of the system and the variable nature of ESH make monitoring an extensive and costly effort. The SEHI model relies on targeted research, because directly measuring the response of subyearling salmonids to habitat is difficult. Challenges include quantifying benefits of variable timing and duration of use by different stocks and species, in habitat that develops gradually following hydrological reconnection. Both models explicitly include uncertainty to allow research needs to be quantified and prioritized. By synthesizing research information and monitoring data for a system, often for the first time, numerical models benefit both restoration and research planning.

The application of models and their incorporation into the planning process can be challenging. A single model is unlikely to adequately address all decisions; identifying key decisions and objectives is critical. As with adaptive management, integrating numerical models into the decision making process can take time. The technical nature of some models creates barriers to understanding, but user-friendly interactive models improve access and encourage discussion. The usefulness of a model may become more apparent after unexpected events that highlight gaps in understanding. Even models with high uncertainty, which may appear less informative for decision making, provide a focus for discussing assumptions, the state of the science, and the refinement of decisions and objectives.

Contact Information: Kate E. Buenau, Marine Sciences Laboratory, Pacific Northwest National Laboratory, 1529 W Sequim Bay Rd., Sequim, WA 98382, USA. Phone 360-681-4590, Fax: 360-681-3681, Email: kate.buenau@pnnl.gov

CRANEY ISLAND EASTERN EXPANSION (CIEE) OYSTER MITIGATION OYSTER SHELLSTRING SURVEY

Russell P. Burke
Christopher Newport University, Newport News, VA, USA

The Craney Island Eastern Expansion (CIEE) mitigation plan for oyster (*Crassostrea virginica*) restoration consists, in part, of constructing a network of oyster reefs throughout the Elizabeth River in partial compensation for ecological services lost due to the construction of the CIEE and associated multi-billion dollar Virginia Port Authority (VPA) port facility. In order to document fully the long-term stability, and regional impact, of the mitigation reefs, the impact of the reefs on local oyster recruitment must be determined. The most cost-effective and accurate way to determine the impact using present monitoring methods is to conduct a shellstring survey for several years post-construction within the Elizabeth River. The 2012 CIEE oyster mitigation oyster shellstring survey represents a system-wide, and site-specific, pre-construction proxy measure of oyster recruitment that is directly derived from the remnant background oyster population in the Elizabeth River. The 2012 CIEE shellstring survey consisted of seven sites in various locations around the Elizabeth River watershed with a total of twenty-eight shellstrings deployed/retrieved weekly from June 4th to October 2nd. A shellstring consists of twelve oyster shells of similar size (>76 mm in length) drilled through the center and strung (inside of shell facing the bottom) with ~1-inch spacers on heavy gauge (14 ga) wire. Four shellstrings, two composed of fresh shells and two composed of fossil shells, were deployed at each site. With fresh shells being scarce, and the knowledge that a recent Virginia fossil shell survey has revealed extensive fossil oyster shell deposits, empirical testing of the two shell types may prove quite useful to current and future oyster mitigation and restoration efforts.

There were at least two visible oyster settlement periods in the Elizabeth River in 2012. Oyster spat settlement differed significantly among sites (General Linear Model, p = 0.014) and was consistently highest at sites sustaining warmer, higher-salinity conditions. The finding of no statistically-significant interaction between site location and shell type leads to the conclusion that both shell types are satisfactory for oyster reef mitigation/restoration. At sites that received regular (sometimes very high) barnacle settlement, fresh shells experienced intense barnacle settlement – to the extent that one may consider it fouling – while fossil shells experienced little to no barnacle settlement. A Kruskal-Wallis analysis of mean barnacle ranks (estimates of barnacle density of an approximate log scale) versus shell type showed a significant difference in barnacle fouling for Week 4 (p = 0.031) and a similar trend for Week 12 (p = 0.076). It appears that fossil shells foul at a lower rate than do fresh shells; a lower fouling rate improves the likelihood that fossil shell reefs will remain viable during years of poor recruitment.

In conclusion, this survey firmly establishes pre-construction oyster settlement patterns at the selected Elizabeth River sites. Ultimately, reef performance, in conjunction with this annual shellstring survey, will reflect the long-term stability of these habitats and their capacity to mitigate regional ecological impacts associated with the construction of the CIEE project.

Contact Information: Russell P. Burke, Christopher Newport University, Newport News, VA 23606 USA, Phone: 804-815-0272, Email: russell.burke@cnu.edu

SUCCESSES AND CHALLENGES IN RESTORING OLIGOHALINE MARSH AND COASTAL UPLANDS IN THE TAMPA BAY REGION

Michael A.G. Burton[1] and *Candie Pedersen*[2]
[1]Stantec Consulting Services, Inc., USA
[2]Manatee County Parks and Recreation, USA

Multiple regional and local governments in the Tampa Bay Region of Florida have made the preservation and restoration of coastal habitats, including salt marsh and coastal hammock, a conservation priority. Lower Tampa Bay and its tributaries have experienced large losses of marsh and fringing coastal hammock due to extensive coastal land use conversion since the mid-20th Century. Manatee County, which bounds the coast of lower Tampa Bay, currently manages and maintains over 29,000 acres contained in 12 public preserves.

Tom Bennett Park is a 181-acre site situated along the Manatee River in the Tampa Bay watershed located off Kay Road and Interstate 75 in Manatee County, Florida acquired for the purpose of conservation and recreation. Due to extensive land clearing, ditching, and habitat alteration associated with historical agricultural use, the majority of the native habitats on site including the coastal hammock, dry prairie, and estuarine and freshwater marshes have been significantly degraded, most notably by encroachment of invasive/exotic vegetation.

The goal of this project is to restore these systems to a sustainable and manageable mosaic of high quality native habitats. The complete plan included wetland restoration and creation, and upland restoration. Target communities included coastal hammocks, oak/pine forests, pine flatwoods and dry prairies, freshwater and estuarine marshes. Restoration and creation efforts in some areas required intensive practices including mechanical clearing and grading, phased nuisance/exotic vegetation herbicide treatments, and revegetation with native plants and seed. Some areas, including areas of oak/pine forest and saltwater marsh, required less intensive practices and disturbance to native vegetation within these communities was minimized. Hydrologic restoration components have increased areas for tidal exchange which benefit wildlife habitat and water quality on site and in receiving waters of the Manatee River, which ultimately discharges to Tampa and Sarasota Bays, both identified by the State of Florida as Surface Water Improvement and Management priority water bodies.

A focal point of the project included a rookery for the endangered wood stork (*Mycteria americana*) constructed with artificial nest platforms, tree plantings for future nest sites, an open water component to limit nest predation, and extensive areas for prey aggregation to create essential foraging habitat under varying hydrologic conditions. These features and other aspects of the project demonstrated early success, while others, including the restoration of prairie and flatwoods, will require additional long term management to achieve the project's stated goals.

Contact Information: Michael A.G. Burton, Stantec Consulting Services Inc., 6900 Professional Parkway E., Sarasota, FL 34221 USA, Phone: 941-907-6900, Email: mike.burton@stantec.com

Candie Pedersen, Manatee County Parks and Recreation, 5502 33rd Avenue Drive West, Bradenton, FL 34209 USA, Phone: 941-792-8784, Email: candie.pedersen@mymanatee.org

THE CENTRAL EVERGLADES PLANNING PROJECT: PLANNING THE NEXT GENERATION OF EVERGLADES RESTORATION PROJECTS

Eric Bush
U.S. Army Corps of Engineers, Jacksonville District, Jacksonville, FL, USA

The Central Everglades Planning Project (CEPP) is a feasibility study combining four components of the Congressionally-approved Comprehensive Everglades Restoration Plan focused on restoring hydrological and ecological conditions in the central portion of the South Florida Everglades natural system. The CEPP is one of five national pilot projects in which the U. S. Army Corps of Engineers is testing means for expediting the planning phase of large-scale civil works projects as part of a more comprehensive effort to transform civil works project implementation and program management. Fast-tracking the planning phase requires more focus on risk identification and management actions; intensive internal coordination; and, an increased level of public, stakeholder group, and agency involvement. This presentation will provide: (1) current status of the CEPP study and highlight issues and concerns affecting study progress; (2) a summary of stakeholder engagement and feedback about the study; and (3) lessons learned and next steps.

Contact Information: Eric Bush, U. S. Army Corps of Engineers, Jacksonville District, 701 San Marco Blvd, Jacksonville, FL 32207 USA, Phone 904-232-1517, Email: Eric.L.Bush@usace.army.mil

TAKING RESTORATION TO SCALE: *ACROPORA* RESTORATION, FLORIDA AND THE USVI

James Byrne[1], *Kemit-Amon Lewis[2], Caitlin Lustic[1], Meaghan Johnson[1]*
[1]The Nature Conservancy, Big Pine Key, FL USA
[2]The Nature Conservancy, St. Croix, USVI

Due to significant declines in living coral cover due to a variety of threats, many associated with changes related to global climate change, the need for active restoration of coral reefs has become apparent. In 2009, under the American Recovery and Reinvestment Act, NOAA recognized this need and funded a large-scale coral restoration project. The aim of this project is to enhance degraded coral reefs throughout Florida and the U.S. Virgin Islands. The long-term goal is to increase larval production and genetic diversity by increasing the likelihood of successful cross-fertilization between genetically distinct colonies located on outplanted restoration sites. The project was a partnership between NGO's, Academic Institutions, State Agencies and Federal Agencies.

This project represents an active form of coral reef management. Nurseries have been maintained or established within eight distinct subregions, and currently support more than 22,000 acroporid colonies. In early 2012, over 8,000 nursery-reared corals were transplanted onto reefs that are known to have supported acroporid communities, with the hope that these corals will contribute to the reseeding of natural reefs. Through careful site selection, this outplanting could help to increase the chances of successful sexual reproduction, thereby encouraging the reseeding of natural reefs.

The success demonstrated through this project enabled the establishment of additional coral nurseries in the Bahamas, Grenada and Cayman Islands. In addition the *Best Practices for Propagation and Population Enhancement for Caribbean Acropora Restoration Guide* was produced. The success of the project along with the guide has inspired the practioners across the Caribbean region to bring coral restoration to the scale that could result in the recovery of the threatened species.

Contact Information: James Byrne, The Nature Conservancy, Florida Keys Office, 127 Industrial Rd. Suite D, Big Pine Key, FL 33043 USA, Phone: 305-872-7071, Fax: 305-872-7072 Email: jbyrne@tnc.org

RESTORATION TECHNIQUES AND MONITORING IN THE MIDDLE RIO GRANDE

Ondrea Hummel *Presented by:* ***Todd Caplan***
U.S. Army Corps of Engineers, Albuquerque, NM, USA

This presentation will give an introduction to the session regarding the Middle Rio Grande Restoration project in Albuquerque, New Mexico. An overview of the restoration projects, , various restoration techniques, and monitoring that is occurring will be presented.

Contact Information: Ondrea Hummel, Albuquerque District, U.S. Army Corps of Engineers, 4101 Jefferson Plaza NE, Albuquerque, NM 87109, USA, Phone: 505-342-3375, Fax: 505-342-3668, Email: Ondrea.C.Hummel@usace.army.mil

SITE ATTRIBUTES AND PLANTING TECHNIQUES FOR GROWING DENSE WILLOW HABITAT FROM CUTTINGS ALONG THE MIDDLE RIO GRANDE, NEW MEXICO

Todd R. Caplan[1], *Kristin Cothern*[2], *Cliff Landers*[3] and *Ondrea Hummel*[4]
[1]GeoSystems Analysis, Inc., Albuquerque, NM, USA
[2]URS Group Inc., Santa Barbara, CA, USA
[3]Stetson Engineers Inc., Albuquerque, NM, USA
[4]U.S. Army Corps of Engineers, Albuquerque District, Albuquerque, NM, USA

The Albuquerque District Corps of Engineers (Corps) is implementing a large-scale floodplain rehabilitation program along the Albuquerque Reach of the Middle Rio Grande (MRG) in central New Mexico. Like many regulated rivers around the world, flood control dams and irrigation diversions have profoundly altered the hydrologic regime along the MRG, causing a near elimination of native cottonwood-willow regeneration. These native riparian communities are important for a large number of passerine birds, including the federally endangered Southwestern willow flycatcher (*Empidonax traillii extimus*). The Corps is experimenting with techniques for growing robust willow communities both to improve floodplain habitat diversity and to benefit listed and non-listed bird species.

One common approach to re-establishing cottonwood-willow habitat along regulated rivers is through installing dormant, rootless cuttings (a.k.a. "live stakes"), yet there is little published information exploring floodplain characteristics that optimize growth of southwestern riparian willows planted in this manner. The goal of this project was to evaluate relationships between growth attributes of coyote willow (*Salix exigua*) and soil texture and soil water availability. Monitoring plots were established in five willow swales planted with dormant *S. exigua* cuttings within habitat restoration sites along the Albuquerque Reach of the Middle Rio Grande.

Data analysis revealed significantly higher aerial cover, height, and stem density for *S. exigua* plants installed in plots with intermediate levels (15% to 25%) of fine textured soils distributed through the soil profile. Similar relationships were found in relation to soil water availability. Regression analysis of percent fines and available water at different depth increments provided limited explanation of variability in willow growth attributes at different plots. Findings indicate that *S. exigua* plants established from cuttings can achieve heights and aerial cover values similar to naturally established willow bars if the floodplain soil profile contains intermediate levels of fine textured soils and the maximum depth to groundwater is within 1.5 m of the ground surface. Where sites are dominated by coarse sand, *S. exigua* growth may be improved if maximum depth to groundwater is within 1 m of the ground surface.

Results from this research are currently being applied by the Corps of Engineers towards designing and constructing large-scale willow habitat restoration projects along the Middle Rio Grande. Given the widespread distribution of *S. exigua* throughout the western United States and Northern Mexico, this research may have broad geographic application.

Contact Information**:** Todd R. Caplan**,** GeoSystems Analysis, Inc. 3150 Carlisle Blvd., NE; Suite 107, Albuquerque, NM 87110 USA, Phone: 505-980-0336, Email: todd@gsanalysis.com

LOCAL BENEFIT FROM THE ROUGE RIVER NATIONAL WET WEATHER DEMONSTRATION PROJECT ECOSYSTEM ASSESSMENTS

Brandy Siedlaczek[1], ***Merrie Carlock***[1] and *John O'Meara*[2]
[1]City of Southfield, Southfield, MI, USA
[2]Environmental Consulting & Technology, Ann Arbor, MI, USA

The Rouge River Watershed is the most densely populated and urbanized watershed in Michigan, encompassing 438 square miles over metropolitan Detroit and 47 other political jurisdictions. The river has a long industrial history which includes the famed Ford Rouge Plant automotive manufacturing complex. Decades of regional development and population growth caused significant impairment to the watershed including degradation of water quality and fish and wildlife habitat, and overall lack of riverine aesthetics for public use and enjoyment.

The Rouge River National Wet Weather Demonstration Project (Rouge Project) is an EPA funded program for the Rouge River Area of Concern whose stated mission is to "demonstrate effective solutions to water quality problems facing an urban watershed highly impacted by wet weather and develop potential solutions and implement projects which will lead to the restoration of water quality in the Rouge River". The 35-community Alliance of Rouge Communities currently oversees the watershed wide effort. Watershed report cards and multiple environmental assessments over time provided critical data on current conditions of the watershed, charting progress and identifying impairments for attention. The project provided grant funding to local communities to address targeted issues and provide for public watershed education programs.

The City of Southfield is centrally located within the Rouge River Watershed on the northern border of Detroit. The community has a long history of commitment to the river whose main branch traverses its boundaries. Southfield initiated the Rouge Rescue annual river clean up, now a regional public event, and began an acquisition program for floodplain parklands over 40 years ago. The assessment programs of the Rouge Project provided a necessary foundation to assist Southfield and other watershed communities in prioritizing local needs and implementing watershed improvement projects. Constructed capital projects include storm water retrofits, permeable parking lots, bioswales, tree planting programs, stream bank restoration, invasive species management, wildlife habitat restoration, land acquisition, and numerous public education and participation projects including the multi-partner Rouge Green Corridor project. The data provided by the watershed assessment programs provided technical support for communities to focus on implementation of numerous projects and programs which provided cumulative watershed-wide benefit and provided justification for funding from both the local units and other granting agencies.

Contact Information: Brandy Siedlaczek, Storm Water Coordinator, City of Southfield, 26000 Evergreen Road, Southfield, MI 48037, Phone 248-796-4806, Email: bsiedlaczek@cityofsouthfield.com

UTILIZING MISSISSIPPI RIVER SEDIMENTS TO RESTORE COASTAL WETLANDS

Russ J. Joffrion and ***Jerry Carroll***
Louisiana Coastal Protection and Restoration Authority, Baton Rouge, LA, USA

The primary goal of the Louisiana Coastal Protection and Restoration Authority (CPRA) is to utilize Louisiana's Comprehensive Master Plan for a Sustainable Coast to develop, implement, and enforce coastal restoration and coastal protection projects for South Louisiana. Several of the major objectives of the Master Plan is to promote a sustainable coastal ecosystem by harnessing the natural processes of the system while providing coastal habitats suitable to support an array of commercial and recreational activities as well as a functioning ecosystem. These objectives can be achieved through the use of Mississippi River Sediment Diversions and the restoration of degrading wetlands through marsh creation projects.

Mississippi River sediment diversions are crucial for the long term sustainability for coastal Louisiana. However, predicting the performance of a large scale Mississippi River sediment diversion is highly variable and presents several design, engineering, and environmental challenges. These challenges and strategies will be discussed and are derived from efforts pertaining to the Myrtle Grove Delta Building Diversion Modeling Effort in Support of the LCA Medium Diversion at Myrtle Grove with Dedicated Dredging Project, Data Collection, Preliminary Design, and Modeling Initiative, December 12, 2011.

Mississippi River sediment is also being utilized to restore degrading wetlands through the use of hydraulically dredged material via a temporary pipeline to create new marsh habitat. This is primarily accomplished by identifying viable Mississippi River sediment sources using the USACE Mississippi River permissible dredging requirements, determining a viable pipeline corridor, and obtaining a construction permit. The CPRA currently has several large scale marsh creation projects in the design phase and construction phase, which utilize the Mississippi River sediment as the marsh fill material source. These marsh creation projects along with the engineering and construction logistics challenges associated with the use of Mississippi River sediment will be presented.

Contact Information: Russ J. Joffrion and Jerry Carroll, Louisiana Coastal Protection and Restoration Authority, Engineering Division, 450 Laurel St, Suite 1500, Baton Rouge, LA 70801 USA
Russ - Phone: 225-342-6850, Fax: 225-342-6801, Email: Russ.Joffrion@la.gov
Jerry - Phone: 225-342-1346, Fax: 225-342-6801, Email: Jerry.Carroll@la.gov

DEVELOPMENT OF A MONITORING AND ASSESSMENT PLAN FOR THE SALTON SEA, CA

H. Lee Case III[1] and *Douglas A. Barnum*[2]
[1]U.S. Geological Survey, Sacramento, CA, USA
[2]U.S. Geological Survey, La Quinta, CA, USA

The Salton Sea, California's largest lake, provides essential habitat for several fish and wildlife species and is an important cultural and recreational resource. It has no outlet, and dissolved salts contained in the inflows concentrate in the lake through evaporation. As part of the efforts to identify an ecosystem restoration program for the Salton Sea, the California Department of Water Resources, California Department of Fish and Game, U.S. Bureau of Reclamation, and U.S. Geological Survey established a team to develop a Monitoring and Assessment Plan (MAP). The goal of the MAP is to provide for data collection, analysis, management, and reporting to guide management actions regarding the Salton Sea ecosystem. The MAP further strives to encourage collaborative use of sampling locations, efforts, and resources wherever possible as a means of integrating data collection and interpretation.

The MAP contains separate, stand-alone modules, which describe approaches to monitoring biologic, hydrologic, geographic and geologic, air-quality and climatic, and socioeconomic resources, as well as data-management needs and activities. Each module includes a general overview, the monitoring objectives, key questions and information needs, the geographic scope, conceptual models, and recommended monitoring activities. Each section describing the recommended monitoring activities includes a description of the purpose and justification for the monitoring, the location, period, and frequency of monitoring, protocols for data collection, a description of the data to be collected, and the anticipated use of the data. Recommended quality-assurance measures, data reporting guidelines, and an overview of related current monitoring activities also are included.

Contact Information: H.L. Case, III, Ecosystem Sciences Coordinator, Office of the Regional Director, U.S. Geological Survey, Pacific Region, 3020 State University Dr. East, Modoc Hall, Suite 3005, Sacramento, CA 95819-2632, Phone: (916) 278-9565; Cell: (760) 218-2404, Fax: (916) 278-9546/9566, Email: hlcase@usgs.gov

THE SAN JOAQUIN RIVER RESTORATION PROGRAM: ACHIEVING LARGE-SCALE RIVER RESTORATION WHILE MINIMIZING WATER SUPPLY IMPACTS TO AGRICULTURAL USERS

Jill C. Chomycia[1] and *William R. Swanson*[2]
[1]MWH, Chicago, IL, USA
[2]MWH, Walnut Creek, CA, USA

One of the largest river restoration efforts in the United States is now under way in the Central Valley of California, one of the most productive agricultural regions in the United States. Since its completion in the 1940s, Friant Dam on the San Joaquin River has provided water to approximately 1 million acres of agricultural lands, but also led to the extirpation of salmon runs on the river. In 1988, a coalition of 14 environmental interest groups led by the Natural Resources Defense Council filed a lawsuit challenging the renewal of the long-term water service contracts between the United States and the Central Valley Project Friant Division contractors on the basis that the renewal violated several environmental protection laws of the United States and the State of California. Following 18 years of litigation supported by scientific study, a Settlement was reached in 2006. Federal legislation enacted in 2009 authorized the Secretary of the Interior, through the Bureau of Reclamation, to implement all provisions of the Settlement, plus additional actions to restore water supplies and protect third parties.

The Settlement has two primary goals: (1) The Restoration Goal - To restore and maintain fish populations in “good condition” in the main stem of the San Joaquin River below Friant Dam to the confluence of the Merced River (approximately 152 miles), including naturally reproducing and self-sustaining populations of salmon and other fish; and (2) The Water Management Goal - To reduce or avoid adverse water supply impacts to all of the Friant Division long-term Contractors that may result from the release of flows provided for in the Settlement.

The Restoration Goal specifies flow requirements, and numerous actions to provide adequate channel capacity, establish fish habitat, and re-introduce salmon. The Water Management Goal includes the recapture, recirculation, reuse, exchange, or transfer of Interim and Restoration flows to reduce or avoid water supply impacts to all Friant Division long-term contractors; use of a Recovered Water Account to track water supply reductions that result from the release of flows; and the sale of water at Friant Dam (during flood operations) at a pre-established rate, up to the amount of reduced deliveries recorded in the Recovered Water Account.

Limited flows were initiated in October 2009 to support experimentation and data collection, including a complex accounting process to quantify water supply impacts and to recapture and deliver water to the Friant Division contractors. Achieving both goals is an ongoing process guided by stakeholder involvement, and will rely on innovation and flexibility. Restoration actions will be implemented in recognition of established water rights, flood protection, and water delivery operations. Reclamation recently prepared a Framework for Implementation that identified costs and schedules for projects identified in the Settlement and Legislation.

Contact Information: Jill C. Chomycia, MWH, 175 W. Jackson Boulevard Suite 1900, IL, 60604 USA, Phone: 312-831-3140, Email: jill.chomycia@mwhglobal.com

EXPLORING THE POSSIBLE ROLE OF WATERSHED –SCALE SEDIMENT MANAGEMENT IN EXPANDING WATER SUPPLY AND ENHANCING ECOLOGICAL FUNCTION IN THE SULPHUR RIVER BASIN, TEXAS

David K. Coffman*, Rebecca Griffith* and *Stephanie Coffman*
Freese and Nichols, Inc., Fort Worth, TX USA

The 3,500 square mile Sulphur River watershed in northeast Texas has been the focus of numerous water supply studies over the past few decades and is considered a major potential water supply source for the growing North and Northeast Texas regions, which include the Dallas-Fort Worth Metroplex. Historically, the Sulphur River, and particularly the North Sulphur River, has been subject to channelization practices intended to increase agricultural development. Two critical issues associated with the development of the basin as a reliable water supply source include excess sediment loading resulting from these past channelization and agricultural activities and the need to avoid/mitigate environmental impacts associated with future reservoir development. This presentation explores opportunities to deal simultaneously with both issues through the implementation of a watershed-scale program of Best Management Practices (BMPs) as a component of regional water supply development.

A Soil and Water Assessment Tool (SWAT) model was developed for the Sulphur River watershed upstream of Wright Patman Lake to aid in the assessment of potential sedimentation impacts on future water supply. The SWAT model is a continuous simulation model that operates on a daily time step to simulate the effects of land management practices on water, sediment, and pollutant yields at the watershed scale. The Sulphur River SWAT model contained 25 subbasins and was calibrated for flow using streamflow measured at USGS streamgage stations throughout the watershed. Sediment was calibrated by comparing modeled watershed sediment loads to measured sediment accumulation in Wright Patman Lake.

Sediment management BMPs were applied to the watershed by altering SWAT model input parameters in the subbasins found to be experiencing the highest sediment yields under existing (no BMPs) conditions. Both land surface and channel BMPs were applied. Two with-BMP scenarios were modeled; an Intensive BMP scenario including six BMPs and a Feasible BMP scenario using a reduced number of BMPs. Sediment loads at the watershed level were reduced by 31% and 28% under the Intensive and Feasible BMP scenarios, respectively.

A reduction in watershed sediment loading would be beneficial not only to regional water supplies, but also to the Sulphur River aquatic and riparian ecosystems. Improvements to water quality, as well as a more natural flow regime, are predicted. The presentation explores possible integration of sediment management programs with impact assessments typically associated with water resources development (e.g. water quality and environmental flows) to improve ecological function in the Sulphur River watershed concurrently with providing a more reliable water supply for the North and Northeast Texas regions.

Contact Information: David K. Coffman, Freese and Nichols, Inc., 4055 International Plaza, Suite 200, Fort Worth, TX 76109, USA, Phone: 703-648-5352, Email: david.coffman@freese.com

PARTNERSHIP AND COLLABORATION: A STRATEGY FOR SUCCESS

Alfred F. Cofrancesco
U.S. Army Engineer Research and Development Center, Vicksburg, MS

To achieve successful ecosystem or river restoration partnerships and collaboration are necessary. The US Army Corps of Engineers (Corps) was given authority by Congress under the 1986 Water Resources Development Act to conduct ecosystem restoration. Currently, the Corps is engaged in 10 major ecosystem restoration activities and a plethora of smaller restoration activities under various authorities. All of these projects are conducted as partnerships or in collaborations with other agencies or organizations or accountable to various stakeholders that derive benefits from these systems. Annually, the Corps executes approximately $500M on restoration activities. In most cases restoration funds provided to the Corps must be matched at some level by non-federal funds.

Similarly, the Bureau of Reclamation (Bureau) also conducts aquatic restoration activates and currently has 16 programs being conducted throughout 17 western states. The Bureau utilizes over 200 partners or collaborators from federal, state or local organizations to achieve their restoration goals. Each restoration program or project represents its own unique requirements but the ultimate goal is the same restoring the function of the system.

In order to preserve the ecological and economical capabilities of our current river systems collaborative efforts by all stakeholders must continue. As funding resources decrease and utilization of water assets increases we are faced with the difficult situation of preserving or restoring resources more efficiently and economically. Partnerships and collaboration allow organizations to pool resources toward a common goal that would have been difficult or impossible to attain individually. Partnering between federal, state and local agencies allows for flexibility in dealing with the national and local requirements and provides a strategy for success.

Contact Information: Alfred F. Cofrancesco, Environmental Laboratory, US Army Engineer Research and Development Centre, 3909 Halls Ferry Road, Vicksburg, MS 39180 USA, Phone:601-634-3182, Fax: 601-634-3664,
Email: al.f.cofrancesco@usace.army.mil

RESTORING GREAT LAKES COASTAL SYSTEMS FOR NATURE AND PEOPLE: TOWARD NEW APPROACHES IN GREEN BAY AND WESTERN LAKE ERIE

Rachael Franks Taylor[1], *Nicole Van Helden*[2] and ***James Cole***[3]
[1]The Nature Conservancy, Traverse City, MI, USA
[2]The Nature Conservancy, Green Bay, WI, USA
[3]The Nature Conservancy, Swanton, OH, USA

While coastal systems are crucial to the ecological and economic health of the Great Lakes, they have been degraded through activities directly on shorelines, as well as from far up in watersheds and from ubiquitous threats like climate change, poor water quality, and invasive species. As The Nature Conservancy and others orient to conservation of whole systems, we are compelled to go beyond addressing discrete, relatively intact places; we must also consider the processes, functions, and services that those whole systems provide – for nature and people. This approach leads us to expanded conservation effort in different types of places than we might have worked in the past, including Great Lakes Areas of Concern. Given their high biological productivity and diversity, fragmented ownership and management, centers of population, and high degree of threat, our two principal coastal conservation projects in Green Bay and Western Lake are prime locations to apply key elements of the whole-system approach.

This talk will focus on how specific elements of the whole-system approach are influencing the way The Nature Conservancy and our partners are pursuing conservation in these complex coastal systems, with an emphasis on: 1) landscape-scale connectivity and how it is being considered in our multiple on-the-ground restoration projects, and 2) the role and needs of people in pursuit of conservation goals, and how community well-being can be advanced through restoration of ecosystems services such as clean drinking water, flood protection, erosion control, and recreation and enjoyment. We will share examples from the field from Green Bay and Western Lake Erie, including tools and approaches for ecological restoration in a whole-system paradigm and lessons learned.

Contact Information: Rachael Franks Taylor, The Nature Conservancy, 307 W. 12th Street, Traverse City, MI 49684, Phone: (617) 532-0964, Email: rachael_taylor@tnc.org;

Nicole Van Helden, The Nature Conservancy, 242 Michigan Street, Suite B103, Sturgeon Bay, WI 54235, Phone: (920) 634-6549, Email: nvanhelden@tnc.org

James Cole, The Nature Conservancy, Oak Openings Project Office, 10420 Old Stateline Road, Swanton, OH 43558, Phone: (419) 867-1521, Email: jbcole@tnc.org

AN APPROACH FOR REAL-TIME EVALUATION OF SAVANNAH HARBOR DEEPENING MITIGATION EFFECTIVENESS FOR THE PROTECTION OF FRESHWATER TIDAL MARSHES

Paul Conrads
USGS South Carolina Water Science Center, Columbia, SC, USA

The Savannah National Wildlife Refuge (SNWR), is one of the nation's largest freshwater tidal marshes along the East Coast of the USA, and is located proximal to one of the busiest ports on the East Coast, the Savannah Harbor. There is a concern that the proposed deepening of Savannah Harbor may increase salinity in the upper reaches of the Savannah River Estuary and convert portions of the SNWR to saltmarsh. The mitigation features of the Savannah Harbor Expansion Project (SHEP) are designed to minimize the ecosystem impacts of harbor deepening. An approach is presented for establishing performance measures for real-time evaluation of the mitigation effectiveness for limiting salinity intrusion in the freshwater tidal marsh.

The relation between specific conductance (field measurement for salinity), flow, and water level can be used to determine ecosystem performance measures. The relation of these parameters at a site is the historical manifestation of process physics at that site. Fifteen years of daily data from an upstream flow gage and a specific conductance gage in the SNWR were used to generate a scatter plot that were used to 1) display the relation of the historical data and 2) establish the upper limit of the historical specific conductance response at the site. An envelope curve was developed to define the upper bound trend of specific conductance with respect to flow.

The impacts of the SHEP on estuarine salinity dynamics were determined using a three-dimension hydrodynamic model. The channel geometry representing the deepened shipping channel and other flow alteration components of the mitigation plan were incorporated into the model. The model-predicted specific conductance values for the deepening project at the gage in the SNWR were then added to the scatter plot showing the field-measured specific conductance and flow. As was done with the historical data, an envelope curve representing the upper bound of the trend of the predicted "with-project" salinity was developed. The scatter plot shows the historical relation between flow and specific conductance and the predicted change in the relation of flow and specific conductance with the SHEP.

During and after construction of the SHEP, real-time values of upland flow and specific conductance in SNWR can be incorporated in the scatter plot to show the historical and "project" specific conductance values. The real-time post-construction data can be quickly evaluated to determine the effectiveness of the SHEP mitigation plans. New data values below the project envelope curve of the upper bound of the salinity indicate the ecosystem (with respect to salinity at this location) is responding as anticipated in the mitigation plan. New data values above the project envelope curve indicate that a modification in the mitigation plan may be warranted.

Contact Information: Paul A. Conrads, USGS South Carolina Water Science Center, Stephenson Center – Suite 129, 720 Gracern Road, Columbia SC, 29210 USA, Phone: 803.750.6140, Fax: 803.750.6181, Email: pconrads@usgs.gov

EDEN-SYN – MOVING FROM "WHAT WAS" TO "WHAT IF"

Paul A. Conrads[1]*, Ruby Daamen*[2]*, Edwin A. Roehl, Jr.*[2] and *Stephen T. Benedict*[3]
[1]USGS South Carolina Water Science Center, Columbia, SC, USA
[2]Advanced Data Mining International, Greenville, SC, USA
[3]USGS South Carolina Water Science Center, Clemson, SC, USA

The Everglades Depth Estimation Network (EDEN), an integrated network of water-level gages and hydrologic models, provides historic and current water-surface maps for the freshwater portion of the Greater Everglades for the period January 1, 1991 to the present (2012). Scientists and water-resource managers are interested in generating water-surface maps for hypothetical hydrologic conditions that can be used to evaluate proposed management scenarios. An application named EDEN-Syn, was developed that generates synthetic hydrographs that can be used in the EDEN water-surface model to develop such hypothetical maps.

The use of the EDEN water-surface model for hypothetical hydrologic conditions is challenging because the model requires input hydrographs for over 240 monitoring sites. The synthetic input hydrographs also must reflect the dynamic relation of timing and magnitude between sites in order for the water-surface model to execute successfully. This challenge was addressed by using a sub-domain (subarea) model of the EDEN model domain, Water Conservation Area 3A South (WCA3AS), and thereby limiting the number of gages for the subarea. The experimental subarea water-surface model was developed that uses 31 stations from the EDEN network to generate hypothetical water-surface elevation maps for WCA3AS. A dynamic time-series clustering technique was used to group stations with similar behaviors. The results of the dynamic clustering showed three classes of water-level behaviors. For each group, one monitoring station was selected as an index site and used to estimate the water-level hydrographs for the other sites in the group using linear regression and(or) artificial neural network models. A correlation was then determined between the two selected index stations so one index site is used for water-level input to the application. To generate synthetic input hydrographs, a user specifies the hydrograph for one index site and the application generates the hydrographs for the other 30 sites using the hydrograph estimation models. The synthetic hydrograph application ensures that the dynamic relations between input stations are maintained.

The application to generate synthetic hydrographs for input into a subarea model of EDEN (EDEN-Syn) adds an important utility for EDEN users to be able to simulate hypothetical water-management scenarios. Previously, EDEN had solely been used to simulate historical conditions and users could ask "what was" the water level at an ungaged location on a particular day. By generating synthetic hydrographs, users can now ask "what if" a certain hydrologic conditions occurred and what would the water level be at an ungaged location on a particular day.

Contact Information: Paul A. Conrads, USGS South Carolina Water Science Center, Stephenson Center – Suite 129, 720 Gracern Road, Columbia SC, 29210 USA, Phone: 803.750.6140, Fax: 803.750.6181, Email: pconrads@usgs.gov

GREAT LAKES COASTAL WETLAND MONITORING PROGRAM: SUPPORT OF RESTORATION ACTIVITIES ACROSS THE BASIN

Matthew J. Cooper[1], *Donald G. Uzarski*[2], *Jessica Sherman*[2] and *Douglas A. Wilcox*[3]
[1]University of Notre Dame, Notre Dame, IN, USA
[2]Central Michigan University, Mount Pleasant, MI, USA
[3]College at Brockport, Brockport, NY, USA

Protection and restoration of coastal wetlands has been identified as a management priority throughout much of the Great Lakes basin. The emphasis on restoring coastal wetlands has resulted from increased awareness of their role in Great Lakes ecosystem functioning coupled with the fact that the majority of coastal wetlands have been manipulated or destroyed basin-wide. Recent estimates suggest that only one-third of pre-settlement coastal wetland area remains and losses as high as 95% have occurred in some areas. To support current and future restoration activities, we initiated a basin-wide coastal wetland monitoring program in 2011. Monitoring focuses on bird, amphibian, fish, invertebrate, and plant communities as well as water quality and follows a probabilistic stratified-random sampling scheme in which over 1,000 coastal wetlands will be sampled during a 5-year period. Data from the monitoring program is being used to prioritize coastal wetland restoration projects, set realistic restoration targets, and evaluate restoration outcomes.

Here, we provide three short case studies of wetland restoration projects occurring on Green Bay, Lake Michigan; North Maumee Bay, Lake Erie; and Braddock Bay, Lake Ontario. Restoration goals and techniques vary widely among the three projects as do the parties responsible for funding and oversight (e.g., state and federal agencies, NGOs). Primary objectives include: control of invasive *Phragmites* and exclusion of common carp (*Cyprinus carpio*) at the Green Bay site, restoration of natural hydrology and native floral and faunal communities at the North Maumee Bay site, and restoration of a natural sand barrier to provide wave protection and enhancement of fish habitat connectivity at the Braddock Bay site. Despite these varied objectives, all are utilizing the basin-wide monitoring program to support restoration planning, set restoration targets, and/or evaluate restoration outcomes.

<u>Contact Information</u>: Matthew J. Cooper, Department of Biological Sciences, University of Notre Dame, 290 Galvin Life Sciences Center, Notre Dame, IN 46556, USA, Phone: 574-631-0580, Email: mcooper3@nd.edu

MILLENNIUM RESERVE: ORGANIZING MULTIPLE AND DIVERSE STAKEHOLDERS

Lisa A. Cotner
Illinois Department of Natural Resources, Chicago, IL, USA

Millennium Reserve is a community-centered initiative and the largest collaborative urban open space project in the country, located in the Illinois part of the Calumet region and stretching from downtown Chicago southeast to the Indiana border and southwest to Midewin National Tallgrass Prairie. At the heart of Millennium Reserve is the Calumet Core area encompassing 35 municipalities, 15 miles of Lake Michigan coastline, and 140,000 acres of land, including 15,000 acres of publically-held natural areas such as parks, forest preserves, and other open space. Millennium Reserve is innovative in that it goes beyond a simple conservation vision. It recognizes that conservation in urban areas is inextricably linked to healthy communities and a robust economy, all of which contribute to quality of life.

The Millennium Reserve Partnership of over 50 agencies and organizations is led by Illinois Department of Natural Resources (IDNR). Partners and stakeholders include federal, state, city, county, and regional agencies, as well as numerous not-for-profit organizations, many of which have been active in the Calumet region long before the Millennium Reserve initiative took shape. IDNR, as the lead organization, faced an initial challenge of communicating with a diverse group of stakeholders who were dubious about the merits of yet another initiative for the region and concerned about IDNR not recognizing Partners' existing on-the ground work. In addition, there was lack of clarity as to what the initiative actually is and what value-added it can bring to the myriad efforts long-underway in the region.

In order to better communicate the promise of Millennium Reserve and IDNR's role in it, the agency partnered with communications experts to develop a vision statement and strategic communications plan. This involved a concerted effort to strengthen partner engagement as well as rouse public interest, including tactics such as reaching out to stakeholders and gathering their opinions about participation in Millennium Reserve. IDNR also focused on providing tangible examples of Partners' innovation and success by selecting and recognizing "Model Projects" implemented by Partners in the Calumet region, the majority of which include restoration elements. These efforts have led to increased enthusiasm and participation from Partners, notable media attention, burgeoning interest from the philanthropic community, and growing support from policy makers and heavy-hitters in the civic arena.

Contact Information: Lisa A. Cotner, IDNR Coastal Management Program, 160 N. LaSalle St S-703, Chicago, IL 60601 USA, Phone: 312-814-6414, Fax: 312-793-5968, Email: Lisa.Cotner@illinois.gov

SEDIMENT REMEDIATION AND HABITAT RESTORATION IN AREAS OF CONCERN

David C. Cowgill
U.S. Environmental Protection Agency, Great Lakes National Program Office, Chicago, IL, USA

The Great Lakes Water Quality Agreement between the United States and Canada (Annex 2 of the 1987 Protocol) defines Areas of Concern (AOCs) as "geographic areas that fail to meet the general or specific objectives of the agreement where such failure has caused or is likely to cause impairment of beneficial use of the area's ability to support aquatic life." More simply put, an AOC is a location that has experienced environmental degradation.The "Beneficial Use Impairments" outlined in the Agreement focuses on issues like loss of habitat, fish contamination, an impaired benthic community, and beach closures. Of the 31 AOCs for which the U.S. Government has responsibility to address problems, only one has been restored to the point where it was "delisted" as of 2011. It has been generally recognized that a more intensive effort is needed.

In 2010, a new Great Lakes Restoration Initiative (GLRI) was launched, with an appropriation of $475 million dollars to supplement existing federal environmental programs in the Great Lakes. An additional $300 million was appropriated in each of fiscal years 2011 and 2012 for this purpose. A GLRI Action Plan was developed and published, outlining key activities to be undertaken, including cleaning up AOCs. Specifically, the Action Plan committed to work with states and other partners to ensure that all management actions necessary for delisting five Areas of Concern would take place by the end of FY2014. In order to be successful in achieving this objective, most of the AOCs require costly contaminated sediment remediation and habitat restoration.

An overview of activities to restore degraded habitat in AOCs and remediate contaminated sediment will be presented, utilizing a variety of technical and administrative approaches..

Contact Information: David C. Cowgill, U.S. Environmental Protection Agency, Great Lakes National Program Office, 77 West Jackson Blvd., Chicago, IL 60604-3590, USA, Phone: 312-353-3576, FAX: 312-385-5454, Email: cowgill.david@epa.gov

RESEARCH IN SUPPORT OF RESTORATION OF CISCO IN LAKE ONTARIO

***Darran Crabtree*[1]**, *Lars Rudstam*[2], *Michael Connerton*[3], *James Johnson*[4] and *Steven LaPan*[3]
[1]The Nature Conservancy, Meadville, PA, USA
[2]Cornell Biological Field Station, Bridgeport, NY, USA
[3]New York Dept. of Environmental Conservation, Cape Vincent NY, USA
[4]U.S. Geological Survey, Lower Great Lakes Center, Cortland, NY, USA

Of all the Great Lakes, fish populations in Lake Ontario have been impacted the most severely, including the extirpation of Atlantic Salmon (*Salmo salar*) and deepwater coregonids such as bloater (*Coregonus hoyi*) and kiyi (*Coregonus kiyi*) and major declines in lake sturgeon (*Acipenser fulvescens*), deepwater sculpin (*Myoxocephalus quadricornis*), lake whitefish (*C. clupeaformis*), cisco or lake herring (*C. artedi*) and American eel (*Anguilla rostrata*). There are ongoing binational, multi-agency efforts to restore many of these native fish populations, and recently there has been increasing emphasis on prey species, including cisco (Great Lakes Fisheries Commission 2012).

Historically, cisco were important components of the open water prey fish community of Lake Ontario. Unfortunately, the cisco is currently reduced to a remnant of its previous levels due to overfishing, water quality decline and competition/predation from nonnative fishes such as alewife. Because of the complexities associated with the decline of native fish species in the Great Lakes there is no single remedy suitable for the restoration of this species. While there are known remnant populations of cisco in Bay of Quinte and Chaumont Bay, many questions remain about their habitat use and life history. This project supports ongoing agency efforts to expand the distribution and abundance of cisco in Lake Ontario, and will determine whether additional spawning populations occur along the southern shore of the lake by trapnetting over potential spawning habitat. In addition we seek to pinpoint spawning sites within one of the known spawning locations by following radio tagged cisco and setting egg traps. We also will investigate potential limitations to successful cisco recruitment including egg and larval predation.

Contact Information: Darran Crabtree, The Nature Conservancy, 301 Chestnut St., Meadville, PA USA, Phone: 814-332-2946, Fax: 814-724-5446, Email: dcrabtree@tnc.org

INTEGRATING SOUND SCIENCE AND ADAPTIVE MANAGEMENT INTO A TRUNCATED TIMELINE FOR CENTRAL EVERGLADES RESTORATION

Stephen E. Davis, III
Everglades Foundation, Palmetto Bay, FL, USA

The Comprehensive Everglades Restoration Plan (CERP) was authorized by Congress in 2000 to improve the ecological value of the Everglades ecosystem while also enhancing economic values and social well-being. Since that time, only a few CERP projects have been constructed around the periphery of the Everglades ecosystem. In late 2011, the Central Everglades Planning Project (CEPP) was approved and designed as a means to bundle multiple CERP projects in order to jumpstart restoration at the heart of the ecosystem—going from Lake Okeechobee to Water Conservation Area 3 (WCA-3), to Everglades National Park. As part of CERP, the CEPP plan is being co-developed by the U.S. Army Corps of Engineers ("the Corps") and the South Florida Water Management District (SFWMD) and the costs of construction and O&M will be split evenly between the two agencies. Unlike past planning efforts led by the Corps, which could take as much as 7 years per project, CEPP was chosen as an expedited planning project that would go from "concept to plan" in two years.

Given that more than a decade has elapsed since CERP was authorized, there was a need to consider the dearth of technical scientific knowledge that had been gained since 2000. In particular, there has been a dramatic increase in our understanding of the sources and impacts of nutrient (i.e., phosphorus) pollution, the implications of reduced volumes of freshwater getting to the Everglades and estuaries such as Florida Bay, and the connections between sheetflow, Everglades ridge-and-slough landscape pattern, and tree islands. Over this same period of time, we have witnessed a continued decline in ecosystem health that has facilitated exotic plant and animal species invasion and expansion, enhanced cattail expansion, increased oxidation and subsidence of organic soils, degraded tree islands, and impacted community structure and productivity of our estuaries. We have also seen continued discharge of high-P water from Lake Okeechobee to the Caloosahatchee and St. Lucie estuaries, as a response to high lake levels and the lack of infrastructure to store, treat, then flow larger volumes of water to the Everglades.

In addition to incorporating "new science", the CEPP Project Delivery Team (PDT) has employed a number of recently developed screening tools and models to more accurately budget water quality, availability and flows through the system (e.g., DMSTA, LOOPS, RSM-BSN) and to screen through options more rapidly that meet proposed targets while honoring operational constraints (iModel, RSM-GL). The CEPP PDT has also utilized recently developed Everglades performance measures and other criteria in addition to traditional habitat credit and construction cost approaches to developing plan features. Implementation of these new tools and criteria, in addition to a much-improved understanding of the ecological functioning of the Everglades, is a form of adaptive management described in the original CERP plan. Further, adaptive management will continue to be implemented through monitoring and enhanced understanding of the ecosystem that may affect structural or operational modifications of the ecosystem to meet the original goals and objectives of CERP.

Contact information: Stephen E. Davis, III, Everglades Foundation, 18001 Old Cutler Rd., suite 625, Palmetto Bay, FL 33157 USA, Phone: 786-249-4460, Email: sdavis@evergladesfoundation.org

THE CAÑO MARTÍN PEÑA ECOSYSTEM RESTORATION PROJECT

Donald R. Deis[1]; *David A. Tomasko*[2]; *Jaime A. Pabon*[3]; and *Katia R. Avilés-Vázquez*[4]
[1]Atkins North America Jacksonville, FL, USA
[2]Atkins North America, Tampa, FL, USA
[3]Atkins Caribe, San Juan, PR
[4]Corporación del Proyecto ENLACE del Caño Martín Peña

The Caño Martín Peña (CMP) Ecosystem Restoration Project (the ERP) consists of the dredging of approximately 2.2 miles of the eastern end of the CMP, starting from the San José Lagoon towards the west of the Luis Muñoz Rivera Avenue Bridge. The CMP represents a unique urban ecosystem restoration opportunity with potential for significantly enhancing the water quality and fish and wildlife habitat of the entire San Juan Bay Estuary (SJBE) system. Secondary benefits of this restoration project include flood control, community socio-economic development, land use planning integration, and quality of life benefits for local residents. The proposed channel restoration could also add to recreation, transportation, and tourism opportunities for the San Juan area once the channel's historic tidal connection and flushing conditions are reestablished. The actual condition of the CMP and surrounding areas, its ecological attributes and biological integrity are extremely degraded due to significant human encroachment, including human settlements, deposits of solid waste and demolition debris, and raw sewage discharges. Multiple ERP alternatives were evaluated for the CMP dredging configuration, including a 33 foot wide by three foot deep as an "existing condition"; 75, 100, 125, 150, 175, and 200 foot channel widths; and ten and fifteen foot depths. Models were developed using an existing hydrodynamic model and benthic index to evaluate the benefits of the alternatives and configurations. This presentation discusses the results from model development and alternatives evaluation.

Contact Information: Donald R. Deis, Atkins North America, 7406 Fullerton Street, Suite 350, Jacksonville, Florida 32256 USA, Phone: +1 (904) 363 8442, Email: don.deis@atkinsglobal.com

THE STATUS OF ISOLATED WETLANDS IN POST-SWANCC FLORIDA: THE CASE FOR A STATEWIDE PRIORITY WETLANDS PROGRAM

Michael J. Dema
Stetson University, College of Law Institute for Biodiversity Law and Policy, Gulfport, FL, USA

In 2001, the U.S. Supreme Court decided Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers (SWANCC), a landmark case on jurisdictional wetlands under the Clean Water Act (CWA) which ruled that hydrologically isolated wetlands are outside the purview of the CWA, essentially deregulating dredge and fill activities associated with such wetlands. Identifying this decision as potentially exposing a large number of beneficial wetlands to perturbation, this research embraces the Court's determination that all wetlands are not created equal. Through the development of a scoring rubric, informed by Florida's water supply regime and other states' wetlands protection programs, the state's wetlands (isolated and jurisdictional) can be ranked to aid decision-making with respect to the development of all wetlands classes.

This research applies Adaptive Management (AM) principles to assess the problem of potential regulatory gaps created by SWANCC. Using AM, the priority wetlands program attempts to be malleable to adapt to local and regional conservation issues and values, allowing resource managers to design and implement their own programs based on their protection goals. The program is based on a scoring rubric, where wetlands "score points" if they are spatially identified as possessing aquifer recharge, riparian buffer, flood protection, and/or biodiversity hotspot value, with isolated wetlands and their more connected brethren treated as equals.

As AM becomes more widespread in policy-making, interweaving legal and scientific perspectives at the problem assessment phase should be a priority for environmental managers. This research identified an issue raised by a change in the CWA, then provided a status report of Florida's implementation of the Act as it pertains to wetlands, finally shifting to scientific methods to design the program. Using ArcGIS to inventory Florida's isolated and jurisdictional wetlands, a baseline geodatabase was developed, which was overlain upon coverages depicting aquifer recharge zones, surface water supplies, and FEMA flood maps to identify those wetlands which were providing the highest anthropocentric ecosystem benefits. Non-anthropocentric values were determined through spatial hotspot analysis, using the Getis-Ord methodology to identify those clusters of wetlands which are unique in their area and number. These hotspots are considered proxies for biodiversity and are scored accordingly. The proposed program is intended to allow resource managers to be able to "pick-and-choose" those values that best suit their chosen conservation goals, adjusting values and goals as evaluations are performed.

Contact Information: Michael J. Dema, Esq., Stetson University College of Law, 1401 61st Street South, Gulfport, FL 33707-3329 USA, Phone: 727-410-2236, Email: mdema@law.stetson.edu

A NEW APPROACH TO SEAGRASS RESTORATION THROUGH LANDSCAPE MANIPULATION

Anne McCarthy, Mark S. Fonseca and ***Raymond F. Dennis III***
CSA International, Inc., Stuart, FL, USA

Injured seagrass habitats often suffer from a lack of suitable sites to conduct meaningful restoration. For seagrass restoration to be effective, it has historically been held to several exacting site selection criteria associated with adding persistent seagrass cover. However, in recent years, we have seen instances where there were simply no off-site restoration sites that met established criteria. This has been particularly true in large habitat conversions to alternate uses, such as harbors, bridges, or industry, where there was no opportunity for on-site restoration. In situations where neither on-site nor off-site restoration is available or when the sites do not meet the published criteria, managers are faced with conducting out-of-kind mitigation, which often does not provide services that compensate for those lost and presents other complex challenges in developing metrics for measuring compensation.

Concomitant with seagrass restoration has been the application of economic principles for determining compensation ratios, wherein up-front mitigation is highly valued in that there are no discounts applied to the services provided by the habitat creation. With up-front mitigation in mind, here we provide an alternative to no restoration or out-of-kind options. We have utilized existing knowledge of the relationship among seagrass landscape pattern and hydrodynamic setting to manipulate seagrass coverage and increase coverage within the boundaries of existing patchy habitat. By engineering wave energy reduction, we forecast that seagrass beds in high wave exposure settings can be shifted from a persistent patchy landscape pattern to nearly continuous cover. If enacted before a project injures seagrass, this shift in landscape pattern would create undiscounted acre-years of seagrass service flows.

Altering seagrass landscape pattern from patchy to continuous cover satisfies the basic requirements of regulators (acre-years) as well as published site selection criteria. However, changes in landscape pattern have been shown, especially in terrestrial systems, to provoke many changes in ecological functions, including faunal composition, movement, and abundance. Fauna in seagrass beds have been shown to respond to changes in landscape pattern, but those patterns have been highly variable and not clearly scalable to inform managers as to potential ecological consequences, if any. We embrace the creation of additional seagrass habitat as in-kind mitigation as opposed to no restoration or dubious out-of-kind projects, but recognize the need for consideration of landscape-scale examination of ecosystem services beyond that of acre-years and how changes in services may guide broader application of landscape manipulation in the context of habitat restoration.

<u>Contact Information</u>: Anne McCarthy, CSA International, Inc., 8502 SW Kansas Avenue, Stuart, Florida, 34997 USA, Phone: 772-219-3000; Fax: 772-219-3010; E-mail: amccarthy@conshelf.com

RESTORING FISH PASSAGE BETWEEN LAKE ERIE AND THE RIVER RAISIN

Scott B. Dierks[1], *Michael J. Donahue*[2] and *Michelle M. LaRose*[1]
[1]Cardno JFNew Ann Arbor, MI, USA
[2]URS Corporation, Southfield, MI, USA

In 2010, the City of Monroe, MI received Great Lakes Restoration Initiative (GLRI) funds to facilitate fish passage over/around eight dams in an effort to mitigate habitat Beneficial Use Impairments (BUIs) identified as part of the River Raisin Area of Concern (AOC). The project will reconnect Lake Erie to the lower 23 miles of the river and, in conjunction with other projects in the watershed, has the potential to de-list the River Raisin AOC within the next few years. The City of Monroe contracted with Cardno JFNew to perform the work for this two-phased project, with URS Corporation as subconsultant. Phase 1 involves removal of two dams and installation of rock arch ramps at two dams. Construction is substantially complete, and final site restoration will occur in Spring 2013. Phase 2 involves installing rock arch ramps at two dams, constructing a natural channel with riffles and pools to bypass a third dam, and cleaning and enhancing the millrace at a fourth dam. Phase 2 preliminary design is complete, and the project is in the permitting stage.

This project has faced several challenges that range in scale from the placement of individual rock arch stone to the steps needed to prevent upstream passage of invasive species from Lake Erie. Rock arch ramp design must balance several design criteria, including water velocity, depth, and drop height, against fish burst speeds and jumping ability. In addition, the rock arch ramps, built in front of dams carrying sanitary sewer, cannot raise the 100-year water surface elevation more than 0.01 feet above existing conditions. Unfortunately, FEMA-accepted 1-D and 2-D models for simulation of river hydraulics do not capture the 3-D nature of energy losses over dams. The delicate balance of meeting conditions that allow for fish passage while not increasing water surface elevations proved to be a significant challenge, both technically and administratively, with the State of Michigan and FEMA. Even after finally reaching a model solution, several adjustments were made during construction based on observed performance in the field.

Phase 2 has, and will face similar challenges. Recently, the U.S. Fish and Wildlife Service (USFWS) has objected to creating fish passage around Waterloo Dam, one of the larger dams in the series of dams that separate the river from the lake. The Waterloo Dam is listed as a barrier to invasive sea lamprey and the USFWS does not want to see any improvements to fish passage at this dam. The State of Michigan and the USFWS are currently in negotiations to resolve the issue. The resolution of this objection will have implications for other dam removal/ modification and ecosystem restoration projects throughout the Great Lakes basin.

This presentation will address project goals, objectives and methodology, as well as how various challenges are being met to realize substantial ecosystem restoration benefits.

Contact Information: Scott Dierks, PE, Cardno JFNew, 605 South Main St, Suite 1, Ann Arbor, MI 48104 USA,
Phone: 734-222-9690, Fax: 734-222-9655, Email: scott.dierks@cardno.com

USING A LIVING SHORELINE APPROACH TO PREVENT EROSION AND RESTORE MARSH HABITAT ON OCRACOKE ISLAND

Jason C. Doll and *Johnny D. Martin*
Moffatt & Nichol Engineering, Raleigh, NC, USA

When the US Coast Guard gave the historic Ocracoke Island Lifesaving Station to the State of North Carolina, and it became the NC Center for the Advancement of Teaching (NCCAT), the change represented real opportunity for improvement. One particular improvement was the recovery of the eroding section of Pamlico Sound shoreline behind the facility where years of wind and wave action were chewing their way landward toward the buildings. In a collaborative effort with NCCAT, the NC Coastal Federation, and the NC State Construction Office, Moffatt & Nichol engaged the complex task of permitting, designing and constructing a natural estuarine shoreline/tidal marsh complex to replace the eroding shoreline, which had been unsuccessfully armored against the advancing sound.

The restoration project involved design and construction of breakwater sills just off shore to dissipate wave energy, regrading of the gradual slope of a natural shore profile, and re-establishment of native shoreline marsh vegetation. The design also involved additional green amenities. An interpretive boardwalk and pier were constructed and future construction phases will include stormwater BMPs on upland areas such as bioretention cells and pervious parking areas. In addition, oyster habitat restoration and seeding are planned for the site. Execution of the project also involved substantive opportunities for outreach and education by using teacher volunteers to implement the marsh vegetation plantings. Construction thus far has resulted in restoration of approximately 300 feet of natural shoreline and 2 acres of coastal salt marsh aquatic habitat. This case study presentation will review the complex permitting, design and construction issues involved in this highly public project built in a sensitive marine environment.

Contact Information: Jason C. Doll, CPSWQ, Moffatt & Nichol, 1616 East Millbrook Road, Suite 160, Raleigh, NC 27609 USA, Phone: 919-781-4626, Fax: 919-781-4869, Email: jdoll@moffattnichol.com

ECOSYSTEM RESTORATION BENEFITS OF LOW-HEAD DAM REMOVAL: LESSONS LEARNED FROM THE DEXTER MILL POND DAM EXPERIENCE

M.J. Donahue
URS Corporation, Southfield, MI, USA

The Dexter Mill Pond Dam is located on Mill Creek, a major tributary to southeast Michigan's Huron River, whose watershed features over 225 miles of streams and some 145 square miles of mixed land use. Mill Creek is ecologically significant, contained within an area of the Huron River System designated as a Michigan "Natural River." It is a focal point for water- based recreation, and a centerpiece for the Village of Dexter, where it is well-recognized for its importance to the community's environmental quality, economic prosperity and quality of life. The Huron River System has the dubious distinction of being home to more dams (95) that any other river system in the state. Removal of the dam (the first in the System) and attendant re-establishment of fish passage via stream restoration, offers dozens of other communities in the Huron River System a first-hand opportunity to view the process and resultant benefits.

The Village of Dexter, in collaboration with Washtenaw County and several state and federal agencies, undertook a multi-faceted project that included dam removal, stream restoration, bridge replacement, parkland design (in the former impoundment), and the design/ construction of an extensive non-motorized trail system. URS Corporation was retained to lead the project.

Originally constructed in 1824 as a rock-filled timber crib, the dam impounded approximately 22 acres of surface water and consisted of a 72 foot-long grouted rubble spillway with a height of approximately eight feet and a width of two feet. It was later modified with metal sheet piling driven along the entire upstream face of the dam and capped with angle iron. There is no fish passage around the dam, biologically isolating Mill Creek from the Huron River System, and contributing to impairments that include elevated phosphorous levels, poor fish/ aquatic communities, degraded habitat, biodiversity loss, and sediment accumulation behind the dam.

A major challenge related to the fact that the dam was physically connected to the abutments of the Main Street bridge in downtown Dexter, which handles some 25,000 vehicle transits daily and, due to extensive deterioration required emergency replacement. Project activities, therefore, included a carefully coordinated multi-objective effort involving extensive impoundment sampling, sediment transport modeling, dredging and on-site placement of excavated sediment, harmonized environmental permitting, rock ramp design (double-throated cross vane structures) to facilitate fish passage and other water-based activities (e.g., kayaking, canoeing), and trail design accommodate historically significant structures as well as an active railroad.

This presentation will highlight innovations (e.g., task sequencing, design solutions, inter-governmental coordination, stakeholder engagement) that garnered an award from the Michigan Chapter- American Council of Engineering Companies and will be applicable elsewhere.

Contact Information: Michael J. Donahue, URS Corporation, 27777 Franklin Road, Suite 2000, Southfield, Michigan 48034 USA, Phone: 248-204-4953, Fax: 248-204-5901, Email: michael.donahue@urs.com

ECOSYSTEM RESTORATION VIA DAMS DISPOSITION ON THE BOARDMAN RIVER SYSTEM

C.A. Platz[1], ***M.J. Donahue*** and *T.R. Naperala*[3]
[1]U.S. Army Corps of Engineers-Detroit, Grand Haven Field Office, Grand Haven, MI, USA
[2]URS Corporation, Southfield, MI, USA
[3]URS Corporation, Traverse City, MI, USA

Located in the northwestern portion of Michigan's Lower Peninsula, the 287 square mile Boardman River Watershed is a nationally significant resource noted for its "blue ribbon" trout fishing and "natural rivers" designation. The lower portion of the system, upstream of its outlet to Lake Michigan's Grand Traverse Bay, features four dams (i.e., Brown Bridge, Boardman, Sabin, Union Street) that date back over a century. Several factors (e.g., FERC requirements, dam safety, economics) prompted the local utility to surrender its FERC license and revert ownership to the city and county, which commissioned an Engineering and Feasibility Study focusing equally on engineering, environmental, socio-economic and cultural considerations.

The U.S. Corps of Engineers-Detroit District (USACE) subsequently initiated a complementary study under the "Great Lakes Fisheries and Ecosystem Restoration" (GLFER) authority (Section 506) of the federal Water Resources Development Act of 2000. Scheduled for completion in late 2013, the study goal is to "Explore the potential to restore tributary habitat for fish by restoring the connectivity and cold water characteristics of the Boardman River and potentially increasing the diversity of species moving between the Great Lakes and Boardman River…through the prospective removal and/ or modification of four dams…" Objectives include "…reconnecting and restoring tributary habitat, allowing unimpeded movement of woody debris and sediment materials…negating thermal disruption, and restoring the natural balance between coldwater and coolwater species." Expected outcomes include "...enhanced populations, diversity and movement of fish species" between the Boardman River System and the Grand Traverse Bay.

USACE retained the services of URS Corporation and Baird and Associates, under a Joint Venture arrangement, to conduct the study. Key elements include extensive analysis of existing conditions; the rigorous evaluation of dozens of dam disposition alternatives (including retain, remove, repair); hydrologic/ hydraulic and sediment transport modeling; habitat analysis of project alternatives; detailed engineering and design; environmental and cultural resource assessments; cost and value engineering; and related tasks yielding a preferred dams disposition alternative (remove Brown Bridge, Boardman and Sabin Dams, modify Union Street Dam).

Project challenges include scope/ magnitude (i.e., multi-dam system); ecological complexity; a large/ diverse stakeholder community; and coordination with a local initiative to remove one of the dams (i.e., Brown Bridge) while the USACE study was ongoing. These challenges- and "lessons learned" for broader applicability- will be discussed during this presentation.

Contact Information: Carl A. Platz, U.S. Army Corps of Engineers- Detroit, Grand Haven Field Office, 307 South Harbor, Grand Haven, Michigan 49417 USA, Phone: 616-842-5510, ext. 25521, Fax:616-842-6141, Email: Carl.A.Platz@usace.army.mil

COLUMBIA ESTUARY ECOSYSTEM RESTORATION PROGRAM: INTEGRATED APPROACH FOR HABITAT ACTION EFFECTIVENESS MONITORING AND RESEARCH

Julie Doumbia[1], *Cynthia Studebaker*[2], *Gary Johnson*[3], *Catherine Corbett*[4], *Matthew Schwartz*[4] *Blaine Ebberts*[2] and *Ben Zelinsky*[1]

[1]Bonneville Power Administration, Portland, Oregon, USA
[2]US Army Corps of Engineers, Portland, Oregon, USA
[3]Pacific Northwest National Laboratory, Portland, Oregon, USA
[4]Lower Columbia Estuary Partnership, Portland, Oregon, USA

In the Lower Columbia River and Estuary (LCRE), the Columbia Estuary Ecosystem Restoration Program (CEERP) applies an ecosystem-based approach to understand, conserve, and restore ecosystems in the LCRE to increase the access, quality and realized function of estuarine and tidal-fluvial ecosystems for juvenile salmonids. CEERP Research, Monitoring and Evaluation includes action effectiveness monitoring and research (AEMR) to determine if habitat restoration actions indeed provide these benefits for juvenile salmonids. Habitat restoration actions include restoring hydrologic connections between main stem and floodplain, creating and/or enhancing shallow-water habitat, and reestablishing native vegetation. A prioritization matrix is used to help Action Agencies select specific habitat actions appropriate for each of these levels, based on geographic and program-specific elements that inform future habitat restoration actions. The CEERP AEMR approach also uses a unique combination of: 1) standard basic metrics; 2) extensive habitat monitoring; and 3) intensive research that are correlated using ratio estimators from CEERP studies and other literature. This structure allows the Action Agencies and regional partners to monitor more actions with finite funds and better synthesize AEMR results using standard methods. The AEMR results are evaluated in the CEERP Synthesis Memorandum, which is used in turn to inform the next CEERP Strategy Report.

Contact Information: Julie Doumbia, Bonneville Power Administration, Portland, Oregon, USA, Phone: 503-230-7641, Fax: 503-230-4563, Email: jadoumbia@bpa.gov.

EVALUATING ECOSYSTEM RESTORATION DURING AND FOLLOWING DAM REMOVAL ON THE ELWHA RIVER

***Jeffrey J. Duda*[1]**, *Jonathan Warrick*[2], *George Pess*[3], *Chris Magirl*[4], *Chris Curran*[4], *Samuel Brenkman*[5], *Michael McHenry*[6], *Matt Beirne*[6] and *Roger Peters*[7]

[1]U.S. Geological Survey, Seattle, WA, USA
[2]U.S. Geological Survey, Santa Cruz, CA, USA
[3]NOAA Fisheries, Seattle, WA, USA
[4]U.S. Geological Survey, Tacoma, WA, USA
[5]Olympic National Park, Port Angeles, WA, USA
[6]Lower Elwha Klallam Tribe, Port Angeles, WA, USA
[7]U.S. Fish and Wildlife Service, Lacey, WA, USA

After years of anticipation, volumes of Environmental Impact Statements, unprecedented mitigation projects, and the multifaceted collection of pre-dam removal data, the deconstruction phase of the Elwha River restoration project officially began on September 17th, 2011. With their simultaneous decommissioning, the removal of the 64 m Glines Canyon Dam and 33 m Elwha Dam represents one of the largest such projects of its kind in North America. The nearly 19 million m^3 of sediment residing in the deltas and reservoirs will be eroded by the river, a major facet of the project that will result in large releases sediment into the river and marine waters. The controlled release of sediment and the halting of dam notching and reservoir draw down during "fish windows" is largely determining a deconstruction schedule expected to last between 2 - 3 years. High suspended sediment concentrations could last for up to 3-5 years following dam removal depending on weather conditions and river discharge. Anadromous fish, including three federally listed species (Puget Sound Chinook, steelhead, and bull trout), reside in the river downstream of Elwha dam for part of their life cycle. All five species of Pacific salmon and steelhead, which are either locally extirpated (sockeye) or persist in degraded spawning and rearing habitat, are expected to recolonize the watershed to degrees that will vary spatially and temporally due to life history characteristics and levels of human intervention. Because no fish passage structures were provided, naturally migrating salmon and their marine-derived nutrients have not seen the protected waters inside Olympic National Park since the Elwha dam was completed in 1913 at river km 7.9. With passage past the Elwha Dam restored in 2012, salmon have started to recolononize upstream. Once the Glines Canyon Dam is removed in 2012, salmon will have access to over 65 river km of mainstem spawning and rearing habitat, at least as much floodplain channel habitat, and numerous tributaries, much of which occurs in wilderness. This presentation will provide an update of dam removal progress, highlight monitoring and evaluation studies, discuss measurement of sediment and geomorphic changes, and detail recent developments with fish populations.

Contact Information: Jeffrey J. Duda, U.S. Geological Survey, Western Fisheries Research Center, 6505 NE 65th Street, Seattle, Washington, 98115, USA, Phone: 206-526-6282, Email: jduda@usgs.gov, Website: http://profile.usgs.gov/jduda

EMPIRICAL MODEL TO DETERMINE NATURAL RESOURCE DAMAGE CLAIMS PER THE OIL POLLUTION ACT OF 1990

Dwight R. Dunk
CDM Smith Inc., Cambridge, MA, USA

The Oil Pollution Act of 1990 (OPA 1990) is a comprehensive law regulating oil spills in U.S. waters. OPA 1990 established strict liability for oil spill damages, replacing the limited liability rule in previous laws. OPA 1990 allows damages for natural resources, the focus of this research. Federal regulations define two natural resource damage assessment methods – Type A computer models, and Type B scientifically rigorous studies. The regulations limit Type A methods to resource damages up to $100,000, regardless of the model results. At this threshold, trustees need to either: limit claims to the threshold, advance a claim using Type B methods, or not pursue a claim. This creates a class of spills defined by the threshold at the lower limit, with an undefined upper limit established by damages equaling Type B assessment costs, the dollar limit at which it becomes cost efficient to advance a claim. Those three options yield economically inefficient outcomes via uncompensated externalities. My research hypothesis is that an empirically derived simplified natural resource damage assessment model adequately values damages above the current regulatory limit.

Statistical analyses of closed NOAA natural resource damage cases in coastal environments (N=53) were conducted to test my hypothesis. The multiple regression model showed a high correlation (r=0.901) and robust explanatory power (r^2=0.828) of the dependent variable, ln damage claim, by the ln of five explanatory variables: gallons spilled, miles of shoreline oiled, human use compensation, protected natural resources harmed, and region (N=20, F=13.471,d.f. 1=5, d.f. 2= 14, p<0.001). This finding shows that this multiple regression model explains approximately 83% of the settled claim value, from a dataset with a median damage claim of $3,304,166. This regression analysis documents that simplified methods can adequately determine claim values above the regulatory threshold.

I recommend raising the Type B threshold to $2.3 million, which correlates to fifty thousand gallons based on a median damage claim of $47/gallon of spilled oil. Raising the threshold would increase the number of natural damage claims using Type A assessments and advance the OPA 1990 goal by: more efficiently internalizing oil spill externalities, reducing spills *ex ante* through increased precautionary investment, and increasing the deterrence value of the law; and concurrently provide funds to Trustee to fund coastal restoration projects.

Contact Information: Dwight R. Dunk, CDM Smith Inc., 50 Hampshire Street, Cambridge, MA 02139 USA,
Phone and Fax: (617) 452-6601; Email: dunkdr@cdmsmith.com

PEOPLE, PLACES & POWER LINES: HABITAT RESTORATION & EDUCATION IN UTILITY RIGHTS-OF-WAY

Tonya S. Hunter and *Michael B. McNulty*[2] *Presented by:* ***Jeff Edstrom***

[1]Environmental Consulting & Technology, Inc., Lansing, MI, USA

[2]ITC Holdings Corp., Novi, MI, USA

Utility corridors are often stereotyped as sterile environments devoid of biodiversity and infested with invasive species. Overhead transmission lines are often believed to serve a single, anthropocentric purpose: to provide the safe and efficient delivery of electricity from place to place. Many believe this can only be accomplished by heavy-handed vegetation management in a way that is incompatible with restoring and maintaining wildlife habitat. Because they span such long distances, power line corridors are inherently diverse from an ecosystem perspective – they pass through uplands and wetlands, river floodplains and streams, and varying physiographic systems with different macro- and micro-climates, soil types, vegetation, and wildlife.

As a member of the ITC Environmental Team, Environmental Consulting & Technology (ECT) has been working to dispel this misconception through habitat restoration and environmental education within high voltage transmission line corridors. ITC's corridors have proven to be effective places for reconnecting people to natural areas in urban, suburban and agricultural landscapes. ITC partners with government agencies, local communities, conservation groups, universities and landowners to establish and restore native vegetation and wildlife habitat, control invasive species and restore and protect rare species and ecosystems within their corridors.

ITC actively participates in the Wildlife Habitat Council's *Wildlife at Work* program, which recognizes conservation efforts by corporations who collaborate with management, employees and communities to conserve and restore wildlife habitats on corporate lands. Corridors at ITC's Corporate Headquarters and two Huron-Clinton Metropark Authority properties have been successfully certified. As a result, the ITC Green Team managed habitat restoration projects, community volunteer installations of pollinator and butterfly gardens, native planting area expansions, species baseline surveys with Oakland Community College science students, invasive species control and construction and installation of bluebird nesting boxes by a local Girl Scout Troop.

Environmental outreach activities also include installation of rain and corridor-appropriate demonstration gardens and interpretive signage. When properly managed, transmission line rights-of-way provide ecologically diverse wildlife habitat corridors, as well as educational opportunities for environmental stewardship and restoration. This presentation will provide a summary of the approaches used in restoration activities in ITC corridors.

Contact Information: Tonya S. Hunter, Environmental Consulting & Technology, Inc., 3125 Sovereign Drive, Suite 9E, Lansing, MI 48911 USA, Phone: 517-272-9200, Fax: 517-272-9703, Email: thunter@ectinc.com

RARE SPECIES PROTECTION STRATEGIES FOR CORRIDOR RESTORATION

Martha R. Holzheuer[1] and *Michael B. McNulty*[2] Presented by: ***Jeff Edstrom***
[1]Environmental Consulting & Technology, Inc., Ann Arbor, MI, USA
[2]ITC Holdings Corp., Novi, MI, USA

Considered fragmenting landscape features, utility corridors are often stereotyped as sterile environments devoid of biodiversity and infested with invasive species. This is a gross generalization, as these corridors can be biologically and ecologically diverse. Spanning thousands of miles, utility corridors are inherently diverse from a landscape ecosystem perspective, representing a diverse cross-section through the landscape and providing suitable habitat for myriad plant and animal species, including threatened and endangered species. These corridors especially serve as refugia for rare and conservative species associated with fire-adapted ecosystems, such as prairie and oak savanna, where the selective removal of woody plant species to provide safe electrical line clearances and maintenance access mimics historic fire disturbance in an otherwise fire-suppressed modern landscape.

ITC Holdings Corp. (ITC) operates approximately 15,000 miles of electric transmission lines in seven states across the Midwest and Great Plains. ITC uses an integrated vegetation management approach to protect threatened and endangered species and maintain their corridors as healthy ecosystems. ITC worked with state agencies to develop a geographic information systems (GIS) database of rare plant and animal species and unique natural ecosystems that occur within, or near ITC transmission corridors.

The database highlights the geographic locations where specialized vegetation management techniques, called prescriptions, are needed to protect rare species and ecosystems. The “prescriptions” were incorporated into ITC’s vegetation management software to help staff plan their management, maintenance, and restoration activities. Specialized techniques typically include limiting equipment access to times when animals are hibernating or plants are dormant, and the use of specialized equipment to limit impacts in sensitive habitats.

ITC also launched an environmental training program to teach vegetation management staff to identify rare species and habitats. The training program utilized the GIS database to locate “hotspots” where numerous rare species and high quality habitats occur in close proximity, providing ideal settings for training sessions. The program used a regional landscape ecosystem approach to understanding corridor restoration and how vegetation management actions affect rare species and their habitats. The training sessions provided unique opportunities to practice rare species and habitat identification skills, review applicable rare species regulatory topics, discuss management actions and their implications for rare species, and empower ITC staff to locate previously unrecorded rare species data to enhance the database.

Contact Information: Martha R. Holzheuer, Natural Resources, Environmental Consulting & Technology, Inc., 2200 Commonwealth Blvd, Suite 300, Ann Arbor, MI 48105 USA, Phone: 734-769-3004, Fax: 734-769-3164, Email: mholzheuer@ectinc.com

TRANSFORMING THE ROUGE AOC FROM MOWED DOWN TO GROWN UP

Zachare Ball[1] and *Tonya Hunter*[1] *Presented by:* ***Jeff Edstrom***
Environmental Consulting & Technology Inc., MI, USA

Six natural areas adjacent to the riparian corridor and located in the highly urbanized Rouge River Watershed have been restored thanks to Great Lakes Restoration Initiative (GLRI) funding to the Alliance of Rouge Communities (ARC). The project increased green infrastructure within the watershed by creating twenty-five acres of grow zones and restoring seven acres of wetlands along the Main, Upper and Lower branches of the Rouge River.

This paper will discuss the following restoration projects: Southfield's Valley Woods Nature Preserve, Detroit's Eliza Howell and Rouge River parks and Wayne County's Lower Rouge Parkway (Inkster Valley and Venoy Park) and Lola Valley Park. The restoration sites, which are located within highly-populated areas, provided both unique challenges and opportunities during the planning and implementation process. Controlled burns had to be carefully coordinated with the communities and adjacent businesses. Local schools and neighborhood associations were participated in the restoration process by assisting in broadcasting the seeds.

The Rouge River, located in southeast Michigan, is the most urban watershed in the state and a tributary to the Detroit River. The Rouge River also has been designated as a significant source of pollution to the Lake Erie system along the border between the United States and Canada.

Valley Woods in Southfield has a relatively intact floodplain forest that provides a variety of natural functions and is bounded by businesses and the Rouge River. The capacity of the seven-acre wetland to store and retain storm water from adjacent developed areas was restored by filling existing man-made drains, removing invasive vegetation and restoring native diversity. Cooperation from the community and local businesses allowed for the first controlled burn to be conducted within Southfield to control invasive phragmites and reed canary grass.

In Detroit, the 200-acre Eliza Howell Park is adjacent to the Rouge's Main Branch and Rouge River Park is the city's largest park with 1,180 acres encompassing 26,000 feet of the Main Branch. Both parks are adjacent to residential neighborhoods. The riparian corridor within the parks is moderately intact and seasonally flooded which provides an important connection to the river. Approximately 10 acres of turf grass was restored to native vegetation grow zones through controlled burns and seed installation.

Finally, Wayne County is the single largest riparian corridor landowner in the Rouge River AOC watershed (approximately 4,200 acres of riparian corridor) and has spent hundreds of millions of dollars over the last 20 years to help restore the river. This project converted 15 acres of upland and riparian property into green infrastructure along the Upper and Lower branches in Wayne County Parks.

Contact Information: Zachare Ball, Environmental Consulting & Technology, Inc., 2200 Commonwealth Blvd., Suite 300, Ann Arbor, MI 48105 USA, Phone: 734-769-3004, Fax: 734-769-3164, Email: zball@ectinc.com

USING A WIKI TO DEVELOP A COASTAL WATERSHED PLAN

Jeffrey Edstrom[1], *Diane Tecic*[2], *Jodi McCarthy*[1] and *Sanjiv Sinha*[1]
[1]Environmental Consulting & Technology, Inc., Chicago, IL, USA
[2]Illinois Department of Natural Resources

Environmental Consulting & Technology, Inc. (ECT) assists the Illinois Department of Natural Resources (IDNR) in developing the Illinois Lake Michigan Implementation Plan (ILMIP) for Illinois' Great Lakes and Coastal Zone Management Programs (ICMP). IDNR is leveraging the power of open source technology, and the expertise of stakeholders, to develop the ILMIP through the use of a wiki utilizing the USEPA's Watershed Central Wiki site.

The goal of the effort is to:

1. empower a broader, more engaged, and demographically diverse stakeholder group,
2. provide a spatially nested framework that scales up to regional goals and down to on-the-ground/in-the-water implementation projects,
3. provide opportunities for more frequent updates, and
4. build stronger partnerships through the sharing of best management practices, tools, and other resources.

ECT designed the basic wiki structure, provides training to local users on how to use the system, develop pages, and update the information about Illinois Lake Michigan watersheds. The goal is to have an integrated planning site with information on local watersheds and their resources and problems, projects that have been completed, as well as projects that can address those environmental problems. This would allow the IDNR, local watershed managers, and the public t better navigate complex watershed information previously difficult to find in a user friendly format. This will result in improved prioritization and implementation of on the ground restoration projects in the Lake Michigan watershed and coastal zone.

The ILMIP is a collaborative effort of the Illinois Department of Natural Resources, Alliance for the Great Lakes, Chicago Wilderness, and the Biodiversity Project to create an agenda for the restoration and protection of Lake Michigan coastal resources in Illinois. The ILMIP will be a shared vision that will inform funding decisions for coastal initiatives, including federal (e.g. Great Lakes Restoration Initiative), State (e.g. ICMP), and local environmental projects within the Illinois Lake Michigan watershed.

Contact Information: Jeffrey Edstrom, Environmental Consulting & Technology, Inc., 125 S. Wacker Dr., Suite 300, Chicago, IL 60606, Phone: 312-421-0444, FAX: 312-421-0220, Email: jedstrom@ectinc.com

CALIFORNIA STATE PARKS GATEWAY>BASE CAMP>ADVENTURE STRATEGY

Dan Ray, ***Cheryl Essex*** and *Philomene Smith*
California State Parks, Sacramento, CA, USA

The Sacramento-San Joaquin Delta and Suisun Marsh "serves Californians concurrently as both the hub of the California water system and the most valuable estuary and wetland ecosystem on the west coast of North and South America" (California's Water Code Section 85002). But it is much more than a water valve and important estuary—the Delta and Suisun Marsh have significant cultural and recreational values. Waterways, parks, wildlife refuges, marinas, historic communities and pleasant country roads seem to be hidden from, but are well within reach of, millions of Northern Californians and other visitors. Opportunities for recreation will change as the region's landscape responds to new water management and ecosystem restoration initiatives.

The Delta Reform Act of 2009 called for strategies to enhance the reliability of California's water system and restore the region's ecosystem, while protecting the inherent cultural, recreational, natural resource and agricultural values. To support the economic sustainability of the Delta and Suisun Marsh's communities, the Act directed California State Parks to "prepare a proposal…to expand within the Delta the network of state recreation areas". The Recreation Proposal for the Sacramento-San Joaquin Delta and Suisun Marsh presents California State Parks' long-term vision for protecting, enhancing and expanding recreational opportunities.

Investing in tourism and recreational facilities and programs, especially to facilitate public access to proposed ecosystem restoration areas, will benefit the region's economy by improving the quality-of-life for residents, attracting more visitors to experience the Delta and Suisun Marsh's recreation assets and authentic character, and providing permanent jobs and an increased tax base. When open space management agencies and recreation providers join together to implement the Gateway>Base Camp>Adventure strategy, described in the report and accompanying poster, it will help more people discover and enjoy the region's recreation opportunities while increasing institutional flexibility and reducing costs. Working together will contribute to the area's economic vitality, supporting jobs, growing businesses and improving the quality of life that makes the region an attractive place to live, visit and do business.

Contact Information: Cheryl Essex, California State Parks, PO BOX 942896, Sacramento, CA 94296, Phone: (916) 651-0386, Email: Cheryl.Essex@parks.ca.gov

RECREATION PROPOSAL FOR THE SACRAMENTO-SAN JOAQUIN DELTA AND SUISUN MARSH

*Dan Ray, **Cheryl Essex*** and *Philomene Smith*
California State Parks, Sacramento, CA, USA

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The report offers a compelling long term vision for state, county and city planners, business and community leaders and environmental organizations by

- documenting existing recreation demand and resources
- identifying how various state agencies contribute to recreation in the region
- discussing projected demographic changes and recreational preferences
- highlighting how potential landscape and policy changes might affect recreation
- providing broad recommendations and potential economic outcomes
- providing specific recommendations for various state agencies
- including appealing "Delta Adventures" vignettes illustrating the Gateway>Base Camp>Adventure strategy

Contact Information: Cheryl Essex, California State Parks, PO BOX 942896, Sacramento, CA 94296, Phone: (916) 651-0386, Email: Cheryl.Essex@parks.ca.gov

THE LOS ANGELES RIVER AND LARGE-SCALE URBAN ECOSYSTEM RESTORATION

Scott Estergard[1], *Kathleen Bergmann*[2], *Michael Affeldt*[3] and *Ira Mark Artz*[4]
[1]Tetra Tech, Inc., Phoenix, AZ, USA
[2]U.S. Army Corps of Engineers, Phoenix, AZ, USA
[3]City of Los Angeles, Bureau of Engineering, Los Angeles, CA, USA
[4]Tetra Tech, Inc., Irvine, CA, USA

The Los Angeles (LA) River Ecosystem Restoration Feasibility Study (Study) is an ambitious effort to restore ecological value to a monumental concrete-lined waterway in the United States' second largest urban agglomeration. The 825 mi^2 watershed ranges from the forested mountains of the Angeles National Forest to the developed coastal plains. From its headwaters to the Pacific Ocean, the river is 51 miles in length and includes nearly 44 miles of a concrete flood control channel.

The Study was initiated in 2006 by the U.S. Army Corps of Engineers (Corps) in partnership with the City of LA as the local cost-sharing partner and Tetra Tech, Inc. as the lead consultant. The Study will be completed in 2013 and recommend sweeping changes along an 11-mile stretch of the LA River from the eastern San Fernando Valley to Downtown LA—an area home to urban neighborhoods that have experienced considerable environmental degradation and socioeconomic decline since the river's channelization. It is estimated that merely 3% of the pre-development riparian and wetland habitat remains in the study area. Nearly 1 million people live within the broader LA River corridor only a short distance away from the study area.

The restoration objectives of the Study area are challenged by considerable physical constraints including road, rail, and utility infrastructure as well as a legacy of extensive urban development that has resulted in ecosystem degradation including land and water quality contamination. The Study team developed key partnerships with community stakeholders to yield an approach to ecosystem restoration that values even the smallest, incremental improvements, recognizing that benefits measured on a per-person basis can be as valuable—or more—than those expressed on a per-acre basis.

The team drew from the City's Los Angeles River Revitalization Master Plan to incorporate design elements such as maintenance pathways that simultaneously serve as wildlife viewing access points and circulation routes to ensure that human needs would be met in concert with ecosystem improvements. Habitat benefits were quantified using the Combined Habitat Assessment Protocol (CHAP) model, which values ecological communities more than individual species.

A notable target for success was modifying the concrete channel to increase habitat value. This goal was embraced by the team and will be realized through the creation of habitat in widened bands and planted terraces to facilitate upstream-to-downstream and in-stream-to-outer bank connections for wildlife and people.

Contact Information: Scott Estergard, Tetra Tech, Inc., Phoenix, AZ, USA, Phone: 602-682-3300, Fax: 602-682-3315, Email: scott.estergard@tetratech.com

AVIAN RESPONSE TO RESTORATION EFFORTS IN THE MIDDLE RIO GRANDE BOSQUE, INCLUDING WETLAND CREATION, AND POTENTIAL IMPACTS OF CURRENT RESTORATION ACTIVITIES ON THE AVIAN COMMUNITY

Trevor Fetz and *Gail Garber*
Hawks Aloft, Inc., Albuquerque, NM, USA

Beginning in December 2003, Hawks Aloft, Inc. conducted avian line transect surveys in the Middle Rio Grande Bosque (riparian forest) between Rio Rancho and the La Joya Waterfowl Management Area, New Mexico. Currently, this project includes 78 transects, each generally between 760-800 m long, that are surveyed three times monthly during winter (December-February) and summer (June-August). In June 2004, we began monitoring a single site in the Tingley Beach area of the Albuquerque, New Mexico bosque designated by US Army Corps of Engineers (USACE) as the future location of a permanent pond and wetland area. Vegetation present prior to the initiation of construction consisted of a mature cottonwood (*Populus fremonti*) canopy with a dense understory dominated by littleleaf mulberry (*Morus microphylla*) and Russian olive (*Elaeagnus angustifolia*). Pre-construction avian use was moderate relative to our other survey areas. However, the establishment of the ponds and marsh habitat has positively impacted bird density and diversity. Since 2006, this site has consistently supported among the highest avian densities and species richness of any transects we survey during both winter and summer. The ponds and marsh provide habitat that is severely lacking throughout the middle Rio Grande bosque. In addition to significantly increasing bird densities and richness from both pre and post-thinning levels, this project has created habitat for several bird species that are generally rare or absent elsewhere along the middle Rio Grande.

Beginning in December 2011, we conducted surveys at 12 additional transects in locations where future restoration efforts by USACE were planned. Although the impacts on birds at these sites have not yet been established, we anticipate increased avian use, especially in areas where the soil substrate has been lowered to improve overbank flows, thereby increasing moist soils for newly-established vegetation.

Since 2010, we have established survey routes for the federally endangered Southwestern Willow Flycatcher (*Empidonax traillii extimus*) at three sites in the Albuquerque bosque where USACE has conducted restoration. At Brown Burn, USACE established willow (*Salix* sp.) swales and an artificial oxbow in an area completely consumed by fire in 2007. Despite the limited potential for hosting breeding Southwestern Willow Flycatchers, this site still holds value for conservation of the species, as it is one of the few remaining areas in the Albuquerque bosque with relatively dense understory vegetation. We documented migrating Willow Flycatchers using the area for refueling and for resting cover during 2010 and 2011. Such migration stopover areas, although not used for breeding, may be important resources affecting local and regional flycatcher productivity and survival. At Durand Outfall and South Corrales, USACE has conducted bank-lowering and is in the process of establishing a diverse native flora. There is potential at both sites for the creation of Willow Flycatcher habitat if the vegetation grows and increases in density over the coming years. We have already documented a positive impact on general avian use at Brown Burn, and anticipate increased avian use at Durand Outfall and South Corrales.

Contact Information: Trevor Fetz, Hawks Aloft, Inc., P. O. Box 10028, Albuquerque, NM 87184 USA, Phone: 505-828-9455, Fax: 505-828-9769, Email: tfetz@hawksaloft.org

APPLICATION OF AN ENHANCED, FINE-SCALE SWAT MODEL TO TARGET LAND MANAGEMENT PRACTICES FOR MAXIMIZING POLLUTANT REDUCTION AND CONSERVATION BENEFITS

Amanda Flynn, *Todd Redder, Joseph DePinto, Laura Weintraub, Brian Lord* and *Derek Schlea*
LimnoTech, Ann Arbor, MI, USA

The Soil & Water Assessment Tool (SWAT) model has gained widespread use in the Great Lakes region for simulating the delivery of water, sediment, and nutrients from agriculturally-dominated landscapes. SWAT models of the Maumee River Basin have been developed or are currently under development for the purpose of projecting current and future watershed conditions. The SWAT models have also been used to evaluate the impact of agricultural conservation and best management practices (BMPs) on pollutant loadings to the Western Lake Erie Basin (WLEB). Limitations of the existing SWAT model applications include coarse scales and resolutions, in addition to the inability to explicitly simulate the process of ephemeral gully (EG) erosion. Previous studies in the Maumee have suggested that EG erosion is likely more important than sheet and rill erosion in removing sediment and nutrients from agricultural fields in certain regions within the basin. These limitations have important implications for identifying and then implementing land management practices that will lead to the greatest possible reduction in pollutant loading as well as providing realistic projections of sediment and nutrient reductions.

To address these limitations, an enhanced, fine-scale model has been developed for one of the priority watersheds that drain to the WLEB. A model called "TRSWAT" has been developed for the Tiffin River watershed, a 778 square mile watershed located in the Maumee River Basin. The model scale and resolution consists of 907 subbasins with an average area of 540 acres. To achieve a "field-scale" resolution within each individual subbasin, a total of 15,652 hydrologic response units (HRUs, smallest model unit) were created to represent the watershed. The standard SWAT source code was also enhanced to include the "tillage-induced ephemeral gully erosion model" (TIEGEM) model originally developed for use with the Annualized Agricultural Nonpoint Source (AnnAGNPS) model to explicitly simulate EG processes.

The fine-scale nature and enhancement of TRSWAT provides a more flexible and accurate tool that can be used to determine the most effective land management practices at target locations to maximize sediment and nutrient load reduction and conservation benefits in the Tiffin River watershed. Location within the watershed, land and soil properties, and existing agricultural practices all factor into prioritizing land management practices that will maximize ecosystem benefits. To support the Great Lakes Protection Fund's "Great Lakes Watershed Ecological Sustainability Strategy" (GLWESS) study, TRSWAT will be used to help identify transactions that can be used to incentivize agriculture practices that produce desired ecosystem benefits (i.e., reduced algal production and sediment problems in WLEB) in receiving waters.

Contact Information: Amanda Flynn, 501 Avis Drive, Ann Arbor, MI, 48108 USA, Phone: 734-332-1200, Fax: 734-332-1212, Email: aflynn@limno.com

ADAPTING GREAT LAKES FOREST MANAGEMENT AND RESTORATION STRATEGIES IN LIGHT OF CLIMATE CHANGE

Tina Hall[1] and ***John Fosgitt***[2]
[1]The Nature Conservancy of Michigan, Marquette, MI, USA
[2]Compass Land Consultants, Inc., AuTrain, MI, USA

Working forests are an integral part of the North Woodslandscape, serving as a dominant ecosystem and providing forest products, jobs, and other environmental benefits to local communities. Sustainable forest management seeks to maintain this diverse supply of benefits while balancing economic, social, and ecological needs. Climate change introduces new challenges to the integrity and productivity of Great Lakes northern forests over the long-term. This talk will explore the North Woods Climate Change Response Framework project which has developed a diverse set of information and resources to help resource managers incorporate climate change considerations into forest management planning and decision-making. This ongoing work expands upon existing sustainable forest pilot projects to demonstrate climate change adaptation through forest management, and can serve as a model to a variety of forest landowners with and beyond the region.

Currently there are few real-word examples of climate change adaptation in forests and other natural systems, and this absence is a barrier to having a more widespread discussion and application of adaptation options among resource managers. This talk will explore two real-world demonstrations of climate change adaption through management. Ecological reference data taken within the Two-Hearted Watershed in Michigan will be adapted to be used within pilot forest systems in the Wisconsin north woods. Both sites will have attributes created or existing parameters honed to better measure climate change effects. Both systems are owned by The Nature Conservancy and managed by the same forestry company. The outcome of this work is a set of climate change data attributes that can be used to assess the effectiveness of adaption actions, and assist in the communication of lessons learned to other forest owners and managers.

NOTE: The North Woods refer to the Laurentian Mixed Forest Landscape, a forested ecoregion in Canada and the U.S. In Canada it is found in Ontario around the Great Lakes and the Saint Lawrence River. In the U.S. it comprises parts of northern Minnesota, Wisconsin and Michigan (Northern Michigan and the Upper Peninsula) and New England.

Contact Information: Tina Hall, The Nature Conservancy of Michigan, Upper Peninsula Office, 101 S. Front Street, Ste. 105, Marquette, MI, 48855, USA, Phone: 906-235-0399, Email: chall@tnc.org

John Fosgitt, Compass Land Consultants, Inc., E5539 Woodland Ave., AuTrain, MI, 49806, USA, Phone: (906) 892-8665, Email: jon@compasslandconsultants.com

WORKING UNDER THE UPDATED AGREEMENT: THE GREAT LAKES NUTRIENT INITIATIVE

***Sandra George**, Brad Bass, Marie-Claire Doyle* and *Lisa Sealock*
Great Lakes Issues and Management Reporting Section, Environment Canada, ON, Canada

Since 1994, there has been a resurgence of of large scale toxic and nuisance algal blooms in the western basin of Lake Erie and the nearshore areas of the other Great Lakes. Some of the worst blooms have been recorded in the past 40 years, particularly during the summers of 2010 and 2011. The reasons for the resurgence of algal blooms since the mid-90s are now more complex than in past decades. The introduction of invasive species to the lakes, such as dreissenids, the intensification of agriculture, increased urbanization, and changes in the intensity, duration and frequency of storm events have significantly changed the cycling of nutrients and food web dynamics in the lakes. In freshwater systems, phosphorus is most frequently the limiting nutrient controlling algal growth and there is now evidence that the forms and cycling of phosphorus, especially soluble reactive phosphorus, found in sewage and fertilizer entering the lakes has further increased the potential for algal growth.

Of all the Great Lakes, Lake Erie is the most susceptible to nearshore water quality issues and is the most heavily impacted by higher amounts of phosphorus. Algal blooms in Lake Erie impact the nearshore waters where human use and interaction with the Lake is greatest, creating environmental, social and economic implications. Costs incurred include the need for increased water treatment, disruptions to utilities by clogged water intakes, and negative effects on commercial fishing and tourism. Human health risks are from direct contact with algae toxins and by ingesting contaminated water. Excess algae degrade fish spawning habitat and cause aquatic ecosystems to become unbalanced by reducing oxygen levels, rendering bottom waters uninhabitable to fish.

The Great Lakes Nutrient Initiative is a new 5-year (2012-2016) Canadian program that was created to understand and address issues related to nearshore water quality and aquatic ecosystem health with a focus on toxic and nuisance algae in the nearshore and open waters of Lake Erie. The Great Lakes Nutrient Initiative has several components including nutrient science, nearshore water quality, urban and agricultural best management practices for managing phosphorous and cost-benefit analysis of various phosphorus reduction strategies with a goal of informing a new strategy for managing phosphorus. This presentation will review how nutrient dynamics have changed in Lake Erie, population dynamics of nearshore nuisance algae, the contributions of different policies, programs and technology to managing phosphorus, the impacts of climate change and some preliminary cost-benefit analyses of various management strategies.

Contact Information: Sandra George, Great Lakes Issues Management and Reporting Section, 867 Lakeshore Road, Burlington ON L7R 4A6, Canada, Phone: 905-336-6284, Fax: 905-336-6272, Email: Sandra.E.George@ec.gc.ca

IRRIGATION AND SOIL MOISTURE ANALYSIS FOR FLOODPLAIN RIPARIAN RESTORATION

***Matthew R. Grabau*[1]**, *Dianne Bangle*[2], *Michael A. Milczarek*[1] and *Lindsey Hovland*[1]
[1]GeoSystems Analysis, Inc., Tucson, AZ, USA
[2]US Department of Interior, Bureau of Reclamation, Boulder City, NV, USA

Under the Lower Colorado River Multi-species Conservation Program (MSCP), the Bureau of Reclamation will re-vegetate over 2,900 ha of historic floodplain with native riparian vegetation. Many of the restoration sites lie outside flood control levees, and thus irrigation must be provided to ensure vegetation success. Additionally, habitat requirements for several avian species covered by the MSCP include the presence of moist soils or surface water. To accommodate these restoration goals, monitoring of irrigation and soil moisture distribution at restoration sites has been identified to as a need for restoration management.

To assess irrigation distribution and soil moisture conditions, a pilot project is being implemented at a 30-ha field at Palo Verde Ecological Reserve, a 500-ha former agricultural site being converted into riparian habitat in Riverside County, CA. Soils are predominantly sand, and groundwater is typically greater than 3 m below ground surface. Thus, irrigation will be provided indefinitely to allow vegetation survival and promote moist habitat conditions.

Characterization consisted of determining soil texture, bulk density, and hydraulic properties (e.g. infiltration rates and soil moisture retention characteristics). Automated soil moisture monitoring instruments were distributed across the site to monitor irrigation application, soil moisture, and plant-available water up to 2 m below ground surface. Additionally, a weather station was installed to determine reference evapotranspiration.

Monitoring data collected during 2012 were used to determine the spatial variation and distribution of water during irrigation periods. Soil moisture data were used to quantify the spatial and temporal response in near-surface and rooting zone soil moisture. Irrigation sensors showed poor irrigation distribution, with excessive percolation near the canal, and little applied water at the opposite end of the field. Soil moisture and groundwater elevation monitoring instruments confirmed rapid movement of water through the root zone and into the aquifer. Following drainage, little moisture was retained at the soil surface. Irrigation distribution was improved and moisture retention was enhanced in less sandy areas of the field.

Monitoring during 2013 will include quantification of surface soil moisture during the avian breeding season and determination of the effective surface roughness due to established riparian vegetation. These parameters will be used to model effects of alternate irrigation flow rates and field schematics on irrigation efficiency and prediction of soil moisture following irrigation events. Finally, project results will be used to recommend large-scale characterization and monitoring methods to promote successful long-term restoration success.

Contact Information: Matthew R. Grabau, GeoSystems Analysis, Inc., 3393 N. Dodge Blvd., Tucson, AZ 85716 USA, Phone: 520-628-9330, Fax: 520-628-1122, Email: matt@gsanalysis.com

SALINITY MANAGEMENT FOR FLOODPLAIN RIPARIAN RESTORATION

***Matthew R. Grabau*[1]**, *Michael A. Milczarek*[1], *Monisha Banerjee*[1] and *Ashlee Rudolph*[2]
[1]GeoSystems Analysis, Inc., Tucson, AZ, USA
[2]US Department of Interior, Bureau of Reclamation, Boulder City, NV, USA

For the Lower Colorado River Multi-species Conservation Program (MSCP), the Bureau of Reclamation will re-vegetate over 2,900 ha of historic floodplain with salt-intolerant native riparian vegetation. Due to river flow modification and levee systems, much of the riparian habitat creation must be implemented on disconnected floodplains. Salinity in these floodplains is often elevated due to a lack of seasonal overbank flooding, evapoconcentration of salts in reservoirs, and addition of fertilizer salts to the system. Additionally, irrigation over shallow groundwater can result upward salinity migration and further salinization. As a result, groundwater and soil salinity exceeds the tolerance of native vegetation in many areas, and additional irrigation might exacerbate conditions. Alternatively, irrigation and drainage might be managed to mitigate salinity.

A study was implemented to determine current soil and groundwater salinity conditions on the lower Colorado River at three riparian restoration sites between Needles, California, and Cibola, Arizona. Soil and groundwater salinity and groundwater elevation was monitored beginning in 2010. Higher soil salinity was correlated with shallower groundwater and finer-grained soils. At sandy sites, soil salinity was significantly reduced with higher irrigation rates. In finer-grained soils with intermediate depth to groundwater, soil salinity greatly exceeding published riparian trees salinity tolerances. Groundwater salinity ranged from that of river water (1 dS/m) to over 20 dS/m, more than double the published salinity tolerance of desired trees. Groundwater salinity was largely controlled by the incoming groundwater, but was sometimes mitigated by high irrigation rates. Adjacent salinity management (leaching) and flooding of adjacent salt-laden areas for waterfowl negatively impacted groundwater salinity at one site.

Soil and groundwater salinity data, aquifer properties, and soil physical and hydraulic properties were utilized to calibrate a salinity model (SaltMod) for each site. Favorable calibration results indicate the potential usefulness of this model to analyze management options. Over the remainder of the project, distinct irrigation rates will be modeled to determine effects on soil and groundwater salinity. Off-season irrigation (salt leaching) and groundwater pumping will also be analyzed for sites for which irrigation alone does not result in acceptable salinity levels.

Study results confirm the potential for salinity accumulation in soils and groundwater where native riparian vegetation is desired. In many cases, irrigation alone can mitigate salinity to acceptable levels. Conversely, poor drainage or elevated incoming groundwater salinity, as observed at a subset of MSCP habitat creation sites, might necessitate more intensive management strategies.

<u>Contact Information</u>: Matthew R. Grabau, GeoSystems Analysis, Inc., 3393 N. Dodge Blvd., Tucson, AZ 85716 USA,
Phone: 520-628-9330, Fax: 520-628-1122, Email: matt@gsanalysis.com

LOUISIANA COASTAL RESTORATION: THE STATE PERSPECTIVE AND ROLE

***Bren Haase**, Jammie Favorite* and *Wes LeBlanc*
Coastal Protection and Restoration Authority of Louisiana, Baton Rouge, LA, USA

Louisiana possesses the largest delta in North America, is the coastal outlet for the commercial waterborne traffic of more than 30 states, handling up to 70 percent of all U.S. exported corn, soy and wheat, is the nation's top producer of shrimp and crawfish, and the number two producer of crabs. By weight, 97 percent of the commercial fish and shellfish harvested in the Gulf of Mexico are species dependent on coastal wetlands. The state is the nation's leading producer of oil and the second leading producer of natural gas (including the resources of the outer continental shelf). However, this vital natural resource is threatened, and its value to the nation declines more each year in the wake of Louisiana's coastal land loss crisis. Over the last 80 years, Louisiana has suffered a net loss of more than 1,900 square miles of coastal lands. Barring decisive action, the rate of land loss will increase with projected losses of 900 to 1,900 square miles over the next 50 years. The Mississippi River flood of 2011 highlighted one of the root causes of Louisiana's plight as large amounts of sediment were deposited into the Gulf of Mexico instead of sediment starved wetlands in the natural manner that built southeast Louisiana.

For more than 20 years the State and Federal government, local communities and non-governmental organizations have developed and implemented projects in an effort to partially restore this important ecosystem. Restoration experts, landowners, and state, federal and community leaders have recognized that a more comprehensive large-scale approach to restoration planning and implementation is needed to achieve a sustainable coastal Louisiana ecosystem. The catastrophic hurricanes of 2005 and 2008 (Katrina, Rita, Gustav and Ike) and the Deepwater Horizon Oil Spill have also highlighted the need for a healthy resilient ecosystem for the good of the state and nation. The State of Louisiana has begun to change its approach to coastal ecosystem restoration planning and implementation to include a comprehensive systems approach that addresses the fundamental problem of land loss facing coastal Louisiana. This approach is described in Louisiana's Comprehensive Master Plan for a Sustainable Coast which illustrates that it's possible to reverse the longstanding trend of wetland loss by 2040.

The coastal Louisiana ecosystem restoration program has greatly evolved over the last 30 years from one funded solely by the state implementing 1-2 small scale projects per year to one funded through several programs implementing numerous multimillion dollar projects per year. This has resulted in improved response to the land loss crisis, flexibility, and success in implementing Louisiana's overall ecosystem restoration and protection program. The State of Louisiana will present its views on the need for coastal ecosystem restoration, discuss its growing and evolving program, the collaboration between the State and its partners to implement projects and some of the challenges from the State perspective in implementing meaningful, efficient restoration projects.

Contact Information: Bren Haase, Office of Coastal Protection and Restoration, P.O. Box 44027, Baton Rouge, LA, 70804-4027, Phone: 225-342-1475, Fax: 225-242-3779, Email: bren.haase@la.gov

COMPARISON OF RAPID STREAM ASSESSMENT TECHNIQUES ACROSS A GRADIENT OF DISTURBANCE

Michael Habberfield[1], *Stacey S. Blersch*[2], *Sean Bennett*[1], *Joseph Atkinson*[2]
[1]Department of Geography, State University of New York at Buffalo, Buffalo, NY, USA
[2]Department of Civil, Structural, and Environmental Engineering, State University of New York at Buffalo, Buffalo, NY, USA

The emphasis on implementation versus monitoring for funding under the Clean Water Act in 2000 has led to a significant increase in stream restoration projects nationwide. This focus has led to an increased usage of visual-based rapid assessment techniques to determine the restoration potential of streams, versus more time consuming monitoring efforts. The current dominant paradigm in stream restoration emphasizes creating stability and increased habitat heterogeneity, therefore many assessment techniques focus on channel stability and in-stream habitat features. However, despite their common usage, few studies have been conducted which compare these techniques in the context of restoration planning. In this study three rapid assessment techniques were applied and contrasted at three different wild trout streams in western New York, representative of varying degrees of disturbance. Two methods focused only on geomorphic stability while the third addressed both stability and biological condition of the streams. All three assessment methods ranked the streams in the same order of quality but the ability to detect a difference between streams was stronger for the method that included both geomorphic and biological conditions. Geomorphic indices may work as proxies for biological indices in highly disturbed or undisturbed systems but may be too sensitive to any form of instability, and may not accurately predict streams in "dynamic equilibrium", which would contain both "stable" and "unstable" reaches. While rapid assessment techniques are an essential tool for watershed planners and stream restoration practitioners to quickly determine potential problems in a stream, translating these assessments into restoration priorities may not be appropriate in some cases if the interpretation of the results is only at the reach level which emphasize channel stability and do not include biological indicators.

Contact Information: Stacey Sloan Blersch, Department of Civil, Structural and Environmental Engineering, State University of New York at Buffalo, Buffalo, NY 14260 USA, Phone: 716-645-4001, Fax: 716-645-3667, Email: sblersch@buffalo.edu

FEASIBILITY STUDIES OF BENTHIC ALGAE CULTIVATION FOR NUTRIENT RECAPTURE AND NEARSHORE WATER QUALITY RESTORATION IN THE LOWER GREAT LAKES

David M. Blersch, Elizabeth Hennessey and *Peter Byrley* *Presented by:* ***Michael Habberfield***
State University of New York at Buffalo, Buffalo, NY 14260, USA

The removal of excess nutrients from tributary waterways is an important component of managing nearshore water quality in the lower Great Lakes. Controlled cultivation of benthic filamentous algae is gaining attention nationally for the removal of nutrients from natural waters. By employing turbulent flow in constructed raceways, algal productivity is maximized, and periodic harvesting removes pollutant nutrients incorporated into algal biomass. The objective of this research was to investigate the utility of benthic algal cultivation for nutrient removal from Great Lakes tributary waterways. Two pilot-scale cultivator raceways were installed near the mouth of the Buffalo River in Buffalo, NY and operated for six months in each 2010 and 2011. Water was continuously pumped from the river and passed over benthic algae in the raceway. Water nitrogen (N) and phosphorus (P) concentrations averaged 0.05 mg PO_4-P L^{-1} and 0.14 mg $(NO_3 + NH_4)$-N L^{-1}. Seasonally-averaged ash-free dry biomass production was 3.1 ± 2.0 and 1.3 ± 1.2 g m^{-2} d^{-1} for 2010 and 2011, respectively, with a maximum weekly average of 19.6 g DW m^{-2} d^{-1}. Ash content in both seasons was greater than 70%. Biomass nutrient content averaged 1.1 ± 0.8 % N and 0.03 ± 0.02 % P by mass. Algal assemblages were dominated by *Cladophora* species in warm months, but shifted to a diatom community in cooler months. The results have significant implications for the feasibility of benthic algal cultivation for water quality management in the Great Lakes region.

Contact Information: David M. Blersch, Department of Civil, Structural and Environmental Engineering, State University of New York at Buffalo, Buffalo, NY 14260 USA, Phone: 716-645-4001, Fax: 716-645-3667, Email: dblersch@buffalo.edu

RAPID RECOVERY OF THE MYCORRHIZAL FUNGAL COMMUNITY FOLLOWING COGONGRASS (*IMPERATA CYLINDRICA*) ERADICATION

Donald Hagan[1], *Shibu Jose*[2], *Francisco Escobedo*[3], *Andy Ogram*[3] and *Kimberly Bohn*[4]
[1]Clemson University, Clemson, SC, USA
[2]University of Missouri, Columbia, MO, USA
[3]University of Florida, Gainesville, FL, USA
[4]University of Florida, Milton, FL, USA

With invasions reported on six continents, cogongrass (*Imperata cylindrica*) is recognized as one of the world's most noxious invasive alien plants. In total, some 500 million hectares worldwide have some degree of cogongrass infestation, with dense monotypic stands widely reported in tropical and subtropical forests, savannas, grasslands, pastures and agricultural fields. In the southeastern US, cogongrass has been observed to dramatically alter the species and functional composition of native southern pine (*Pinus* spp.) ecosystems by displacing native groundcover species, inhibiting the performance of sapling trees and altering fire behavior. Little is known, however, about the role of belowground processes in cogongrass-impacted forest communities. Furthermore, researchers have yet to assess the changes to soil properties that occur following these control efforts, and the implications they have for restoration.

We conducted a study to assess soil biogeochemical dynamics in longleaf pine (*Pinus palustris*) stands severely impacted by cogongrass. Emphasis was placed on arbuscular mycorrhizal fungi (AMF), as these symbionts likely play a role in the establishment of cogongrass, as well as desirable understory species. We sampled surface soils from cogongrass-invaded sites and uninvaded reference sites to assess the effects of cogongrass invasion on AMF community structure. Additionally, since cogongrass had been locally eradicated from numerous sites across the study stands in recent years, we collected additional soil samples from a 7 year "recovery" chronosequence. DNA was extracted from soil samples and used in a PCR reaction using AMF specific 18S rRNA primers, and standard laboratory techniques were used to quantify AMF spores. At a 97% cutoff, we classified our sequences into 31 operational taxonomic units (OTUs). Our comparisons indicate that the richness and diversity of the AMF community, along with spore counts, were unaffected by either cogongrass invasion or eradication. Pairwise comparisons of sequence similarity revealed a novel AMF community in cogongrass invaded soils, as well as soils where cogongrass was eradicated 3 years prior. Convergence with reference, however, occurred by year 5.

The rapid recovery of AMF communities corroborates evidence from a previous study on soil nutrient cycling in these same sites. In that study, all measured soil properties returned to reference levels within 3-7 years of cogongrass eradication. Interestingly, however, sampling of the understory plant community revealed that it remained markedly different from reference – even after 7 years of succession. These findings suggest that the lag in plant colonization is due to dispersal limitations, rather than belowground "legacy" effects. This hypothesis should be tested via studies that evaluate the performance of reintroduced native species in similar sites.

<u>Contact Information</u>: Donald Hagan, Clemson University, 212 Lehotsky Hall, Clemson SC 29634, Phone: (864) 656-7333, Email: dhagan@clemson.edu

RESTORATION OF GUACHINANGA ISLAND AND SAN JOSÉ LAGOON, PUERTO RICO

E. Hague and *J. Massa*
Tetra Tech, Inc., Boynton Beach, FL USA

EPAs designation of the San Juan Bay Estuary (SJBE) System as an estuary of National Importance in 1992 was intended to protect and restore the health of the SJBE, while supporting the economic and recreational interests of stakeholders in the region. This designation and the release of SJBEs Comprehensive Conservation and Management Plan (CCMP) includes an action plan to address water quality issues by filling the deep dredge holes, particularly in in San José Lagoon, and periodic aquatic debris clean-up throughout San Juan Bay Estuary. For more than 50 years, the San José Lagoon located in the SJBE have been impacted by a change in land use from primarily open space with few residential lots to a heavily urbanized landscape. This increase in impervious surfaces has resulted in large volumes of stormwater run-off and untreated sanitary sewage to discharge into San José Lagoon, resulting in decreased flushing and water quality (Atkins, 2011; SJBEP, 2000).

The project is located along the western shoreline of San José Lagoon, where sedimentation has accreted forming a land bridge between Guachinanga Island and the Cantera Peninsula. Mangroves and water hyacinth (*Eichhornia crassipes*) have populated the area between the peninsula and island, trapping plastics and other debris. The project is managed by The Company for the Comprehensive Development of Cantera and the SJBE Program, with the goals and objectives of restoring the habitat on Guachinanga Island by: 1) removing the land bridge which feral cats and other non-native species use to access the island and disturb native populations and 2) improving water quality by removing sediment, debris and vegetation to allow flushing around the island and adjacent to Caño Martín Peña.

The project will be conducted in two phase, with Phase I activities limited to flora and fauna field investigations, laboratory analysis, aquatic vegetation and debris removal, and permitting. The short-term aquatic vegetation and removal plan includes a half-acre of water hyacinth to be treated once with the systemic herbicide glyphosate. Glyphosate is a slow-acting herbicide commonly used to treat aquatic plants growing in the water surface. The low toxicity levels and limited soil activity makes glyphosate an important tool for aquatic weed management. Periodic monitoring of the treated and untreated water hyacinth will occur up to two months after application of the glyphosate.

Phase I will support the development and implementation of a dredge and disposal plan under Phase II. Dredging efforts will be limited to the historic Guachinanga Channel, with disposal in historic dredge holes located in San José Lagoon. Phase II efforts will include one-year post-construction flora and fauna surveys to characterize and assess the spatial coverage and/or community shifts within and adjacent to the historic Guachinanga Channel. Phase I field efforts are scheduled for Early 2013, and will involve partial removal, treatment and disposal of *E. crassipes*, and debris removal from the historic Guachinanga Channel.

Contact Information: Erin Hague, Senior Coastal Ecologist, Tetra Tech, Inc., 1901 S. Congress Ave., Suite 200, Boynton Beach, FL 33426 USA, Phone: 561-735-0482 Ext. 232, Fax: 561-742-0873, Email: erin.hague@tetratech.com

USE OF A LONG-DISTANCE SEDIMENT PIPELINE FOR RESTORATION OF SCOFFIELD ISLAND, LA

Bill Hanson and *Steve Auernhamer*
Great Lakes Dredge & Dock Company, Oak Brook, IL, USA

This presentation will highlight the impressive project to pump river sediment 22 miles from the Mississippi River to a coastal barrier island in Louisiana. The project achieved many firsts and has emboldened the engineering community to think innovatively in developing long term solutions to coastal restoration in combination with river management. There are many aspects to the project including planning, engineering, permitting, and funding, but the fun part the actual construction of the project, will be highlighted during this discussion.

Contact Information: Bill Hanson, Great Lakes Dredge & Dock Co. LLC, 2122 York Road, Suite 200, Oak Brook, IL 60523, Phone: 630-574-3000, Email: WHHanson@gldd.com

RESTORATION SCALING IN THE FACE OF A CHANGING ENVIRONMENT AND UNCERTAINTY

***David A. Hanson*[1]**, *Erika Britney*[1], *Thomas Stewart*[2] and *Alan W. Wolfson*[3]
[1]ICF International, Seattle, WA, USA
[2]ICF International, Sacramento, CA, USA
[3]Parametrix, Portland, OR, USA

Restoration ecologists and planners have traditionally incorporated an implicit assumption of stationarity when planning and designing habitat restoration. Stationarity is based on the assumption that ecosystems function in dynamic equilibrium, fluctuating with a predictable envelope of variability (Milly et al. 2008). Under many regulatory programs (e.g., Clean Water Section 404 or Endangered Species Act Section 7), compensatory restoration was based on replacement of impacted areas on an acre to acre basis with some additional factor (e.g., 3x) to account for uncertainty. Tools such as Habitat Equivalency Analysis (HEA), which was developed in association with natural resource damage assessment (NRDA) under CERCLA and OPA, recognize not all impacted and restored areas are functionally equivalent and instead focus on restoring lost ecosystem services. HEA was first developed as a scaling methodology used as a surrogate for habitat valuation to define compensatory restoration. HEA has primarily been used to assess impacts from oil spills and other contaminants but in recent years is being applied for evaluation of impacts from major forest fires (Kimball 2009), mitigation of new transmission lines (SWCA 2012), and other perturbations of both aquatic and terrestrial habitats. In these applications, HEA has typically been applied as a deterministic model that implicitly assumed stationarity of environmental conditions. HEA more explicitly addresses temporal change in economic value through discounting of ecological services. In some applications, it could be assumed non-stationary environmental conditions affecting baseline would be similar in size and magnitude as the factors impacting compensatory restoration.

The objective of this presentation is to begin a discussion of issues associated with addressing dynamic environmental conditions (i.e., nonstationarity) in restoration planning using HEA. With the increasing frequency and severity of environmental disruptions that can reset or completely change ecological baselines, it is beneficial to step back and to identify compensatory actions that provide ecosystem resiliency and thereby protect or enhance primary restoration. Examples will be presented of how HEA may address declining or changed baselines. However, the discussion will more broadly address issues associated with stationarity, geospatial variability, connectivity, uncertainty, limiting factors and ecosystem protection and how compensatory mitigation might be determined and applied in various circumstances.

Contact Information: David A. Hanson, ICF International, 710 Second Ave, Suite 550, Seattle, WA 98104 USA, Phone: 206-801-2847, Fax: 206-801-2899, Email: david.hanson@icfi.com

EVALUATING INCENTIVES FOR CROP FARMERS TO PROVIDE AQUATIC ECOSYSTEM BENEFITS

Leah M. Harris and *Scott M. Swinton*
Department of Agricultural, Food, and Resource Economics, Michigan State University, East Lansing, MI USA

Agricultural best management practices (BMPs) can reduce the negative impacts of agricultural production on surrounding ecosystems while maintaining productivity. But BMPs are effective only if farmers adopt them. A host of factors affect farmer choices about adopting new practices, including costs, benefits, personal preferences, and risk. Some BMPs offer environmental benefits but reduce farm profitability. Often in these cases, farmers will adopt the BMP only in exchange for an incentive payment.

In order to get the greatest conservation impact from limited funds for incentive payments, two kinds of information are essential. The first is a reliable prediction of ecosystem benefits from adopting the BMP on a specific farm. The second is an understanding of the lowest payment that a farmer would be willing to accept in order to adopt that BMP. Predicting ecosystem benefits can be done with models. But farmers hold private information about costs, benefits, and preferences that affects their willingness to accept payments for BMP adoption. Offering cost-effective conservation incentives requires knowledge about both the farm and the individual.

An effective way to learn about both the farm and the farmer is to use procurement auctions in which farmers compete to win the low bid to offer conservation benefits from BMP adoption. We have designed a procurement auction to evaluate farmer bids to adopt BMPs that can result in aquatic ecological benefits in Lake Erie. The farmers provide the cost information through their bids. Then two hydrological models – Soil and Water Assessment Tool (SWAT) and Western Lake Erie Ecosystem Model (WLEEM) – inform the ranking of bids by predicting the magnitude of benefits from those practices in the farm's geographical setting.

We use farmer focus groups to pilot test procurement auctions, using four types of incentives to encourage BMP adoption: 1. direct payments, 2. payments + yield protection insurance, 3. tax reductions, and 4. market access benefits. In multiple rounds of bidding, we compare individual bidding with a collective bidding mechanism designed to motivate coordinated landscape management needed for aquatic improvements within a watershed.

Using procurement auctions as a tool, this project identifies cost-effective incentives that can lead to widespread adoption of agricultural practices that improve water resources in the Great Lakes. Results from our research can help regulators understand farmer willingness to adopt new BMPs and will guide the development of incentive programs that motivate coordinated land management leading to enhanced aquatic benefits across a watershed.

Contact Information: Leah M. Harris, Department of Agricultural, Food, and Resource Economics, Michigan State University, East Lansing, MI 48824 USA, Phone: 804-357-8510, Email: leahmh@msu.edu

INDICATORS, METRICS AND TOOLS FOR INFORMING THE SCIENCE AND VISION OF GULF COAST ECOSYSTEM RESTORATION

Matthew C. Harwell and *Janis C. Kurtz*
U.S. Environmental Protection Agency, Gulf Breeze, FL, USA

The Gulf Coast Ecosystem Restoration Council will oversee restoration efforts the under the recently passed RESTORE Act in response to the historic Deep Water Horizon oil spill in the Gulf of Mexico. The Council will develop a Comprehensive Restoration Plan using best available science to restore and protect the natural resources, ecosystem, habitats and economy of the Gulf Coast. Clearly the Council's Plan, based on a strategy previously developed by the Gulf Coast Ecosystem Restoration Task Force (GCERTF), will include both restoration science and issues of economic recovery associated with restoring vial gulf communities. In this poster, we examine the linkages between the GCERTF's Strategy, Council Plans and recent scientific advances conducted by the U.S. Environmental Protection Agency's Office of Research and Development which include indicators, metrics and tools that may be useful for measuring restoration performance. The natural resources of the Gulf's coastal and marine habitats and the services they provide are essential to the regional economy and provide 17% of the Nation's gross domestic product (GDP). Restoration of these natural resources, goods and services will be pivotal to recovery of this ecosystem and the regional economy.

Contact Information: Matthew C. Harwell, Gulf Ecology Division, U.S. Environmental Protection Agency, 1 Sabine Island Drive, Gulf Breeze, FL 32561 USA, Phone: 850-934-9206, Fax: 850-934-2403, Email: harwell.matthew@epa.gov

LESSONS LEARNED FROM THE EVERGLADES COLLABORATIVE ADAPTIVE MANAGEMENT PROGRAM

Andrew LoSchiavo[1], *Ronnie Best*[2], *Rebecca Burns*[3], *Susan Gray*[4], ***Matthew Harwell***[5], *Eliza Hines*[6], *Agnes McLean*[7], *Tom St. Clair*[8], *Steve Traxler*[9] and *Jim Vearil*[1]

[1]U.S. Army Corps of Engineers, Jacksonville, FL, USA
[2] U.S. Geological Survey, Davie, FL, USA
[3]Atkins, Raleigh, NC, USA
[4]South Florida Water Management District, West Palm Beach, FL, USA
[5]U.S. Environmental Protection Agency, Gulf Breeze, FL, USA
[6]U.S. Fish and Wildlife Service, Grand Island, NE, USA
[7]Everglades National Park, Homestead, FL, USA
[8]Atkins, Jacksonville, FL, USA
[9]U.S. Fish and Wildlife Service, Vero Beach, FL, USA

Recent technical papers explore whether adaptive management (AM) is useful for environmental management and restoration efforts and discuss the many challenges to overcome for successful implementation, especially for large-scale restoration programs (McLain and Lee 1996; Levine 2004; Gunderson and Light 2006; Walters 2007; Ruhl and Fischman 2010; Doremus 2011). Few successful examples of large-scale AM applications are available because of the many logistical and technical challenges that arise with ecosystem management activities of this magnitude Examining where and how the components of an AM program have been successfully implemented may yield insight into what approaches have and have not worked, including what needs improvement. This presentation documents the progress and challenges faced during development and implementation of the Comprehensive Everglades Restoration Plan (CERP) AM program; additionally, the presentation identifies eight lessons learned including: 1) establishing a legislative authority for AM; 2) developing an applied science framework; 3) identifying AM champions, team roles and responsibilities; 4) understanding the governance structure; 5) integrating AM activities with existing institutional practices; 6) obtaining input from expert peer review; 7) defining uncertainties and management options matrices; and 8) exploring creative stakeholder engagement methods.

<u>Contact Information</u>: Andrew J. LoSchiavo, U. S. Army Corps of Engineers, Jacksonville District, 701 San Marco Blvd, Jacksonville, FL, 32207 USA, Phone: 904-232-2077, Fax: 904-232-1434, Email: Andrew.J.LoSchiavo@usace.army.mil

STREAMBANK STABILIZATION IN THE MIDWEST – LESSONS LEARNED

***David J. Heinze*[1]*,* *Scott Hayter*[2] and *Victor Magar*[3]
[1]ENVIRON International Corp., Denver, CO, USA
[2]ENVIRON International Corp., Ann Arbor, MI, USA
[3]ENVIRON International Corp., Chicago, IL, USA

Bioengineering generically means the use of engineering technology to manipulate biological systems. The most common use of this term applies to genetic research and manipulation but it can refer to a host of other applications. For the purposes of this presentation, bioengineering refers to the manipulation of biological systems, primarily horticultural communities, for the purposes of erosion control and stream stabilization. Bioengineering tries to mimic the processes that occur naturally in a highly compressed time frame. Bioengineering tries to implement processes that would naturally require decades or centuries within time frames as short as a few growing seasons.

Bioengineering differs from traditional engineering only in the sense that biological or organic systems are the primary stabilizing application in lieu of traditional engineered materials such as stone or concrete. Since biological systems are being utilized, there are a number of additional considerations that must be accounted for because the stabilizing materials are typically weaker and less predictable, which are apparent disadvantages. To offset these disadvantages, bioengineering has several advantages not offered by traditional engineering applications. These advantages include potentially lower implementation costs, more pleasing aesthetic qualities, and potential restoration or enhancement of the impacted natural environment.

A bioengineering design approach incorporates the same steps as a traditional engineering design approach with a number of additional steps and considerations added. To successfully implement a bioengineering stream project, the sciences of stream morphology, soil bioengineering, agrohistology, biology, and horticulture must also be employed. These sciences reveal much about the natural biological systems that can successfully stabilize a stream corridor.

A successful bioengineering project can address stream stability concerns in a cost effective, aesthetically pleasing, and environmentally friendly manner. However, without a thorough understanding of the biological systems and capabilities of the biotechnical materials used for stabilization, success can be difficult to achieve. We will discuss a number of projects constructed in the mid-west that provide valuable information on the design and construction of natural solutions for streambank stabilization.

Contact Information: David J. Heinze, ENVIRON International Corp., 303 E. 17th Avenue, Suite 400, Denver, CO 80203 USA, Phone: 303-382-5474, Fax: 303-382-5499, Email: dheinze@environcorp.com

HURRICANE IMPACTS ON A COASTAL ECOSYSTEM RESTORATION PROJECT: PLANT COMMUNITY, INVASIVE SPECIES AND ADAPTIVE MANAGEMENT

Marc A. Foster[1], ***Cynthia J. Henderson***[1] and *Loretta L. Battaglia*[2]
[1]Cypress Environmental Services, LLC, Biloxi, MS, USA
[2]Department of Plant Biology and Center for Ecology, Southern Illinois University Carbondale, Carbondale, IL, USA

The Conservation Fund operates a wetland mitigation bank located near the southwest coast of Mississippi. The 960-acre site is 3 miles north of the Mississippi Sound and was crossed by the eye of Hurricane Katrina in August 2005. The bank site was inundated with eight feet of seawater and impacted by hurricane-force winds during Hurricane Katrina. Over the next seven years, we examined response of the pine savanna wetland vegetation community to the hurricane disturbance, the increase in invasive exotic plant species, and the subsequent adaptive management changes necessary to meet performance metrics for the site.

The performance metrics for the site are based primarily on species richness of the pine savanna herbaceous vegetation. Rapid monitoring assessment of the pine savanna plant community has been conducted annually from pre-Katrina conditions to 2012. Multivariate analyses of the herbaceous wetland plant community composition indicated that the high diversity, pre-Katrina plant community diverged after the storm to a lower diversity subset assemblage. Some recovery through time is evident, although species composition had neither stabilized nor completely returned to pre-storm conditions by 2012.

Invasive exotic Chinese tallow trees (*Triadica sebifera*) and cogon grass (*Imperata cylindrica*) increased dramatically at the site following Hurricane Katrina. We examined the relationship between expansion of invasive exotic-infested habitat with a dramatic reduction in total herbaceous plant cover following inundation by Katrina.

For the site to achieve the project performance metrics, management methods have been adapted over time to achieve reduction of invasive exotic plants and to facilitate re-establishment of the native plant community. Management measures were evaluated multiple times annually with regards to progress towards the performance metrics and substantial multi-phase intervention was required to achieve the performance metrics for invasive exotics following Hurricane Katrina.

Current climate change research indicates a trend of more intense tropical storms which may result in more frequent transport of saline water and higher wind speeds to inland areas. These coastal ecosystems may be shifting away from fixed reference standards regarding their plant communities. Additionally, climate change-driven shifts in underlying environmental conditions may promote increased invasion of native habitats by exotic species, particularly when resiliency of native plant communities is reduced.

Contact Information: Cynthia Henderson, Cypress Environmental Services, LLC, PO Box 1168, Biloxi, MS 39533 USA, Phone: 228-596-2708, Fax: 800-507-6306, Email: chenderson@cypress-environmental.com

ECOSYSTEM RESTORATION AND REGIONAL RESILIENCE: A POST-SANDY PERSPECTIVE

Roselle E. Henn
Roselle E. Henn, North Atlantic Division, US Army Corps of Engineers, Brooklyn, New York, USA

The North Atlantic Division, US Corps of Engineers is evaluating the performance of coastal ecosystem restoration projects in the wake of Super Storm Sandy. Our goal is to examine the relationship between our green infrastructure portfolio and regional resiliency to extreme storm events. It is anticipated that the results of this evaluation will provide valuable lessons learned for forward coastal planning, as well as recommendations for improved ecosystem restoration design and adaptive management strategies. This presentation will compare the pre- and post-storm conditions of constructed projects, implemented through the collaborative efforts of numerous Federal, State and Local Governments, and Non-Governmental Partners, located between the Chesapeake Bay and Rhode Island. The inventory of projects includes the Lower Cape May Meadows coastal wetlands restoration project in southern New Jersey and marsh island projects in Jamaica Bay, New York; areas that were among those directly impacted by Sandy. Relationships between the examined ecosystem restoration projects and storm-related effects to larger systems, human and natural, will be discussed in the context of regional resilience and an integrated, systems approach to coastal sustainability.

Contact Information: Roselle E. Henn, Planning and Policy, North Atlantic Division, Brooklyn, NY 11252 USA, Phone: 347.370.4562, FAX: 718.765.7210, Email: roselle.e.henn@usace.army.mil

THE OHIO LAKE ERIE PHOSPHORUS TASK FORCE II

Gail Hesse
Lake Erie Commission, Sandusky, OH, USA

The Ohio Lake Erie Phosphorus Task Force was first convened in 2007 to analyze the relationship between increases in dissolved reactive phosphorus loading from the Ohio portion of the Lake Erie basin and corresponding increases in algal blooms in the western basin of Lake Erie. The Task Force analyzed relative contributions from multiple sources of dissolved reactive phosphorus. The Task Force published a report in 2010 (Ohio Environmental Protection Agency (OEPA), 2010. *Ohio Lake Erie Phosphorus Task Force Final Report*, Columbus, Ohio). Phase II of the Task Force was convened in 2012 to develop target loading reductions and evaluate new and emerging data and information.

Both Phase I and II of the Task Force conducted science-based analyses for the purpose of developing policy recommendations. The Task Force did not conduct any monitoring or modeling but relied on published research and presentations by content experts. The composition of the Task Force includes members from the research community, representatives from the agricultural community and water resources and environmental interests. The mix of public and private sector interests and research scientists fostered deliberation on the status of the science in disparate fields of study and programmatic feasibility and implications. This exchange enabled assumptions to be challenged and allowed for new ideas to come forward while establishing a platform for consensus based recommendations

Contact Information: Gail Hesse, Lake Erie Commission, 111 Shoreline Drive, Sandusky, OH 44870, Phone: 419-621-2040, Email: gail.hesse@lakeerie.ohio.gov

WHO'S KEEPING SCORE? DEVELOPING A REPORT CARD FOR COASTAL LOUISIANA

Nick Speyrer, Denise Reed, and ***Ann Hijuelos***
The Water Institute of the Gulf, Baton Rouge, LA, USA

Louisiana's coast includes one of North America's most productive wetland ecosystems, hosts five of the nation's largest ports, and provides more than 90 percent of the nation's offshore energy supplies. In addition, the coast is home to nearly half of Louisiana's population. All of these resources and communities are at risk from coastal land loss. According to the US Geological Survey, Louisiana has lost approximately 1,900 square miles of land since 1932. This extensive land loss not only harms priceless natural systems, it makes towns and cities more vulnerable to flooding. The same flooding risks also threaten nationally important infrastructure, such as navigation channels and energy supply systems that are critical to the nation's economy.

Recognizing how much there is at stake, both in terms of problems to be addressed and opportunities to be wisely used, the Louisiana Legislature unanimously adopted Louisiana's 2012 Comprehensive Master Plan for a Sustainable Coast. The plan was based on a two-year analysis involving some of the state's best scientists and engineers as well as national and international experts. The State's Coastal Protection and Restoration Authority used this analysis to select 109 high performing projects that could deliver measurable benefits to Louisiana's communities and coastal ecosystems over the coming decades. The plan showed that if these projects were fully funded, at a cost of $50 billion, the state could substantially increase flood protection for communities and make great strides toward creating a sustainable coast.

As funding sources are identified and implementation begins, it is imperative that progress is measured and reported. As such, The Water Institute of the Gulf is developing an approach for producing report cards that will highlight the progress of the State's coastal restoration and protection program.

The session will focus on how The Water Institute worked with subject-matter experts and key stakeholders to:

- identify the appropriate performance measures;
- design procedures for quantifying and scoring the selected measures;
- develop a methodology for producing the report card;
- conduct focus group sessions to receive input on proposed measures as well as the graphical and visual elements of the score card; and
- create a report card that is rigorous and technically sound, but also understandable and digestible for policy makers and the general public.

Contact Information: Nick Speyrer, Director of Planning, Coordination, and Outreach, The Water Institute of the Gulf, 301 North Main Street, Suite 2000, Baton Rouge, LA 70825, USA, Phone: 225-227-2716, Email: nspeyrer@thewaterinstitute.org

SETTING MEANINGFUL RESTORATION TARGETS FOR URBAN RIVER RESTORATION EFFORTS

Peter J. Hill and *Josh Burch*
District Department of the Environment, Washington, DC, USA

Following decades of neglect and corresponding degraded water quality, urban river restoration efforts are proliferating as a response to these ecological impairments but also as a model for urban renewal. These efforts vary depending upon the cities and types of impairments, but nearly all contain elements of habitat restoration, stormwater retrofitting, redevelopment, and urban renewal. With so many different goals implicit in this range of activities, how can funders and the public at large know if the work is resulting in sufficient ecological improvements? Without an objective measurement of progress, how can a city know if they should sustain, modify, or increase their efforts? Typical “score-card” type evaluations frequently conflate data measurements with measurements of political support or government dollars invested. Indicators based on data such as “days not meeting water standards” are scientifically clear but not always understood by the public. Due to a built environment where landscape change is by default slow, indicators such as water quality generally do not show improvements for decades, may have a significant time lag, and are dramatically influenced by precipitation patterns. In general, the tools used for assessing progress tend to be either exceedingly all-inclusive such that they mix intention with results or they are so narrowly focused that they do not capture what may be happening in the broader urban environment, where human behavior is as influential upon aquatic health as is riparian buffer. Additionally, these indicators for progress typically do not allow for comparison among restoration efforts and generally do not offer an ability to discern the slight trends that would be expected in areas where change is incremental. With a greater amount of funding being invested in river restoration efforts and with cities banking on river-focused development as a key element in their urban renewal efforts, a better system of assessment is needed.

A new type of aggregated score will be presented that measures change in the most important on-the-ground indicators in a manner that focuses on incremental change in conditions rather than comparison to a pristine state. This approach consolidates habitat improvements, water quality changes, and community engagement. This score could give residents, practitioners and funders a better sense of whether restoration efforts are on the right track or wrong track. Importantly, this can be a way for the unique mix of interested parties found in cities to engage in this progress indicator. Finally, restoration efforts that are showing better results could be examined as model case studies, advancing efforts elsewhere.

Contact Information: Peter J. Hill, Watershed Protection Division, District Department of the Environment, 1200 First Street NE, 5th Floor, Washington, DC USA, Phone: 202-535-2241, Fax: 202-535-1363, Email: peter.hill@dc.gov

WORKING UNDER THE UPDATED AGREEMENT: THE GREAT LAKES RESTORATION INITIATIVE

Elizabeth K. Hinchey Malloy, *Thomas K. O'Donnell* and *Paul J. Horvatin*
U.S. Environmental Protection Agency, Great Lakes National Program Office, Chicago, IL USA

The Great Lakes Restoration Initiative is the largest investment in the Great Lakes in two decades. A task force of 11 federal agencies developed a plan to put this historic initiative into action. This action plan covers fiscal years 2010 through 2014 and addresses five urgent focus areas: 1) Cleaning up toxics and areas of concern; 2) Combating invasive species; 3) Promoting nearshore health by protecting watersheds from polluted run-off; 4) Restoring wetlands and other habitats; and 5)Working with partners on outreach and education. Essentially, the GLRI provides an unprecedented opportunity to systematically tackle the most significant environmental problems impacting the Great Lakes ecosystem.

One such persistent environmental problem is nonpoint source pollution, which is a substantial contributor to the impairment of waters across the Great Lakes basin. The GLRI Action Plan identifies five targeted geographic watersheds (Fox River, Saginaw River, Maumee River, St. Louis River, and Genesee River) for nonpoint source pollution control measures. Three of these targeted watersheds (Maumee River, Saginaw River, and Lower Fox River) have been clearly identified as watersheds with excessive phosphorus inputs, the occurrence of harmful algal blooms, or the occurrence of nuisance algae (*Cladophora*) in the corresponding nearshore areas. Beginning in FY 2012, the GLRI Inter-agency Task Force identified smaller priority sub-watersheds located within these larger targeted watersheds for coordinated phosphorus reduction efforts. These sub-watersheds were selected based on the existence of watershed management plans, percentage of agricultural land, potential for high impact phosphorus reduction practices, and local interest.

This presentation will give an overview of progress being made to reduce non-point source nutrient pollution to the nearshore environment though the GLRI. Interagency projects implemented to reduce agricultural phosphorus runoff in tributaries draining targeted watersheds will be highlighted.

Contact Information: Elizabeth K. Hinchey Malloy, U.S. Environmental Protection Agency, Great Lakes National Program Office, Chicago, IL 60604 USA, Phone: 312-886-3451, Fax: 312-697-2606, Email: hinchey.elizabeth@epa.gov

FRIEND OR FOE? DO REGIONAL LARGE-SCALE ECOSYSTEM RESTORATION PROGRAMS HELP OR HURT ONE ANOTHER AT A NATIONAL LEVEL?

Bill Hinsley
ARCADIS U.S, Inc., Seattle, WA, USA

Large-scale and regional ecosystem restoration programs have a multitude of technical, political, stakeholder, and financial hurdles standing in between concept and reality. Fundamental to achieving restoration success is gaining knowledge about the functionality of the ecosystem to be restored and incorporating this learning into the project's development and implementation. To overcome these challenges, practitioners have worked within and between programs to develop, document, test, refine, and share lessons learned. Best practices, adaptive management, decision support systems, and evolving governance structures are supporting planning and implementation of successful projects at a state and regional level. That said, in almost every case, Federal authorities and funding are a critical and integral part of a successful program.

With the intention of comparing and contrasting experiences of three ecosystem restoration programs (Sacramento-San Joaquin River Delta, Louisiana Coastal Area, and Florida Everglades), this session will explore the crafting and sustaining of a federal policy and funding frameworks to sustain each. While sharing lessons learned between programs can benefit scientific and engineering professionals, the rise of the "mega program" initiatives puts a strain on existing Federal programs and budgets. Designing and defending the proper policy and funding frameworks may not always be a collaborative pursuit between programs when each seeks to kick off and sustain what will inevitably be a multi-decadal effort, spanning tenures of elected and appointed officials as well as career service employees from public sector and private sector stakeholders. Furthermore instead of growing the federal "financial pie" – these programs may now compete for funding as well as talented agency management and technical staff.

So, what's to come of it? Open collaboration, fierce competition, or a middle-ground between/amongst multiple ecosystem restoration programs? We'll explore successes and suggestions for pushing forward a national resource management and ecosystem restoration agenda.

Contact Information: Bill Hinsley, ARCADIS U.S., Inc., Eastlake Avenue E., Suite 200, Seattle, WA 98102 Phone: 206-726-4741, Mobile: 206-653-5440, E-mail: william.hinsley@arcadis-us.com.

APPLYING ENGINEERING SOLUTIONS TO THE SCIENCE OF PROTECTION AND ENHANCEMENT OF AQUATIC ENVIRONMENTS

William E. Holman
Stanley Consultants, Minneapolis, MN, USA

Considerable behavioral and physical research is undertaken by Universities, Wildlife Management Agencies, Associations and other interested parties to learn more about the behavior of native and invasive species. This research, coupled with the field experience of our wildlife and environmental management professionals results in "ideas" of how we can enhance the environment to support native species, and/or control the advance of invasive species that threaten our native flora and fauna. Strategies are developed, modeled and evaluated, with those showing the most potential selected for implementation in our rivers, streams and wetlands. Scientist and engineers then come together to design and construct the physical structures that scientific research and past practice have found to show the most promise.

The presentation of several case histories will illustrate the teaming of science and engineering to transform ideas developed from experience and research into real life solutions in the field. The case histories will include design and implementation of structures to enhance the ability of wildlife management professionals to promote conditions supporting native species. Included are water control structures to provide the safety and flexibility management professionals require for providing optimum conditions for native flora and fauna to flourish. Also discussed will be the engineering challenges of implementing proven nature-like fish passage technology on a tall Midwest dam. Nature-like passages have been successfully implemented on lower head dams (less than 15 feet) across the Midwest. A case history relating the challenges of transferring and implementing this technology to a dam nearly 50 feet in height will be presented.

Engineers and scientists also need to collaborate in transforming ideas for the control of invasive species into real life solutions in the field. The presentation will include several case histories relating to the implementation of strategies for control of the European Sea Lamprey. Sea lampreys are an invasive species in the Great Lakes that prey on native species of fish. They are the object of an integrated control program implemented in U.S. waters by the U.S. Fish and Wildlife Service as an agent of the Great Lakes Fishery Commission. The program uses a suite of techniques to kill or prevent reproduction by sea lampreys including application of selectively toxic lampricides to larval infested waters, trapping of spawning-phase lampreys, release of sterilized lampreys, and construction of barriers to prevent upstream migration of lampreys to spawning grounds. The program has been successful in reducing sea lamprey populations to about ten percent of pre-control abundance. Continued suppression of sea lampreys is essential to achieve healthy aquatic ecosystems in the Great Lakes. The design and construction of lamprey barrier and trapping structures in Great Lakes tributaries will be discussed.

Contact Information: William E. Holman, Stanley Consultants, Inc., Minneapolis, MN 55416 USA, Phone: 952-738-4331, Fax: 952-546-4279, Email: holmanbill@stanleygroup.com

COMMON THEMES FOR RESTORING THE COLUMBIA BASIN ECOSYSTEM THROUGH SALMON AND STEELHEAD RECOVERY

Elizabeth Holmes Gaar
NOAA Fisheries, Northwest Region, Portland, OR

Thirteen species of Columbia Basin salmon and steelhead are threatened or in danger of extinction and are listed under the Endangered Species Act (ESA). The ESA's purpose is to restore the ecosystems upon which listed species depend. However, the expanse of these species' ecosystem is huge. They are far-ranging species and face threats throughout their life cycle from tributary habitat loss and degradation; degraded water quality; an extensive network of dams; loss and degradation of estuary habitat; predation; commercial, sport, and tribal fisheries; and the effects of hatchery programs. Recovering the species requires a concerted holistic approach on a basin scale. However, there is no one entity in the Columbia Basin with the jurisdictional scope, expertise, or resources to carry out such an undertaking.

Against this backdrop, NOAA organized ESA recovery plans for these species geographically and in collaboration with local stakeholders, tribes, states and other federal agencies. NOAA also incorporated basin-scale agreements, notably for the Federal Columbia River Power System and Columbia River treaty fisheries. The recovery plans have, to some degree provided unifying themes that serve all the entities. These unifying themes include biological objectives based on recommendations from technical recovery teams; prioritized limiting factors, actions, and research, monitoring, and evaluation; common reporting systems; and adaptive management.

NOAA depends on its local and basin-wide partners for much of the recovery plan implementation, however, we are actively assisting and guiding those efforts. We are supporting coordinated status and trend monitoring to evaluate the species' progress toward biological objectives. NOAA's Pacific Coast Salmon Recovery Fund has invested millions of dollars in recovery actions, as have numerous other programs, including the Bonneville Power Administration's Fish and Wildlife Program. NOAA is developing analytical tools for evaluating whether recovery actions across the Columbia Basin are indeed addressing the priority limiting factors. Reporting the results of these analyses and demonstrating that limited resources are being appropriately prioritized is critical to maintaining available funding streams for salmon recovery. NOAA has also developed a web-based Recovery Action Mapping Tool to assist recovery implementers in identifying the priority recovery actions specified for their watersheds. Research and monitoring is also an essential tool for adaptively implementing salmon recovery. NOAA is also prioritizing Intensively Monitored Watersheds and large-scale habitat status and trend monitoring to evaluate the effectiveness of recovery strategies in restoring ecological processes, and to inform adaptive recovery implementation. Our challenge and our hope is to provide common themes and tools that promote listed salmon and steelhead recovery, which, in turn, will help restore the Columbia Basin ecosystem.

Contact Information: Elizabeth Holmes Gaar, NOAA Fisheries Northwest Region. 1201 NE Lloyd Blvd.., Suite 1100, Portland, OR 97232 USA, Phone: 503-230-5434. Fax: 703-648-6953, Email: lwingard@usgs.gov

RIVER ENHANCEMENTS AND LEVEE REPAIRS IN AN URBAN SETTING

Michael K. Homza[1], *Brian Wolcott*[2], *John Wells*[3], *Jed Volkman*[4] and *Jonathan Thompson*[4]
[1]GeoEngineers, Boise, Idaho, USA
[2]Walla Walla Basin Watershed Council, Milton-Freewater, Oregon, USA
[3]Anderson Perry & Associates, Walla Walla, Washington, USA
[4]Confedereated Tribes of the Umatilla Indian Reservation, Walla Walla, Washington, USA

The City of Milton-Freewater, Oregon got caught in a struggle between four federal agencies when it became evident the City's levees desperately needed repairs. On one side, the US Army Corps of Engineers (Corps) and FEMA were requiring significant repairs to the levees to protect the City from flooding. On the other side, NOAA Fisheries (NOAA) and US Fish and Wildlife (USFW) would not allow the repairs because the Walla Walla River, which flows through the City, contains endangered fish species. After many painstaking negotiations between these and other stakeholders, a compromise was finally agreed upon. A key element in reaching this agreement was the development of a comprehensive habitat enhancement plan that identified numerous distinct projects that protect the City from flooding and simultaneously enhance in-stream and riparian habitat. This presentation will describe the conflict, collaboration and compromise—as well as the habitat enhancement plan—that was pivotal to this resolution.

After inspecting the City's levees, the Corps deemed the levees "out of compliance." This determination caused FEMA to "decertify" the non-compliant levees, which in turn placed the majority of the City into regulatory floodplains and threatened to remove it from FEMA's flood insurance program. In addition to being in real danger of flooding, households and businesses in the floodplains were required to pay thousands of dollars per year in flood insurance premiums. Furthermore, mortgages for buildings in the flood zones could not be secured; federal projects in the flood zones were halted; real estate values plummeted; and real estate transactions essentially came to a standstill. In spite of all these impacts, attempts to repair the levees were thwarted by NOAA and USFW because the repairs would damage habitat vital to ESA-listed Steelhead and Bull Trout as well as reintroduced Chinook salmon.

The authors of this presentation, in cooperation with other stakeholders, collaborated on a habitat enhancement plan that made real improvements to the river's in-stream and riparian habitat. Such improvements included levee setbacks, floodplain and side channel creation, grade stabilization and enhanced fish passage. The plan, which included the development of a hydraulic model of the river and levees, was also utilized to identify and develop infrastructure improvements to protect the City from flooding. Infrastructure improvements included levee reconstruction, bridge retrofits, dam operation adjustments and a vegetation plan. The hydraulic model also was used as the basis to bring the levees into compliance with Corps standards and return the City to FEMA's flood insurance program. Many of the projects identified in the plan have already been implemented. Other projects are in various stages of construction, design and planning as this plan lays out years of habitat enhancement projects.

Contact Information: Michael K. Homza, Associate, GeoEngineers, Inc., 1525 South David Lane, Boise, Idaho 83702 USA, Phone: 208-841-3537, Fax: 208-433-8092, Email: mhomza@geoengineers.com

SIGNIFICANT SPATIAL VARIABILITY OF BIOAVAILABLE PAHS IN THE WATER COLUMN AND SEDIMENT POREWATER IN THE GULF OF MEXICO ONE YEAR AFTER THE DEEPWATER HORIZON OIL SPILL

Yong-Seok Hong[1], *Pan Ji*[2], *Erik Rifkin*[3], *Dana Wetzel*[4], *Erin Pulster*[4], *Pete Hull*[4], *Danny D. Reible*[5], *Hyun-Min Hwang*[6] and *Edward J. Bouwer*[2]

[1]Daegu University, Jillyang, Gyeongbuk, South Korea
[2]Johns Hopkins University, Baltimore, MD, USA
[3]Baltimore National Aquarium, Baltimore, MD, USA
[4]Mote Marine Laboratory, Sarasota, FL, USA
[5]University of Texas at Austin, Austin, TX, USA
[6]Texas Southern University, Houston, TX, USA

Semipermeable membrane devices (SPMDs), polyethylene devices (PEDs), and polydimethylsiloxane fiber devices (PDMSs), were deployed in areas of the Gulf of Mexico impacted by the Deepwater Horizon oil spill to investigate the spatial variability of parent and alkylated polycyclic aromatic hydrocarbon (PAH) concentrations in the water column and sediment porewater. The passive samplers were deployed in the wetland areas of Barataria Bay, LA, and in the coastal areas of MS, AL, and FL during May and September, 2011. The PAH sampling rates of SPMDs and PEDs were estimated using more than 5 deuterated PAHs as performance reference compounds (PRCs) using nonlinear least square methods. The average (range) sampling rates of PEDs in the overlying water (n=20) and sediment porewater (n=27) of the coastal areas were 21 (13-47) L/d and 5 (1-19) L/d, respectively, when the log K_{ow} is 5. In the area, the sampling rates in the overlying water were higher than those in the sediment porewater due to expected higher water mixing in the overlying water. The average (range) sampling rates of SPMDs in the overlying water (n=10) and sediment porewater (n=9) in the wetlands were 74 (6-151) L/d and 61 (6-155) L/d, respectively, when the log K_{ow} is 5. The sampling rates in the wetland areas were higher than those in the coastal areas probably due to higher dissolved organic carbon concentrations which may enhance PAH dissipation from the samplers. The average (range) total PAH concentrations in the overlying water and sediment porewater of the coastal areas were 0.36 (0.05-1.11) ng/L and 1.03 (0.03-5.58) ng/L, respectively. The average (range) total PAH concentrations in the overlying water and sediment porewater of the wetland areas were 14.1 (1.4-72.9) ng/L and 19.7 (3.3-107.4) ng/L. The PDMS profilers deployed in the coastal areas didn't show any vertical profiles of PAH levels in the sediment porewaters from surface to 60 cm below. Generally, the total PAH levels in the sediment porewater were higher than those in the overlying water suggesting that sediments could be a potential long-term source of PAHs in the overlying water. The total PAH levels in the coastal areas were close to the reported baseline PAH concentrations in the Gulf of Mexico suggesting that the areas may be recovered to the pre-spill condition. However, the total PAH levels in the wetland areas were more than one order of magnitude higher than those in the coastal areas. During the deployment, localized oil contamination still existed in the wetland areas from the oil entrapped in the complex ecosystems of swamp, marshes, and small embayments in Barataria Bay. The complexity may cause the persistence of PAHs in the wetland areas. The results showed more than two orders of magnitude variability of PAH levels in the Gulf of Mexico one year after the oil spill. A principal component analysis is being conducted, and we expect to differentiate the sources of the PAHs measured in the wetlands and coastal areas.

Contact Information: Yongseok Hong, Department of Environmental Engineering, Daegu University Engineering 6601, Jillyang, Nae-ri-ri, Gyeongsan, Gyeongbuk 702-714, South Korea, Phone: +82-10-2793-1697, Fax: +82-53-850-6699, Email: yshong@daegu.ac.kr, hongzang77@gmail.com

RESTORATION AND CONSERVATION PLANNING BASED ON CARBON SEQUESTRATION AND GREENHOUSE GAS FLUX UNDER CURRENT AND PROJECTED FUTURE SCENARIOS

Michael Hooper[1], *John Schmerfeld*[2], *Kristin Byrd*[3], *Susan Kennedy*[4], *Robin Tillitt*[1], *Susan Finger*[1], *Zhiliang Zhu*[5]

[1]U.S. Geological Survey, Columbia Environmental Research Center, Columbia, MO, USA
[2]U.S. Fish and Wildlife Service, Arlington, VA, USA
[3]U.S. Geological Survey, Western Geographic Science Center, Menlo Park, CA, USA
[4]U.S. Department of Interior, Office of Damage Assessment and Restoration, Denver, CO, USA
[5]U.S. Geological Survey, Reston, VA, USA

As a part of implementing the 2007 Energy Independence and Security Act, the USGS Biologic Carbon Sequestration Assessment (the LandCarbon Project) is developing baseline and projected levels of carbon sequestration and greenhouse gas fluxes of ecosystems as a function of existing and projected changes in land use. Their assessments identify lands with high carbon sequestration capacity and the potential for future climate change, wildfire, land use change, and land management activities that could modify that capacity. Department of Interior agencies overseeing contaminant-associated restoration and refuge conservation activities are working to provide practitioners with tools that assist in adapting to climate change effects as well as identifying lands whose restoration and protection could result in maintaining or increasing biological carbon sequestration.

We describe here efforts to incorporate biological carbon sequestration considerations into resource planning in wetlands across the United States Great Plains ecosystems. The goal of this project is to develop and test guidelines to identify lands with the greatest current or potential carbon stocks and/or sequestration values. Two key areas of interest are: (1) National Wildlife Refuge System land protection and acquisition, and (2) ecological restorations associated with Natural Resource Damage Assessment settlements. Working with products of the LandCarbon efforts, spatial distributions of wetlands with high soil organic carbon and woody biomass levels and high likelihood of future conversion were identified and classified based on wetland type. We assessed future opportunities for climate change mitigation, primarily though the avoided loss of high carbon wetlands, and considered suitability of land for competing uses. Locations of existing and anticipated restoration and conservation efforts were overlaid with the maps of wetland carbon values to identify resource activities that could benefit from input on carbon sequestration potential. Resource practitioners will be contacted to initiate discussions of applying the LandCarbon data.

In addition to setting priorities for acquisition and restoration, this effort would also identify and test methods for monitoring carbon sequestration over time as a measure of restoration progress and success, incorporating in-field carbon sequestration monitoring with spatial analysis methods developed and applied through the LandCarbon program.

Contact Information: Michael J. Hooper, USGS Columbia Environmental Research Center, 4200 New Haven Rd., Columbia, MO, 65202 USA. Phone: 573-441-2985, Fax: 573-876-1896. Email: mhooper@usgs.gov.

CREATING A HABITAT SUITABILITY INDEX TO PLAN FOR FUTURE SEAGRASS RESTORATION

Bob Swett[1], ***Althea S. Hotlaing***[2], *Tom Frazer*[2], *Rex Ellis*[3] and *Chuck Listowski*[4]
[1]University of Florida School of Forest Resources and Conservation, Gainesville, FL, USA
[2]University of Florida School of Natural Resources and Environment, Gainesville, FL, USA
[3]University of Florida Department of Soil and Water Science, Gainesville, FL, USA
[4]West Coast Inland Navigation District, Venice, FL USA

There is a need to restore an estimated 1,600 hectares of seagrass in Southwest Florida. In light of this fact a technique was developed to identify sites in Estero Bay that would be ideal for seagrass restoration. Such a technique could be used anywhere in the world where seagrass restoration is taking place or included in future restoration proposals. This need is great as there has been a loss of 3.3 million hectares or 20% of total documented seagrass coverage in the world in just the last 2 decades. Losses occur as a result of direct impacts from marine construction, navigation channels and boating as well as from indirect impacts like eutrophication, sedimentation, changing salt/freshwater flow patterns, overfishing, climate change, and accompanying sea level rise.

In order to create a habitat suitability index for the bay using data was collected every 3 weeks throughout the year to capture annual variations in light and climate. The primary variables of interest were light or PAR (photosynthetically active radiation), salinity, water depth, and water temperature. Geostatistical Kriging was used to interpolate habitat conditions throughout the bay from the 50 sites where the data had been collected. It is hoped that data collection can be continued in future years to continual update the model as conditions on the ground change. Light is the most critical or limiting factor to seagrass growth in Southwest Florida and this work will also help to elucidate what light levels are required on an annual basis for seagrass in the bay to be healthy. We are looking for sites with more than 40% of the surface irradiance available at the bottom for seagrass restoration. Estero Bay is very shallow but there are still many areas where there is not sufficient light at the bottom for seagrass to establish. It may be necessary to stabilize sediments in some shallow sites to keep the water clear enough for seagrass growth. We hope to add predicted locations where seagrass could be restored into the future by adding in projected sea level rise.

Contact Information: Althea Hotaling, University of Florida, Boating and Waterway Management, Bldg. 107 Mowry Rd., Gainesville, FL 32611. Phone: 352-502-3666, Email: theah@ufl.edu

WORKING WITH STAKEHOLDERS TO CREATE A VISION FOR ESTERO BAY

Martha Monroe[1], ***Althea S. Hotlaing***[2], *Tom Frazer*[2], *Bob Swett*[1] and *Chuck Listowski*[3]
[1]University of Florida School of Forest Resources and Conservation, Gainesville, FL, USA
[2]University of Florida School of Natural Resources and Environment, Gainesville, FL, USA
[3]West Coast Inland Navigation District, Venice, FL, USA

The West Coast Inland Navigation District has asked for help coming up with a vision of the bay that is social and ecologically feasible. In order to assure that the vision and management actions involved are not opposed by the public, input from all the stakeholders is sought. A workshop was held so that stakeholders could come up with a common vision and work to create relationships and knowledge about what everyone has to offer in terms of improving the bay and what their priorities or needs are in terms of management actions. The workshop began by building on common ground which in this case was concern for Estero Bay. The group began by outlining the history of the bay and then talked about both the issues they see facing the bay and the goals they have for the future of the bay. At the end of the workshop they came up with a vision for the bay. A key to successful collaborative efforts is involving everyone early on and throughout the decision making process so an effort was made to include a diverse variety of stakeholders.

Interviews with all stakeholder representatives occurred prior to the workshops and then again a few weeks after the workshops. If adaptive management is working and useful it was expected that all groups would have the same or similar visions for Estero Bay. There should be an increase in frequency of communication with other stakeholders and a willingness to share knowledge and work together. All stakeholders should feel informed and responsible for making management decisions and satisfaction with management of the bay should increase. If adaptive co-management is taking place everyone should agree that there is no way to predict the future but be in agreement that monitoring should occur after every management action and that the knowledge gained should be applied to the next set of decisions. Perception of how well the bay is managed should improve with adaptive co-management.

Adaptive collaborative management is an ongoing process and not one that can be developed and implemented in a few months or even a year. It is hoped that with the connections made and the tools gained at the workshops managers will know who they can work with to come up with a solution when a problem arises. In essence the future of adaptive co-management lies in the hands of the stakeholders, agency and non agency alike.

Contact Information: Althea Hotaling, University of Florida, Boating and Waterway Management, Bldg. 107 Mowry Rd., Gainesville, FL 32611. Phone: 352-502-3666, Email: theah@ufl.edu

ACCELERATING MANAGEMENT ACTIONS IN THE SHEBOYGAN RIVER AREA OF CONCERN

Stacy L. Hron[1], *Victor Pappas*[1], *Steve Galarneau*[2], *Heather Williams*[3], *Edwin Smith*[3], *T. Kevin O'Donnell*[3], *Chad Pelishek*[4] and *Aaron Brault*[5]

[1]Wisconsin Department of Natural Resources, Plymouth, WI, USA
[2]Wisconsin Department of Natural Resources, Madison, WI USA
[3]U.S. Environmental Protection Agency, Chicago, IL, USA
[4]City of Sheboygan, Sheboygan, WI, USA
[5]Sheboygan County, Sheboygan, WI, USA

The Great Lakes Restoration Initiative (GLRI) began in 2010, committing $475 million to accelerate restoration of the Great Lakes basin including Areas of Concern (AOCs). Through GLRI, the U.S. Environmental Protection Agency (EPA) has provided enhanced resources which are strategically being focused on sources of impairment within AOCs. The Sheboygan River AOC, located in Sheboygan County, Wisconsin, is an AOC where resources have been focused in order to accelerate the pace at which management actions such as contaminated sediment removal and habitat restoration can take place in order to address these impairments. Approximately $80-$100 million of public and private funding will be spent to restore the Sheboygan River. The goal is to kick-start restoration activities that have languished for decades with little or no funding and achieve the objectives set forth in the GLRI Action Plan.

This presentation provides a perspective on the implementation and coordination of numerous and concurrent large scale remediation, restoration and assessment projects. These diverse projects include; two Superfund remedial actions; Great Lakes Legacy Act and navigational dredging projects; seven habitat restoration projects ranging from invasive species management to wetland restoration to miles of shoreline restoration; and four assessment projects including fish and wildlife surveys and contaminant monitoring, waterfowl consumption advisory evaluation, fish tumor rate evaluation and plankton and benthic community assessment. From the project development through planning and execution, the process and needs of getting this complex effort off the ground will be detailed. The important role of partnerships, community outreach, maintaining quality under tight timelines and management support in integrating multiply programs and engaging stakeholders will be highlighted. Lessons learned while implementing this multifaceted effort will be shared.

Contact Information: Stacy L. Hron, Office of the Great Lakes, Wisconsin Department of Natural Resources, 1155 Pilgrim Road, Plymouth, WI 53073 USA, Phone: 920-892-8756 x3051 Fax: 920-892-6638, Email: stacy.hron@wisconsin.gov

LONG-TERM SUCCESS OF A LARGE CONSTRUCTED TREATMENT WETLAND IN THE EVERGLADES AGRICULTURAL AREA BASIN (FLORIDA) AND ITS BENEFITS TO THE DOWNSTREAM NATURAL MARSH

D. Ivanoff, *K. Pietro, B. Garrett, B. Robbins* and *M. Powers*
South Florida Water Management District, West Palm Beach, FL, USA

The Everglades Stormwater Treatment Areas (STAs) are the largest complex of constructed treatment wetlands in the United States. Operated by the South Florida Water Management District, they were constructed to treat phosphorus-enriched runoff primarily from agricultural areas prior to discharging that water into the Everglades Protection Area. STA-2, one of the five Everglades STAs, treats water that is delivered to the Water Conservation Area 2A (WCA-2A). The WCA-2A marsh consists of sawgrass, cattail, open water sloughs, and remnant-drowned tree islands, which have been impacted by high nutrient waters discharged into the area.

This presentation will focus on the first phase of STA-2 operation which was comprised of three individual cells encompassing approximately 6,338 acres. Since it began flow through operation in July 2001, the STA has treated approximately 2.8 million acre-feet of water, retaining approximately 270 metric tons of total phosphorus (TP) that would have otherwise been delivered to WCA-2A. Through more than eleven years of operation, the STA has reduced the annual flow-weighted mean TP concentration from 102 ppb (inflow) to 22 ppb (outflow). The success is attributed to various factors, including healthy vegetation establishment which is comprised of emergent and submerged aquatic vegetation in compartmentalized cells, sophisticated flow structure system, antecedent land use, and moderate nutrient concentrations and loading.

The anticipated benefits of STA discharge on the receiving downstream marsh, i.e. WCA-2A, include the restoration of more favorable hydroperiods and hydropatterns and the improvement of ecological marsh functionality. Monitoring results to date indicate that the marsh has benefited from receiving STA discharge water, as evidenced by improved hydroperiods, reduced TP concentration in periphyton tissue, and a general decrease in surface water TP concentrations. As a result of STA operation, surface water TP of 10 ppb or less has been observed in many locations within the affected region of the marsh. These data and observed changes in soil and macrophyte composition will also be discussed.

Contact Information: Delia Ivanoff, Water Resources Division, South Florida Water Management District, 3301 Gun Club Road, West Palm Beach, FL 33406 USA, Phone: 561-682-2681, Fax: 561-682-5128, email: divanoff@sfwmd.gov

CLIMATE CHANGE ADAPTATION AND ADAPTIVE ENVIRONMENTAL MANAGEMENT INTEGRATION

Ian Jewell
AECOM, Raleigh, NC

The 'AEM' system of restoration (Adaptive Environmental Management) has been established for many years as a guide in carrying out Natural Channel Design for stream restoration projects in Ontario Canada. The system is comprised of a nine step process in the assessment, evaluation and design of sustainable restoration that examines alternatives using a holistic approach considering engineering, geomorphologic and biological functions. With the recent focus on climate change adaptation, the application of the AEM system becomes more important in achieving long term success of restoration projects.

Based on a highly degraded stream system located in Toronto, Canada, we demonstrate how the AEM system integrates with climate change adaptation, focusing on the engineering aspects necessary to quantifying the impacts of changes in the hydrology. The analysis is tied to considerations in maintaining viable fish habitat potential which helped to direct the design of channel cross section, profile and plan form. When also considering the identified objectives of mitigating flood potential, limiting erosional processes and protecting built infrastructure, the climate change adaptation element is integrated with specific aspects of the AEM system, providing an evolution of adaptive management using specifically derived data. This example can show how current design methodologies can be optimized, and how climate change can affect design.

Contact Information: Ian Jewell, JD, Environmental Scientist, AECOM, 701 Corporate Center Drive, Suite 475, Raleigh, NC 27607, Phone: 919 854 6254, Fax 919 854 6259, Email: ian.jewell@aecom.com

COLUMBIA ESTUARY ECOSYSTEM RESTORATION PROGRAM: ADAPTIVE MANAGEMENT STRATEGY REPORT AND ACTION PLAN FOR PROGRAM EXECUTION

Ben Zelinsky[1], Blaine Ebberts[2], Julie Doumbia[1], Cynthia Studebaker[2] and ***Gary Johnson**[3]*
[1]Bonneville Power Administration, Portland, Oregon, USA
[2]US Army Corps of Engineers, Portland, Oregon, USA
[3]Pacific Northwest National Laboratory, Portland, Oregon, USA

The Columbia Estuary Ecosystem Restoration Program (CEERP) applies an ecosystem-based approach to understand, conserve, and restore ecosystems in the lower Columbia River and estuary (LCRE) to help mitigate the environmental effects of the Federal Columbia River Power System. The CEERP's objectives are to 1) increase the capacity and quality of estuarine and tidal-fluvial ecosystems, 2) increase the opportunity for access by aquatic organisms to shallow-water habitats, 3) improve realized functions for juvenile salmon. Primary approaches to restoration are to restore hydrologic connections between main stem and floodplain, create and/or enhance shallow-water habitat, and reestablish native vegetation. The CEERP is conducted within a formal adaptive management framework that includes three main annual deliverables: a Strategy Report, an Action Plan, and a Synthesis Memorandum. The Strategy Report contains strategies for prioritizing and implementing restoration and RME actions which are subsequently outlined in the companion Action Plan. The results of these actions are evaluated in the Synthesis Memorandum, which in turn is used adaptively in the next Strategy Report. The CEERP deliverables guide or inform, as appropriate, the Actions Agencies (BPA/Corps), the National Marine Fisheries Service, the Council, restoration project sponsors, researchers, and various interested parties. This paper describes the strategies and associated actions we are undertaking to execute the Columbia Estuary Ecosystem Restoration Program.

<u>Contact Information</u>: Gary E. Johnson, Pacific Northwest National Laboratory, Portland, OR, 97204 USA, Phone: 503-417-7567, Fax: 503-417-2175, Email: gary.johnson@pnnl.gov.

A LARGE LANDSCAPE CONSERVATION APPROACH TO ECOSYSTEM RESTORATION

Shawn M. Johnson
The University of Montana, Missoula, MT, USA

Growing numbers of conservationists, policy makers, and practitioners agree that some of the most important land and water issues facing North America require new approaches. These challenges involve protecting ecosystem integrity and connectivity; restoring and protecting water resources; providing access for recreational opportunities; sustaining the working farms, ranches, and forests that are critical to local economies and cultures, and provide important wildlife habitat; protecting and interpreting cultural resources as part of our national heritage; enhancing economic viability and resilience in rural and urban communities; and adapting to climate change.

In response to these concerns, people from many walks of life are experimenting with a variety of approaches that are best captured by the term *large landscape conservation*. This new paradigm for conservation is provocative but can be difficult to define. Based on research and a range of examples, the paradigm encompasses three criteria: (1) multijurisdictional—the issues being addressed cut across political and jurisdictional boundaries; (2) multipurpose—they address a mix of related issues, including but not limited to environment, economy, and community; and (3) multistakeholder—they include public, private, and nongovernmental actors.

This presentation will focus on the nature of current environmental and governance challenges, examine the promise of large landscape conservation in meeting those challenges, identify current practical and policy barriers to large landscape conservation, and offer recommendations based on research and practice. The presentation will also introduce the Practitioners' Network for Large Landscape Conservation, launched in 2011 to connect practitioners, policy makers, researchers, funders, and others who are interested in advancing the theory, practice, and performance of large landscape conservation. The Practitioners' Network seeks to facilitate an active learning community focused on: (1) building awareness and understanding of the diversity of approaches to catalyze, enable, and sustain large landscape conservation initiatives, (2) providing opportunities for practitioners to develop skills, acquire tools, access funding, and share best practices, (3) understanding and refining the key elements of success, (4) documenting and evaluating what is working, what is not, and why, and (5) advancing policy discussions at multiple scales.

Contact Information: Shawn M. Johnson, Center for Natural Resources & Environmental Policy, The University of Montana, 32 Campus Drive, Missoula, MT 59812 USA, Phone: 406-381-2904, Fax: 406-243-6330, Email: shawn.johnson@umontana.edu

DEVELOPING AMERICA'S WATERSHED INITIATIVE REPORT CARD

Harald E. Jordahl [1], *Jonathan Higgins*[2], *Rainy Shorey*[3], *Roger Wolf*[4], *Heath Kelsey*[5], *David Galat* [6] and *Michael Reuter* [7]

[1]America's Watershed Initiative, Madison, WI, USA
[2]The Nature Conservancy, Chicago, IL, USA
[3]Caterpillar Inc., Peoria, IL, USA
[4]Iowa Soybean Association, Ankeny, IA, USA
[5]University of Maryland Center for Environmental Science, Cambridge, MD, USA
[6]University of Missouri, Columbia, MO, USA
[7]The Nature Conservancy Great Rivers Partnership, Peoria, IL, USA

America's Watershed Initiative seeks to build and implement a vision for the Mississippi River Basin based on collaboration and mutually beneficial outcomes. We aim to find solutions to issues that span multiple regions—issues such as energy, transportation, water quality, and comprehensive flood management—while respecting vital work at smaller scales within the Watershed. Building upon strong leadership, this approach seeks to link and augment successful efforts, creating a broad partnership serving as a unified voice for the watershed

A draft assessment framework has been developed based on goals identified in America's Watershed Initiative and derived from principles of Integrated River Basin Management. The framework includes balanced information from Social, Economic, and Environmental sectors, and is intended to be transparent and clear. Measures for goals, values, drivers, strategies, critical success factors, outcomes, and impacts will be used to evaluate progress toward values and goals. Using these measures, we can evaluate the issues, design and implement strategies to address issues, and evaluate whether these strategies are effective.

One tool that we are developing is a Report Card, which will be used to evaluate regional and national progress toward achieving sustainable economic, social and environmental management of the Mississippi River Watershed. Report cards allow us to distill key messages from large amounts of information from different disciplines, including economic, social, and environmental sciences. These key messages are important sources of information for decision and policy makers and can help prioritize management and monitoring activities. Our current focus is to define the values that characterize the overall of goals of the Mississippi River Watershed, and indicators that could be used to measure the status and progress towards achieving those goals.

This transparent framework and reporting process will communicate results to broad audiences and provide a scientific foundation for the report card results. Users will be able to start at the report card, and "drill down" to the level of information appropriate to their use, technical ability, or interest. We enthusiastically seek feedback on how to improve the framework, report card process, and values associated with the larger goals of America's Watershed Initiative.

Contact Information: Harald (Jordy) Jordahl, America's Watershed Initiative, c/o Vandewalle & Associates, 120 East Lakeside Street, Madison, WI 53715; Phone: (608) 445-8543; Email: hjordahl@tnc.org

SEASONAL TREND IN THE ECOLOGICAL VARIABLES OF A TIDAL CREEK IN NIGER DELTA, NIGERIA

M. O. Kadiri and *O.M. Ugwu*
University of Benin, Benin City, Edo State, Nigeria

A study was carried out in 'Ekpan Creek, Niger Delta area of Nigeria. The Niger Delta, an area drained by River Niger into the Atlantic Ocean, is situated in the southern coastal region of Nigeria. The purpose of the study was to provide pioneer limnological information for the effective monitoring and management of the creek, coupled with filling the gap of the ostensibly gross neglect, in Africa, of studies of smaller waterbodies in general and rivers in particular. It also sought to ascertain the influence of season on the ecological variables. Climatically, two seasons prevail in the study area- wet season, May-October with a break in August -September; and dry season, November-April.

Five study sampling stations were selected to cover respective ecological zones. Samples were collected monthly for fifteen months and analyzed for physical and chemical variables. The ecological parameters were defined by season and space. There were distinct seasonal and spatial trends in most environmental variables. Temporal trend showed significant difference in monthly readings. Parameters like total solids, total dissolved solids, salinity, conductivity, Na, K and Cl showed bimodal pattern, exhibiting dry season maxima and rainy season minima while others-temperature, pH, SO_4 PO_3, NO_3, SiO_3 and dissolved oxygen fluctuated greatly. The creek was essentially slightly acidic to slightly basic, rich in nutrients, with an order Na > K >Mg > K for cations and Cl> SiO_3, > PO_3, > SO_4, > NO_3 for anions. Three categories of variables were observed- dry season maxima, wet season maxima and those with no discernible trend

The study is novel as it has generated, a hitherto absent comprehensive background limnological database useful for the management of the creek, ecosystem restoration and a pertinent reference point against future environmental impact e.g eutrophication, pollution. Such information is of immense benefit in fisheries, recreation, tourism and water use.

Contact Information: M. O. Kadiri, Department of Plant Biology & Biotechnology, University of Benin, Benin City, Edo State, Nigeria, Phone: (+234) 8023404118, Email: mokadiri@hotmail.com

PARTNERSHIPS BOLSTERING IMPLEMENTATION OF NATIONAL MARINE FISHERIES SERVICE SOUTHERN STEELHEAD RECOVERY PLAN IN SOUTHERN CALIFORNIA

Wendy R. Katagi[1], *George Sutherland*[2] and *Mark Capelli*[3]
[1]CDM Smith, Inc., Los Angeles, CA, USA
[2]Trout Unlimited, San Clemente, CA, USA
[3]National Marine Fisheries Service, Santa Barbara, CA, USA

What is being done to bring endangered southern Steelhead Trout (*Oncoryhnchus mykiss irideus*) back into southern California's creeks and estuaries? The National Marine Fisheries Service (NMFS) released the Final Southern Steelhead Recovery Plan in January 2012. The plan establishes priorities and guidance for species recovery in southern California, but there are challenges to plan implementation in this unique urban landscape. Challenges include competing demands for water, public agency staffing and finances, conflicting flood management policies, as well as physical constraints due to urbanization and hydromodification of watersheds. This session will describe how partnerships between non-profit organizations, federal, state, and local agencies are essential to addressing these challenges and successful implementation of the plan to recover federally endangered southern Steelhead Trout.

The South Coast Chapter of Trout Unlimited, a non-profit conservation organization, has been successful in bringing funding to the table. As lead proponent for many state grants, The South Coast Chapter of Trout Unlimited has partnered with the California Department of Fish and Game (DFG) and NMFS, among others to complete a watershed management plan, engineering studies, and design drawings for steelhead recovery projects in Orange County, California. The non-profit has also completed steelhead recovery projects in Santa Barbara and San Diego Counties.

Deal points and agreements that integrate multi-agency priorities are essential to implementation of projects and programs described in he NMFS Southern Steelhead Recovery Plan. In particular, agencies involved in one of the largest steelhead recovery projects in southern California to restore steelhead habitat in Trabuco Creek include NMFS, DFG, State Wildlife Conservation Board, County of Orange, City of San Juan Capistrano, Moulton Niguel Water District, Southern California Regional Rail Authority, Trout Unlimited, Caltrans, Saddleback Valley Christian School, and other private property owners. Significant outreach and coordination as well as education regarding the species have also played a major role in building effective partnerships in Orange County.

The Trabuco Creek Multi-Benefit Channel Improvements project is slated for pre-construction activities in 2013. NMFS and DFG believe this project will help make other steelhead recovery efforts in Orange County and the southern California region possible by providing a model for bolstering similar partnerships in other jurisdictions.

Contact Information: Wendy Katagi, CDM Smith, Inc. 523 W. 6th Street, #400, Los Angeles, CA 90014 USA, Phone/Fax: 213-457-2132, Email: katagiwr@cdmsmtih.com

A REGIONAL GEOLOGICAL APPROACH TO A SUSTAINABLE ECOSYSTEM RESTORATION OF THE MISSISSIPPI RIVER DELTA PLAIN

Syed M. Khalil
Coastal Protection and Restoration Authority, Baton Rouge, LA, USA

It is well documented that Louisiana's environmentally sensitive wetlands, marshes and barrier islands require remediation to mitigate their degrading trend. In order to be successful in its enormous undertaking of restoring and protecting coastal Louisiana as envisaged in the 2012 Coastal Master Plan, the State needs a planned systematic approach to management of its fluvial and marine sedimentary resources. In addition to knowing where to explore for sand to rebuild disappearing barrier islands, we need also to know where best to extract sediments for building coastal protection structures and creating marshes. It is also important to appreciate spatial and temporal subsidence variability, as high subsidence rates could compromise project effectiveness. Selecting the optimal river diversion locations is also critical to maximize land-building and marsh-enhancement potential. . These are but a few examples that require detailed knowledge of Mississippi River Delta (MRD) history and associated geologic framework. Obviously, understanding the sedimentary framework of the modern MRD and its alluvial valley are fundamental to the success of such a large-scale coastal restoration efforts.

During the latest Pleistocene-to-Holocene sea-level cycle, the Mississippi River produced a series of six major delta-building pulses that have built the delta plain as we know it today. These events have determined the depositional fabric and geomorphology of Louisiana's present coastal plain and shelf. The underlying geological setting shaped the delta plain geomorphology, which dictates the sediment distribution pattern. The sediment distribution pattern, in turn, shapes the ecology. Thus, a detailed knowledge of this geologic framework is essential for making informed decisions concerning many aspects of restoration of a sustainable coastal ecosystem.

When the regional-scale geological framework is not considered to the level that it should be during planning, designing, or evaluating, restoration projects, the results may not reflect the project in the context of the larger geomorphologic system. Viewing projects in isolation discounts the inter-connected nature of regional ecosystems which may compromise effective regional-scale management. Sediment is critical for the restoration and in order to maximize the efficient and effective use of sediment a regional geological perspective is crucial. For this the Louisiana Sediment Management Plan (LASMP) has been conceptualized and formulated for better planning and coordination that ties various components together for sustainable ecosystem restoration. This talk provides an overview of the geological setting of MRD Plain as it relates to sediment resources in coastal Louisiana and will also emphasize the need of a regional approach for managing sediment.

Contact Information: Syed M. Khalil, Coastal Restoration and Protection Authority, 450 Laurel Street, Baton Rouge, LA 70801, USA, Phone: 225-342-1641, Fax: 225-242-3760, Email: Syed.Khalil@la.gov

THE GREAT LAKE INFORMATION MANAGEMENT AND DELIVERY SYSTEM: FOSTERING SHARED GOALS AND COLLABORATIVE SOLUTIONS

Scott P. Sowa[1], ***Mary Khoury***[2], *Sagar Mysorekar*[1], *Reid Bogert*[2], *Stephanie Judge*[3], *Patrick Doran*[1], *Paul Seelbach*[4], *Brad Potter*[5] and *Craig Czarnecki*[5]

[1]The Nature Conservancy, Lansing, MI, USA
[2]The Nature Conservancy, Chicago, IL, USA
[3]The Nature Conservancy, Madison, WI, USA
[4]U.S. Geological Survey, Ann Arbor, MI, USA
[5]U.S. Fish and Wildlife Service, East Lansing, MI, USA

Decisions that maintain or restore ecological patterns and processes that sustain biodiversity are at the core of all conservation. These decisions require the integration of relevant data and knowledge as one is useless without the other. Integration of relevant data and knowledge is easy for problems that are simple and small in scope, but such problems are rare in the world today. Over the past century the complexity of the conservation decision-making environment has increased significantly across scale, time, and factors considered as conservationists have embraced the concepts of ecosystem and adaptive management. Unfortunately, to deal with this increasing complexity the conservation community has largely focused on generating more and more data and knowledge, leading to ever increasing fragmentation of information, rather than the effective integration and delivery of information.

We believe that ecosystem and adaptive management serve as good business principles to guide strategic habitat conservation, but we lack effective business operations to support and carry out these principles. We argue that the conservation community must start thinking and functioning like a conservation *enterprise* with much more emphasis on developing managing an information supply chain to meet the demands of strategic habitat conservation decision making. This will require a new age of research and equitable attention to the a) development, b) management, c) integration, and d) delivery of the raw materials (data and knowledge) and component parts (models and decision tools) to decision makers. Only then will we be able to develop the shared goals and collaborative solutions needed to address complex conservation problems across large geographies like the Great Lakes Basin.

To begin addressing this need, The Nature Conservancy and U.S. Geological Survey, working with a broad network of scientists, natural resource professionals, agency staff, and non-profit colleagues, are in the process of designing and developing a shared Great Lakes information management and delivery system (IMDS) to help support the mission of the Upper Midwest/Great Lakes (UMGL) Landscape Conservation Cooperative (LCC). This presentation will discuss the need for an information supply chain to support landscape scale conservation and the specific objectives and tasks surrounding the Great Lakes IMDS project.

Contact Information: Scott P. Sowa, The Nature Conservancy, Michigan Field Office, 101 East Grand River Ave., Lansing, MI 48906 USA, Phone: 517-316-2255, Fax: 517- 316-9886, Email: ssowa@tnc.org

"MAKE NO LITTLE PLANS": DEVELOPING BIODIVERSITY CONSERVATION STRATEGIES FOR THE GREAT LAKES

Douglas Pearsall[1], *John Paskus*[2], ***Mary Khoury***[3], *Rachael Franks Taylor*[4] and *Dan Kraus*[5]

[1]The Nature Conservancy, Lansing, Michigan, USA
[2]Michigan Natural Features Inventory, Lansing, Michigan, USA
[3]The Nature Conservancy, Chicago, Illinois, USA
[4]The Nature Conservancy, Traverse City, Michigan, USA
[5]Nature Conservancy of Canada, Guelph, Ontario, Canada

Four Great Lakes now have strategic plans to protect and conserve their native biodiversity, and a biodiversity assessment is underway for Lake Superior. These lakewide "blueprints" address the initial phases of the adaptive management process—defining the project and developing strategies—and leave implementation to the communities associated with each lake, primarily the stakeholders of the Lakewide Action and Management Plans (LAMPs). Funded through the US Environmental Protection Agency and Environment Canada, these multi-agency planning efforts have assessed the lakes' natural systems, defined multi-agency visions for biodiversity conservation, developed shared strategies to protect and restore the lakes, described how these strategies can benefit people, and are promoting coordinated conservation action.

Common to each plan is a focus on the biodiversity of the lakes and their immediate coastal area, while considering the influence of the whole lake watershed on this focal biodiversity. The biodiversity targets include the Open Water Benthic and Pelagic Ecosystem, Nearshore Zone, Native Migratory Fish, Coastal Wetlands, Islands, Aerial Migrants, and Coastal Terrestrial Systems. Strategies vary among plans, and address agricultural and urban pollution, invasive species, incompatible coastal development, improving freshwater habitat connectivity, and offshore fisheries restoration.
These blueprints provide a basis and direction for a collaborative, adaptive approach to conserving the biodiversity of four of the five Great Lakes. They define a focus for conservation efforts, identify ambitious but feasible goals, and establish quantitative measures for tracking progress towards goals. The plans also identify priority areas for some conservation actions, and call for more effective coordination and collaboration among agencies, organizations, and other stakeholders.
Effective adaptive management will require continued investment, such as that provided by the US EPA through the Great Lakes Restoration Initiative and Environment Canada via the Great Lakes Action Plan. This talk will highlight the findings of the biodiversity blueprints and suggest a course for their implementation.

Contact information: Mary Khoury, The Nature Conservancy, 8 S. Michigan Ave., Suite 2301, Chicago, IL 60603 USA, Phone: 312-580-2172, Email: mkhoury@tnc.org

INCREASING CONSERVATION PRACTICE ENROLLMENTS THROUGH MODELING AND TARGETED OUTREACH IN AN AGRICULTURAL WATERSHED

Jill A. Kostel[1] and *Jeff Boeckler*[2]
[1]The Wetlands Initiative, Chicago, IL, USA
[2]Northwater Consulting, Springfield, IL, USA

Given that nearly 73% of U.S. lands are in private ownership and a majority of tributaries and streams flow through or adjacent to private lands, engaging these landowners is essential to restoring ecosystems and improving water quality. The Wetlands Initiative (TWI) and its partners formed a collaborative effort to develop and implement a communication and outreach strategy that engages agricultural producers within the Big Bureau Creek Watershed in north-central Illinois. Three subwatersheds that received an USDA Mississippi River Basin Healthy Watersheds Initiative (MRBI) award are targeted.

Illinois is the #1 contributor of nutrient pollution to the Gulf of Mexico. The Big Bureau Creek Watershed is typical of heavily agricultural watersheds in the Midwest. Surface and tile-drainage nutrient runoff is high, and landowner participation in conservation practices, particularly wetland practices, has traditionally been low. Great potential exists for landowners to provide habitat and water quality benefits in their watershed by enrolling in practices; however, outreach and technical assistance is critical to inform them of the availability and effectiveness of these practices and help them to successfully integrate them into their agricultural operations.

Building on research already conducted and partnerships formed in the Big Bureau Creek Watershed, this project seeks to increase farmers' use of conservation practices to address natural resource concerns and improve watershed wildlife habitat through a planned and focused effort. Producers within the MRBI subwatersheds need to be encouraged to implement conservation practices in a "systems approach" to avoid, capture, and trap nutrients and sediments. According to NRCS staff, there has been a significant increase in calls to the NRCS office and practice signups over the last year for the entire Big Bureau Creek Watershed, which correlates to the increase in the outreach work to raise awareness of the need for conservation practices.

However, to increase the effectiveness of the outreach and technical support, it is necessary to use a rational approach to both quantify pollutant loading and identify lands that are major contributors to water impairments. GIS spatial analysis was used to assist in both identifying priority contributing areas and potential conservation practice sites, particularly wetland restoration sites, within the three subwatersheds. These modeling efforts and complementary economic analyses are utilized in one-on-one outreach efforts to demonstrate to landowners that the voluntary implementation of certain best management practices will not only benefit their operation, but will provide a positive impact to the local ecosystem.

Contact Information: Jill A. Kostel, The Wetlands Initiative, 53. W. Jackson Blvd, Suite 1015, Chicago, IL 60604 USA, Phone: 312-922-077, Fax: 312-922-1823, Email: jkostel@wetlands-initiative.org

A STRUCTURED DECISION-MAKING PROCESS FOR RESTORING THE ATCHAFALAYA RIVER BASIN, LOUISIANA: DEVELOPING A PROCESS TO BRIDGE THE BOUNDARIES BETWEEN SCIENTISTS, MANAGERS, AND STAKEHOLDERS

Justin P. Kozak[1] and *Bryan P. Piazza*[2]

[1]NSF IGERT Program in Watershed Science and Policy, Department of Environmental, Resources and Policy, Southern Illinois University, Carbondale, IL, USA

[2]The Nature Conservancy, Baton Rouge, LA, USA

At over one million acres, the Atchafalaya River Basin (ARB) provides a multitude of ecosystem services and resources to society (i.e., flood control, forest, fish, and wildlife resources, navigation and nutrient cycling) valued in the billions of dollars annually. It is also a biodiversity hotspot of regional, national, and global importance. However, the environmental quality of the ARB is in decline due to large-scale and local water management problems resulting from its development as a Mississippi Basin floodway and other human activities. Restoration efforts in the ARB are hampered by a fragmented management landscape that has not allowed stakeholders to have meaningful involvement in management decisions. For example, the Louisiana Department of Natural Resources and the US Army Corps of Engineers each have an ARB master plan, but the objectives of each can be at odds and also contrary to stakeholder values. In 1998, the State created the Atchafalaya Basin Program within the Department of Natural Resources to "protect, enhance, and where feasible, restore the ARB." Research and development of restoration projects is conducted by the Atchafalaya Basin Program's Technical Advisory Group and the Research and Promotion Board, two groups with a strong commitment to science but limited non-governmental stakeholder involvement. Public participation is limited to two sets of public meetings per year, and participation in those meetings is waning. Stakeholder groups are well defined but view each other as competitors rather than interdependent collaborators. To address these issues, reduce conflict, and move restoration forward, we developed a framework for incorporating Structured Decision Making into the restoration planning process in the ARB. This framework builds on research into stakeholder viewpoints and will use a professional, neutral facilitator to engage stakeholders to design the future of the ARB through a values-based, objective decision-making process supported by rigorous scientific assessment. It also incorporates a non-technical Stakeholder Advisory Board to balance competing interests and calm the contentious stakeholder dynamics that continually obstruct planning and impede restoration efforts in the ARB.

Contact Information: Justin P. Kozak, IGERT Program in Watershed Science and Policy, Parkinson Lab, Rm. 207 – Mail Code 4325, Southern Illinois University, 1259 Lincoln Drive, Carbondale, IL 62901 USA, Phone: 630-805-1575, Email: jkozak@siu.edu

ASIAN CARP EDNA: EVOLUTION AND CALIBRATION

Richard F. Lance[1], *Jon Amberg*[2], *Meredith Bartron*[3], *Duane Chapman*[4], *Michael Guilfoyle*[1], *Martin T. Schultz*[1], *David L. Smith*[1], *Heather L. Farrington*[1], *Christine E. Edwards*[1], *Matthew R. Carr*[1], *Xin Guan*[1], *Edward Perkins*[1], *Edmond Russo*[1], *Richard Fischer*[1], *Jack Killgore*[1], *Catherine Richter*[4], *Mark Gaikowski*[2], *Sunni McCalla*[2], *Katy Klymus*[5], *Lorin Hatch*[6], *David Schulenberg*[7] and *Kelly Baerwaldt*[8]

[1]Environmental Laboratory, U.S. Army Research & Development Center, Vicksburg, MS, USA
[2]U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI, USA
[3]U.S. Fish and Wildlife Service, Northeast Fishery Center, Lamar, PA, USA
[4]U.S. Geological Survey, Columbia Environmental Research Center, Columbia, MO, USA
[5]University of Missouri, Columbia, MO, USA
[6]HDR Engineering Inc., Minneapolis, MN, USA
[7]Buffalo District, U.S. Army Corps of Engineers, Buffalo, NY, USA
[8]Saint Paul District, U.S. Army Corps of Engineers, Saint Paul, MN, USA

The U.S. Army Corps of Engineers is monitoring the Chicago Area Waterways (CAWs) for Asian carp environmental DNA (eDNA) upstream of two electric fish barriers designed to prevent the fish from reaching the Great Lakes. Repeated detections of eDNA above the barrier may indicate advancement of the Asian carp invasion front, but numerous uncertainties prevent such a conclusion. The eDNA Calibration Study (ECALS) is a multi-agency research project initiated in 2012 to improve the efficiency and reliability of eDNA detection methods, understand the sources of uncertainty in interpreting monitoring data, and assist resource managers use monitoring results for decision making. This presentation will describe the ECALS scope and study results to date. Numerous whole mitochondrial genome sequences have been obtained for Asian carp and are being used to develop additional presence/absence markers, quantitative PCR markers, and markers that may provide indications as to potential eDNA vectors or time since DNA deposition. ECALS is also employing a large suite of nuclear DNA markers to understand genetic structure in North American populations of Asian carp in order to lay the groundwork for using genetic diversity values from eDNA samples as corroborative data for population size estimates. Efforts to increase the efficiencies eDNA sampling and processing are on-going and have already resulted in cost- and time-savings. Investigations of alternative sources and vectors of Asian carp eDNA have found that eDNA can be deposited, stored, and transported via numerous means, including sewers, sediment, boat hulls, fishermen's nets, and bird feces; as well as showing that local piscivorous birds can transport eDNA considerable distances. ECALS results are being incorporated into modeling studies, such as hydrodynamic models to simulate the movement and persistence of Asian carp eDNA in the CAWS. ECALS will also develop analytical tools that will allow resource managers to draw probabilistic inferences about the origin of eDNA detected in monitoring samples and that, ultimately, will assist agencies in understanding and making decisions based on eDNA evidence.

<u>Contact Information</u>: Richard F. Lance, Environmental Laboratory, U.S. Army Engineer Research & Development Center, Vicksburg, MS 39180 USA, Phone: 601-634-3971, Fax: 601-634-4017, Email: richard.f.lance@usace.army.mil

BREAKING EDAWN: EDNA, CURRENT CHALLENGES, AND THE FUTURE

***Richard F. Lance*[1]**, *Heather L. Farrington*[1], *Christine E. Edwards*[1], *Matthew R. Carr*[1], *Edward J. Perkins*[1] and *Kelly Baerwaldt*[2]

[1]Environmental Laboratory, U.S. Army Research & Development Center, Vicksburg, MS, USA

[2]St. Paul District, U.S. Army Corps of Engineers, Saint Paul, MN, USA

DNA left behind in aquatic environments, colloquially termed aquatic environmental DNA or, simply, eDNA, initially appears to be approachable with fairly standard genetic capabilities, but is actually accompanied by complex and demanding requirements for handling and processing, optimization for low DNA yields and different environmental matrices, myriad potential complications in data interpretation, and controversy. Nevertheless, aquatic eDNA studies are growing in number, technological advances are being reported, and the future horizon for eDNA as a tool in ecology and conservation is very broad. Here we report on studies aimed at advancing the application of eDNA for detection of a number of rare or invasive species, detection of select biological assemblages, and characterization of ecological communities. Our lab has or is developing eDNA tools and approaches for detection and monitoring of endangered sturgeon, invasive Dreissenid mussels, invasive Asian carp, etc. Likewise, we are employing aquatic eDNA sampling with next generation DNA sequencing in "meta-barcoding" efforts to characterize biodiversity and relative species abundances within entire faunal communities. Progress and lessons learned from these efforts will be shared, along with observations on the future of eDNA applications.

Contact Information: Richard F. Lance, Environmental Laboratory, U.S. Army Engineer Research & Development Center, Vicksburg, MS 39180 USA, Phone: 601-634-3971, Fax: 601-634-4017, Email: richard.f.lance@usace.army.mil

NORTHEAST ILLINOIS RAVINE RESTORATION, MONITORING & POLICY PROGRAM

Angela Larsen[1]*, Gerould Wilhelm*[2]*, Susanne Masi*[3]*, Ed DeWalt*[4]*, Jeff Boeckler*[5] and *Debbie Maurer*[6]

[1]Alliance for the Great Lakes (Alliance), Lake Michigan Watershed Ecosystem Partnership (LMWEP), Chicago, IL, USA
[2]Conservation Research Institute, Chicago, IL, USA
[3]Chicago Botanic Garden, Glencoe, IL, USA
[4]Illinois Natural History Survey, Champaign, IL, USA
[5]Northwater Consulting, Springfield, IL, USA
[6]Lake County Forest Preserve District, Libertyville, IL, USA

The primary goal of the Illinois Lake Michigan Ecosystem Partnership (LMWEP) is to facilitate implementation of habitat restoration projects that have positive environmental and quality of life outcomes for Illinois' Lake Michigan communities. The LMWEP is an active coalition of federal, state, provincial, non-profit, and corporate members from multiple sectors (e.g. ecology, policy, land use, transportation, recreation, education) who develop common goals, share best management practices, and partner on projects. The LMWEP recently carried out a stakeholder driven process that used quantifiable indicators to assess the condition of the LMWEP's natural resources and identified where projects should be focused to maximize the benefits of ecosystem management; the result was development of significant baseline data and prioritization of the ravine system. Despite decades of disturbance from urban development, the Lake Michigan shoreline and ravine ecosystems of northeast Illinois (a system of 47 ravines that start north of Chicago and continue through the Wisconsin boarder) continue to support a unique and diverse flora and fauna and "represent(ing) the only remaining natural drainage systems in the presentday Lake Michigan watershed in Illinois" (Illinois Department of Natural Resources 2007), and both public and private landowners have begun to prioritize the restoration of this unique habitat.

On behalf of the LMWEP, the Alliance and our grant partners are currently implementing a multifaceted project encompassing: 1) on-the-ground ravine restoration, 2) a ravine assessment and field guide that takes scientific monitoring protocol such as the Floristic Quality Assessment, Plants of Concern, and CTAP, and develops a less technical assessment that allows land managers w/varying levels of expertise to articulate restoration goals for their ravine(s), 3) a ravine policy handbook that provides provincial governments with suite of policies (e.g. LID, steep slope ordinances, reduction of impervious surface) that if implemented will reduce stressors to the ravines, and 4) a private land-owner engagement process and restoration design guidelines. This suite of tools (i.e. assessment protocol, policy handbook, and private land-owner manual) will be shared and promoted via LMWEP to municipal, park district, and county staff that manage 900 acres of highly visible and valuable Lake Michigan shoreline - thus increasing land managers' capacity to assess the biological integrity of their ravines, develop BMPs, and quantitatively assess and communicate whether implemented BMPs are improving habitat quality over time. This project was funded by the National Fish and Wildlife Foundation through their Sustain Our Great Lakes program, and will be complete March 2013.

Contact Information: Angela Larsen, Alliance for the Great Lakes, 17 N State St., Suite 1390, Chicago, IL 60602 USA, Phone: 312.445.9746, Email: alarsen@greatlakes.org

A CASE STUDY OF REMEDIATION AND RESTORATION STRATEGIES IN A CONTAMINATED NEW JERSEY WETLAND

Mark S. Laska[1], *Barbara Barnes*[2], *Christopher Keil*[2], *Carl Carlson*[2] and *Erin Hathaway*
[1]Great Ecology, San Diego, CA, USA
[2]Great Ecology, New York, NY, USA

The 185-acre contaminated site located in Woodbridge Township, New Jersey was operated as an organic chemical manufacturing facility for much of the last century. Historically, much of the site was tidal wetlands; however, nearly two thirds of the site was filled via dredge material placement during channel deepening of the Raritan River during the 1940s and 1950s. Over the next 50 years, this area was converted into stormwater-fed, freshwater wetlands dominated by an invasive plant, *Phragmites australis*. As a result of the facility operations, the site became contaminated with a suite of constituents including Dense Non-aqueous Phase Liquids (DNAPLs) in the groundwater, which can be problematic to delineate and remediate.

In 2008 Great Ecology and Brown and Caldwell initiated the remedial and ecological investigation for the current site owner, EPEC Polymers Inc. The subsequent remedial action workplan included a hydraulic barrier wall to contain groundwater impacted by DNAPL source material that resulted in approximately 30 acres of permanent impacts to open water and wetland habitats. An integrated approach to the remediation and required wetland mitigation was necessary to achieve the project goals of 1) attaining cleanup standards protective of human health and the environment, 2) compensating for wetland impacts due to implementation of the remediation, 3) preparing the site for eventual redevelopment, and 4) providing public access to the Raritan River in Woodbridge Township for the first time in over 100 years.

We present on our innovative approach to remediation, wetland mitigation, regulatory compliance, and stakeholder outreach, and discuss the benefits of implementing a comprehensive strategy to achieve successful restoration for contaminated sites. This strategic approach resulted in a novel, integrated design that is now under construction.

<u>Contact Information</u>: Sarah Stevens, Great Ecology, La Jolla, CA 92037 USA, Phone: 858-750-3201, Fax: 858-750-3205, Email: SStevens@greatecology.com

INCREASING ECOLOGICAL UPLIFT USING ECOLOGICAL MODELING: A NOVEL APPROACH WITH A CASE STUDY IN WOODBRIDGE, NEW JERSEY

Mark S. Laska[1], *Jessie Quinn*[2] and *Zachary Lehman*[3]
[1]Great Ecology, San Diego, CA, USA
[2]Great Ecology, New York, NY, USA
[3]Great Ecology, Denver, CO, USA

Compensatory wetland mitigation is required in the context of federal regulatory compliance under the Clean Water Act. Mitigation ratios of wetland acres impacted-to-wetland acres created are often established by federal and state regulators. However, it is becoming increasingly preferred to determine mitigation requirements based on a comparison of the wetland functions lost due to development and gained due to compensatory restoration. This is consistent with the 2008 Mitigation Rule of the Clean Water Act jointly released by the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers that advocates for the goal of "No Net Loss" of wetlands or their functions.

Estimating the ecological function of restored wetlands compared to that of pre-project conditions requires a quantitative ecological model. Wetland Functional Assessments (WFAs) provide a method to assess ecological functionality using a suite of habitat attributes, which are used to calculate a composite metric to estimate ecosystem functions. WFAs can be used in wetland restoration planning and design to maximize the functional provision of restored wetlands and demonstrate to regulators the relationship of restoration attributes to the wetland functions they provide.

We illustrate the process of using a WFA, the Evaluation of Planned Wetlands, in the planning, design, permitting, and implementation of wetland restoration to create the maximal amount of ecological uplift using a 185-acre remediation and restoration project currently underway in Woodbridge, New Jersey as a case study. We discuss the details of this approach and apply the results of the Woodbridge case study to the broader context of planning approaches to achieve successful ecosystem restoration.

<u>Contact Information</u>: Sarah Stevens, Great Ecology, La Jolla, CA 92037 USA, Phone: 858-750-3201, Fax: 858-750-3205, Email: SStevens@greatecology.com

GOVERNANCE CHALLENGES TO ADDRESSING ALGAL BLOOMS IN THE GREAT LAKES

Joe Logan
Ohio Environmental Council, Columbus, Ohio, USA and Lake Erie LaMP Public Forum, Great Lakes National Program Office, Chicago, Ill, USA

The Great Lakes ecosystem straddles the boundaries among eight U.S. States and Canada. This incredibly valuable natural resource provides a myriad of critical ecosystem services, including their having been used extensively by industries and municipalities, for waste disposal. As a result, the ecosystem health has suffered periodically. Lake Erie, the shallowest, most highly developed of the Great Lakes has approached a catastrophic ecosystem collapse in the late 1960s and 1970s. Since that time, the states and nations have worked together successfully to make major reductions in point source pollution. Lake Erie made an impressive recovery, during the 1980s and 1990s. International agreements like the newly-updated Great lakes Water Quality Agreement (GLWQA) have been indispensable in achieving this major ecosystem restoration.

More recently, Lake Erie has once again been in decline, as dissolved reactive phosphorus loading has increased. All indications suggest that the main sources are nonpoint sources, including agriculture. The challenges of achieving nonpoint reductions are complicated by the diversity of agency authority and by the large number of private land owners. Achieving reductions will require an extraordinary level of management, cooperation, and funding.

Thanks to the GLWQA, the Great Lakes Restoration Initiative in the US and the Great Lakes Nutrient Initiative in Canada, many of the essential framework components are in place. A great deal of difficult work lies ahead. Several types of strategies for addressing nonpoint pollution are being tried throughout the ecosystem . None have been proven successful to date.

This dedicated session will focus on the complexities, obstacles, and advantages of executing ecosystem restoration in international and multi-jurisdictional settings. This presentation will focus on my experiences as coordinator of the Lake Erie Lakewide area Management Program (LaMP) Public Forum, and with the Western Lake Erie Basin Partnership. The LaMP Forum works with international agency representatives (USEPA and Environment Canada) to implement the LaMP Management plans.

Contact Information: Joe Logan, Director of Agricultural Programs, The Ohio Environmental Council, Columbus, OH 43212 USA, Phone: 614 487-7506, Fax: 614 487-7510, Email, joe@theoec.org

OLD AND NEW CHALLENGES TO RESTORE THE UPPER MISSISSIPPI RIVER SYSTEM

Kenneth S. Lubinski
U. S. Geological Survey, La Crosse, WI, USA

In many ways, habitat restoration and ecosystem monitoring activities on the Upper Mississippi River System (UMRS), as envisioned by the creators of the Environmental Management Program in the early 1980's, have clearly been successful. Effective habitat projects have been designed and built. Consistent monitoring has yielded previously unheard of amounts of easily accessible information about important ecosystem components in each of the system's distinct floodplain reaches. Resource management and science partner agencies have become familiar with each other's goals, needs, constituencies, and methods of operation. But after twenty five years, some old challenges still remain unmet, and new challenges loom on the horizon. Many people familiar with the program, recently retitled the Upper Mississippi River Restoration-Environmental Management Program (UMRR-EMP), highlight decreasing federal funding as its primary future concern. The challenges described here, however, relate more to the effective functioning of the program and its influence on the condition of the river system, things that should and can be addressed regardless of its funding status.

Habitat restoration activities continue to focus on project scale benefits, with limited attention to whether the projects yield synergistic results at reach or system scales. As a result, we don't know now, nor is there a process in place to know in the future, how much more restoration is ultimately going to be necessary. Some restoration practitioners dismiss this lack of knowledge, being comfortable with the notion that the need for restoration will never end. This position seems indefensible from an economic viewpoint, in addition to undermining a broader desire to learn how best to allocate limited resources between restoration and other management alternatives (e. g. reducing nonpoint-source pollution).

Monitoring results still have not been operationally linked to specific, anticipated management decisions. Two system status and trend reports have described, with examples, the concept of using quantifiable metrics in decision-making, but a well-articulated program framework that links system status information to tactical or strategic decisions, is still lacking. As a result, while we are effectively tracking how aquatic vegetation changes over time in selected areas for example, there is no agreed upon *a priori* process by which an undesirable change in vegetation can trigger one or more specific management actions.

Current institutional arrangements related to restoration mostly favor the operational status quo. Innovation and experimentation are routinely viewed by risk-adverse program managers either as negatively affecting long-term data strings, or as being an inefficient use of funds.

The challenges described above will not go away, and delaying attention to them will allow the program behaviors requiring change to become more entrenched. Effective restoration will also become more difficult with climate change and new invasive species. The sooner the old challenges are met, the sooner we can move on to new ones. Ignoring the old challenges will prevent the quantification of ecological responses to multiple projects and the demonstration of positive effects of restoration on the river ecosystem as a whole. Arguments for future support, from federal, state or private sources, will gradually become weaker and weaker.

Contact Information: Ken Lubinski, U.S.G.S., 2630 Fanta Reed Road, La Crosse, WI 54603, Phone: 608-781-6297,
Email: klubinski@usgs.gov

DEFINING A PATH TO ACHIEVABLE AND HISTORICALLY RELEVANT GOALS FOR RESTORATION OF CORAL REEF ECOSYSTEMS

Matthew J. Lybolt
Tetra Tech, Stuart, FL, USA

Approaches that quantify the historical range of natural variability are particularly valuable for coral reef ecosystems, because reefs change slowly on human timescales, and because their complexity often requires decades or centuries of observation to identify the relevant ecological relationships. Here I suggest applications of marine historical ecology to set appropriate targets, identify the relevant drivers of coral reef ecosystem change and track incremental progress towards the target ecosystem state(s) of 4 important coral reef ecosystems.

The shifting baseline syndrome is the cross-cutting theme of the multiple causes of our ocean's trajectory of decline (Pauly 1995, Halpern et al. 2008), where scientists, managers and other stakeholders set inappropriate management goals based on their own short-term experience with an environment that was degraded before their time (Knowlton and Jackson 2008, Pinnegar and Engelhard 2008). Another insidious problem is "false precisionism", coined by Jeremy BC Jackson (2011). This refers to the tendency to favour numerical data collected using modern techniques and ignore older data despite often overwhelming evidence regarding historical changes (e.g., fantastically high past abundances (Jackson 1997, Rosenberg et al. 2005), or animal sizes that haven't been seen in generations (McClenachan 2009)). These sources of historical data are often ignored as a matter of convenience because their semi-quantitative or multidisciplinary sources do not easily fit into conventional models (Pandolfi et al. 2003).

Both of these underlying problems affect ecological theory and policy implementation, and both are substantially resolved by considering the range of variation on a longer timescale. Along with these historical perspectives come multiple lines of evidence, each with different characteristics of power, depth, sampling intensity, and spatial and temporal scales.

I present a framework to implement historically relevant advances to natural resource management (NRM) goals using 4 case studies; the Great Barrier Reef, Moreton Bay, North-western Hawaiian Islands, and the Florida Keys. The GBR Marine Park Authority (GBRMPA) is at the leading edge of science-based maritime conservation and natural resource management. But even under the management of GBRMPA, arguably the most successful marine NRM agency, the long-term outlook for the GBR is poor (Great Barrier Reef Marine Park 2009). I show that multiple lines of historical evidence allow a variety of approaches to identify a new range of low-hanging-fruit, and pathways to measure incremental success towards ecosystem restoration goals. Furthermore, I use examples to show that quantitative palaeoecological information supports integrated approaches that help managers to claim some credit for follow-on, downstream, or synergistic benefits of other management efforts. Palaeoecological and historical ecology provide a sound base on which to make plans and measure historically relevant successes.

Contact Information: Matthew J. Lybolt, Tetra Tech, Inc., Stuart, FL 34994 USA, Phone: 772-781-3420, Fax: 772-781-3411, Email: matthew.lybolt@tetratech.com

CLIMATE ADAPTATION AND GREAT LAKES RESTORATION: IMPLEMENTING GLRI, GLWQA, AND THE IUGLS

Scudder D. Mackey
Ohio Department of Natural Resources, Sandusky, OH, USA

Unlike marine coastal systems which are facing the threat of gradual sea level rise, Great Lakes coastal systems face an uncertain future with respect to both climate and water-level change. Early climate models predicted gradual long-term declines in Great Lakes water levels. More recent work by the IJC International Upper Great Lakes Study (IUGLS) suggests that Great Lakes water levels will remain slightly below the long-term average but with increased variability and a plausible risk of water level fluctuations outside of historic water level ranges. Recent downscaled Regional Climate Models suggest increased variability due to increased precipitation and changes in evaporation due to warmer Great Lakes surface water temperatures and loss of winter ice cover. These models also suggest changes in storm patterns and increased storm frequency and severity within the Great Lakes. While the absolute magnitude, frequency, duration, and timing of these events cannot be determined, the risk of wetter or dryer conditions and resulting extreme lake levels outside the historical range within the Great Lakes cannot be ignored.

The Great Lakes Restoration Initiative (GLRI) has supported numerous restoration projects in the Great Lakes region designed to restore and protect Great Lakes water quality, restore habitat and ecological functions, and address Beneficial Use Impairments that will result in delisting of designated Great Lakes Areas of Concern. GLRI-funded restoration projects are required to anticipate and incorporate possible climate change impacts into project designs. Even though there are several basinwide initiatives focused on adaptive management, these initiatives and the planning tools they provide do not provide guidance at scales appropriate for most GLRI projects. There is a pressing need to develop fine scale scenario-based adaptive management approaches that are applicable to restoration activities at local scales. This need may be addressed by Annex 9 of the recently signed Great Lakes Water Quality Agreement (Agreement). In that Annex, it states “The Parties shall communicate and coordinate binationally regarding ongoing developments of domestic science, strategies and actions to build capacity to address the climate change impacts on the Great Lakes Basin Ecosystem.” The Agreement will provide the legal and programmatic justification for both the U.S. and Canada to develop robust adaptive management programs and implement appropriate monitoring and performance indicators related to climate change adaptation and management. Moreover, water levels on two of the five Great Lakes are regulated. The IUGLS recently completed two reference studies whereby new two new water level regulation plans were recommended for Lakes Superior and Ontario. These plans incorporate recommendations that make them more resilient and responsive to climate-induced water level changes and implement innovative adaptive management approaches as core elements of the new water level regulation plans.

Contact Information: Scudder D. Mackey, Ph.D. Office of Coastal Management, Ohio Department of Natural Resources, 105 W Shoreline Drive, Sandusky, OH 44870 USA, Phone: 419-626-7980, Fax: 419-609-4158, Email: scudder.mackey@dnr.state.oh.us

ABC'S OF FRESHWATER WETLAND DESIGN: CONCEPT TO CONSTRUCTION

***Michael Mak**, Karen Appell* and *Christopher Benosky*
AECOM, New York, NY, USA

The Brookland Mitigation Site, located in Middlesex County, New Jersey, was selected for the compensatory mitigation of wetland impacts resulting from the construction of the New Jersey Turnpike Interchange 6-9 Widening Program. The site encompasses 412 acres of predominately agricultural and forested land uses that drain to the Millstone River, Cranbury Brook, and their anthropogenic tributaries via surface water runoff and groundwater flow. The site is almost entirely situated within the 100-year floodplain of the existing waterways, which are all regulated under the NJDEP Agency regulations.

The goal of the conceptual design was to establish a variety of ecosystem habitats, including vernal pool complexes, forested freshwater wetlands, and reforested upland areas. The locations of these habitats were dictated by the site's existing features including modified agricultural wetlands, tile drains, regulated floodways, cultural resource areas, site topography, and observed groundwater levels. The overall site design was also governed by the required mitigation credits and the need to keep all excavated materials onsite. AECOM was the subconsultant during the conceptual design phase.

Following conceptual design, site-specific wetland characteristics were translated into quantitative water budget models to predict long-term behavior. A hydraulic and hydrologic analysis of the site was developed to assess the hydrologic response of the proposed design and its impact on the floodplain and flood storage characteristics. Fourteen interconnected wetland water budgets were developed to simulate daily fluctuations in surface water and groundwater within the existing and proposed wetlands of the site. The complexity of the site required each water budget model to be integrated into a network of models to capture the hydrodynamic interactions throughout the site. Special methodology was developed to bridge data gaps in hydrologic and climatic data. Seasonal correlation factors were developed for groundwater data collected on-site and the long-term data from regional groundwater wells. Daily fluctuations in water level at the site were simulated to help ensure the sustainability of a hydrologic regime capable of supporting the targeted wetland and upland habitats and species.

Based the water budget simulations, habitats were established by lowering ground surface elevations within the proposed wetland and vernal pool areas, raising ground surface elevations in existing upland areas, and raising the thalwag of the anthropogenic tributaries to reconnect them to their floodplains, thus restoring a more natural hydrologic and hydraulic regime to the site.

Construction commenced in October of 2012 and will be completed by July of 2013. Lessons learned and adaptive management measures will be discussed.

Contact Information: M. Mak, AECOM. 71 West 23rd Street, New York, NY USA, Phone: 212-763-4512,
Email: michael.mak@aecom.com

GULF SAVERS® BAG: A NOVEL APPROACH FOR *SPARTINA ALTERNIFLORA* IN MARSH ECOSYSTEMS RESTORATION

Lawrence D. Malizzi[1], *Leslie Carrere*[2], *PJ Marshall*[2], *Marv Marshall*[2], *Alan Parsons*[3], *Seth Domangue*[4] and *Margo Moss*[4]

[1]Matrix New World Engineering, Inc., Wilmington, DE, USA
[2]CRestore the Earth Foundation, Inc., Ithaca, NY, USA
[3]Matrix New World Engineering, Inc., East Kingston, NH, USA
[4]Matrix New World Engineering, Inc., Baton Rouge, LA, USA

The use of the Gulf Savers® bag (GSB) for *Spartina alterniflora* marsh restoration at Popcorn Beach at the Pass a Loutre WMA, Venice, Louisiana is anovel approach to marsh ecosystems restoration. The GSB bag is a biodegradable, self-contained package of native plants with its own site-specific custom mixed supply of natural nutrients to support, feed, and protect the native vegetation. Each GSB bag contains three, one year old *Spartina* seedling plugs and are the size of a sandbag (45 cm). The GSB) is a stability kit that jump starts growth and survivability in the face of storm surge, wave action, and rapid erosion. As one of the three principal outlets of the Mississippi River, the Pass a Loutre Site is challenging to restore using traditional planting techniques due to the variable tidal range, high wave energy and substantial discharge rates on-site creating an obstacle to *Spartina* plug establishment. In December 2010, 400 bags (1200 plugs) were placed on the north end of Popcorn Beach as a demonstration project. Half of the bags (200 bags) were distributed in cluster formation (2-3 bags) in a checkerboard pattern, in an approximately 22 m by 25 m area adjacent to the beach, with 3 m between bag clusters. The remaining half (200 bags), were deployed as a continuous row along portions of the perimeter in order to enhance sediment capture and to buffer interior bag groupings from high energy tidal forces. In March and April of 2011, 1,600 additional GSBof *Spartina* plugs in cluster formations were deployed to reinforce the perimeter by arraying bags adjacent to the perimeter rows deployed in December 2010. The first monitoring event at the Site was conducted in December of 2011 at pre-surveyed, permanent 1 m by 1 m plots. The average percent cover of the *Spartina* was 78%, with an average canopy height of 93 cm in the bag area. A second monitoring was conducted at the same plot locations in April of 2012. The average percent cover was 85% and the average canopy height was 119 cm in the bag area. Of importance is the fact that the *Spartina* had completely filled in the treatment area in a twelve month period. In addition, the initial linear formation of *Spartina* along the perimeter had expanded outwards to a width of 8 m from the original planting in 17 months. The percent cover, average canopy height, and aerial extent of the *Spartina* demons trates the effectiveness of the GSB and is a novel approach for use in marsh ecosystem restoration. This fact is exemplified by the GSB bags surviving Hurricane Isaac undamaged.

Contact Information: Lawrence Malizzi, PG, Matrix New World Engineering, Inc., 1521 Concord Pike, Suite 301, Wilmington, DE 19803, Phone: 302-598-7553, Fax: 302-824-7086, Email: lmalizzi@matrixneworld.com

THE USE OF SCIENCE FOR FISHERIES RESTORATION IN THE HURON-ERIE CORRIDOR

Bruce A. Manny*[1]*, *J. Boase*[2]*, G. Kennedy*[1]*, E. Roseman*[1]*, D. Bennion*[1] and *J. Read*[3]
[1]U.S. Geological Survey, Ann Arbor, MI, USA
[2]U.S. Fish and Wildlife Service, Waterford, MI, USA
[3]Michigan Sea Grant, University of Michigan, Ann Arbor, MI USA

The unobstructed St. Clair and Detroit rivers and Lake St. Clair connect Lake Huron to Lake Erie in the central Great Lakes. Since 1900, rock-rubble spawning habitat used by high-value native fish, such as lake whitefish, lake sturgeon, and walleye, was systematically removed from the bottom of these rivers during creation of more than 100 miles of navigation channels up to 800 feet wide and 29 feet deep. Decreased diversity and abundance of many valuable native fish populations in the St. Clair and Detroit rivers was an environmental result of this channelization. Since 2002, restoration of this lost fish spawning habitat has been a scientific objective of the St. Clair-Detroit River Initiative (or Huron-Erie Corridor Initiative), and is a prime example of remediation of beneficial use impairment (BUI) 14 – Loss of fish and wildlife habitat, in these two international areas of concern. A decade of scientific investigations, using a rigorous assessment protocol, has produced detailed information about factors which govern selection of spawning habitat by native fishes. Initial investigations included evaluations of reported historic spawning habitats, evaluation of preferred spawning substrate sizes, and assessments of movements of spawning ready adult fish in the system. These studies were followed by use of a priori knowledge of the river system to select a site for experimental reef construction. The selected site was investigated for use by spawning fish prior to reef construction, and followed with assessments of use for spawning after construction. The steps of this first construction project were refined and applied to two more successful reef projects within the system. Building on the lessons learned during these projects, as well as evaluation of historic habitat availability, a geo-spatial model of water velocity and depth in these two rivers was developed to locate other potential areas for reef construction. This modeling effort, combined with ongoing studies of larval and adult fish habitat use, has formed our "blueprint" for spawning habitat remediation in this system. This adaptive management framework has permitted scientists to verify that each fish habitat restoration project has successfully increased the amount of productive spawning habitat. We anticipate that remediation of fish spawning habitats will measurably contribute to the abundance and diversity of numerous valuable native fish species in this central Great Lakes area and also enable the delisting of BUI 14 in these two international areas of concern.

Contact Information: Bruce A. Manny, Great Lakes Science Center, USGS, 1451 Green Road, Ann Arbor, MI 48105 USA, Phone: 734-214-7255, Fax: 734-994-8780, Email: bmanny@usgs.gov

VALUING CHANGES IN AQUATIC ECOSYSTEM SERVICES FROM REDUCTIONS IN NUTRIENT LOADINGS: A METHODOLOGY FOR LINKING ENVIRONMENTAL BENEFITS AND ECONOMIC VALUATION

Carol Mansfield[1], *George Van Houtven*[1], *Dan Phaneuf*[2], *Roger von Haefen*[3], *Bryan Milstead*[4], *Melissa Kenney*[5] and *Ken Reckhow*[6]

[1]RTI International, Research Triangle Park, NC, USA
[2]University of Wisconsin, Madison, WI, USA
[3]North Carolina State University, Raleigh, NC, USA
[4]U.S. Environmental Protection Agency, Narragansett, RI, USA
[5]University of Maryland, College Park, MD, USA
[6]Cardno Entrix and Duke University, Durham, NC, USA

Ecosystems provide valuable services to households and businesses, but it can be difficult to define, measure and link changes in physical or chemical properties of ecosystems with the final goods and services that enter into people's decision making and that people value. Often regulators set targets for the chemical or physical properties of the ecosystem, but the changes in the properties of the ecosystem must be translated into goods or services that people have preferences over before an economic value can be calculated.

The presentation will describe a multistage modeling framework that allows us to translate reductions in nutrient loads to surface waters into changes in indicators of lake ecosystem services and then to estimate the monetary value of these changes. This framework was specifically designed to provide an integrated multidisciplinary framework that links environmental and economic models using ecosystem service concepts. We used expert elicitation to develop a function linking water quality readings to a text-based eutrophication index. The categories in the eutrophication index were used as the basis for a stated-preference (SP) survey to put a monetary value on changes in eutrophication. This combination of expert elicitation and SP surveys offers an innovative approach for linking changes in chemical and physical water quality parameters with the final ecosystem services that individuals recognize and value.

We describe two applications of the method using Total Maximum Daily Load (TMDL) restrictions. The first example values changes in water quality for a single lake from regulations to reduce nutrient run-off in a watershed. In the second example, we look at the value of co-benefits resulting from the Chesapeake Bay TMDL. The Chesapeake TMDL is designed to protect and restore the Bay estuary by reducing nitrogen, phosphorus, and sediment loads to surface waters throughout its 64,000 square mile watershed. By requiring point and nonpoint source controls throughout the Bay watershed, the TMDL is expected to improve and protect other aquatic and terrestrial ecosystems in nontidal areas of the watershed, as well as in the Bay. We will look at one of these ecosystem service co-benefits: reductions in eutrophic conditions in freshwater lakes and reservoirs in Virginia.

Contact Information: Carol Mansfield, 3040 Cornwallis Rd. Research Triangle Park, NC, 27709, USA, Phone: 919-541-8053, Fax: 919-541-8830, Email: carolm@rti.org

ECO-AGRO-CLIMATIC CONDITIONS TO EXPANSION OF PALM OIL IN THE STATE OF PARA

***L. G. Martorano*[1]**, *Leila S. Lisboa*[2], *José R.S.C. Moraes*[3], *Alailson V. Santiago*[1] and *Daiana C. A. Monteiro*[5]

[1]Researcher of Embrapa Eastern Amazon
[2]Doctorate in ESALQ/USP – Piracicaba, São Paulo
[3]Scholarship Student PET/UFRA/ Embrapa Eastern Amazon, Belem/Para
[4]Master's student in ESALQ/USP – Piracicaba, São Paulo

With the release in 2009 of the National Oil Palm Program (*Elaeis guineensis* Jacq.) was included as an alternative for use of biofuels in the energy matrix in Brazil, demanding the productive sector and the scientific community new studies related to its supply chain. The objective of this work is evidence pointing response of palm oil to eco-agro-climatic condition to support decisions making in the process of expanding cultivation in the state of Para.

The water balances were calculated considering the available water capacity in the soil of 125 mm. We also calculated the vapor pressure deficits (VPD) and eco-agro-climatic zoning was generated in ArcGIS 9.3 and exported to TerraView 3.2 to create space for the cellular integration of variables in TerraME. Another factor that was considered was a disease called Fatal Yellowing (FY) associated with excess of water in the soil analyzed daily rainfall data for the period 1993 to 2008, in the cities of Moju, Cameta and Belem.

According Barcelos et al. (1987) the ideal temperature range for the culture is between 24° and 30°C and in this paper showed that in Para annual average ranging from 23.3 to 27.3°C. For Scotton (1982) annual rainfall should be above 2,000 mm and water deficit should not exceed 150 mm. The eco-agro-climatic zoning showed that areas near Belem present conditions able to express the potential of culture to 125 mm of water deficiency, which can reach a maximum of 150 mm deficits year. It is noteworthy that in areas with higher values at 200 mm indicative of present need of fluid, resulting in effects on "water footprint" of culture. Vapor pressure deficits between 0.3 to 0.5kPa tracks indicate preferential expansion of palm oil. In the southwestern portion water deficits are in bands below 150 mm, but they are primary forest and have legally protected areas and it is necessary attention by the peculiarity of environmental constraints. As to FY disease there was intensification of cases during March and April, which are the rainy months pointing effects of excess soil water. In 2006, counted up more than 80% of days with rain in April, which may have influenced the 1440 cases of plants with FY in May, indicating gradual effects of soil moisture associated with this disease. We conclude that Para has eco-agro-climatic conditions to the expansion of Palm crops, but periods of high rainfall offer may be associated with fatal yellowing (FY), limiting the success of entrepreneurs in the chain of biofuel in the Amazon. Annual water deficit exceeding 125 mm, increased "water footprint" to ensure crop productivity.

Contact Information: L. Guerreiro Martorano, Embrapa Eastern Amazon. Enéas Pinheiro Lane, Marco Postal Code: 66095-100, Belem/Para, Phone: (+5591) 32041185, Email: martorano.lucietta@gmail.com or lucieta.martorano@embrapa.br

RESTORATION OF GRAVEL MINED FLOODPLAINS, WILLAMETTE RIVER, OREGON

Merri Martz[1], *Chris Budai*[2] and *Leslie Bach*[3]
[1]Tetra Tech, Inc., Seattle, WA, USA
[2]U.S. Army Corps of Engineers, Portland, OR, USA
[3]The Nature Conservancy, Portland, OR, USA

The floodplains of the Willamette River and many of its key tributaries have been used extensively for gravel mining purposes over the past 100 years. This mining legacy has left highly disturbed floodplains including both shallow and deep ponds, compacted soils, limited vegetation, and extensive debris. Many of these sites have been abandoned or otherwise left fallow after the primary gravel sources were removed. However, these floodplains also provide an important opportunity for large-scale restoration of natural flooding processes that is not possible on sites with other land use or infrastructure concerns.

The U.S. Army Corps of Engineers, The Nature Conservancy, and a number of other landowners and stakeholders in the upper Willamette River valley are undertaking the restoration of gravel mined floodplains for fish and wildlife habitat and to promote natural floodplain and channel functions and processes such as flood storage, groundwater recharge, channel migration, and sediment erosion and deposition. Floodplain habitats are important for numerous listed or sensitive fish and wildlife species including Chinook salmon, steelhead trout, Oregon chub, Western pond turtle, Northern red legged frog, and Oregon spotted frog. As a consequence of upstream dams, as well as revetments and levees, and various land uses, many floodplain areas are rarely connected to their rivers except during extreme flood events. Gravel mined floodplains could provide important off-channel aquatic habitats and provide other floodplain functions if restored and reconnected to the river systems during more frequent flow conditions. Key factors limiting the populations of Upper Willamette River Chinook salmon and steelhead trout include impaired access to spawning and/or rearing habitats, and reduced physical habitat quality and quantity (ODFW et al 2011).

Lessons learned from the few gravel mined floodplains that have already been restored and reconnected are being used to guide the design and implementation of additional projects including predicted versus actual frequency and volume of connections between the floodplain and river, invasive species management, and human use management. The Willamette River Floodplain Restoration Study currently nearing completion has incorporated this information into the overall recommended restoration plan that includes 5 floodplain sites. Design features include connection channels, gravel pond restoration, riparian and wetland revegetation, engineered log jams, and floodplain grading and wood placement. A monitoring and adaptive management plan to evaluate physical and biological parameters and guide future actions, as necessary, to ensure the overall success of these projects is also being implemented.

Contact Information: Merri Martz, Tetra Tech, Inc., 1420 Fifth Avenue, Suite 550, Seattle, WA 98101 USA, Phone: 503-704-2777, FAX: 206-728-9670, Email: merri.martz@tetratech.com

Chris Budai, U.S. Army Corps of Engineers, Portland District, P.O. Box 2946, Portland, OR 97208-2946 USA, Phone: 503-808-4725, FAX: 503-808-4699 , Email: christine.m.budai@usace.army.mil

RESTORING A RAVINE ECOSYSTEM: OUTREACH TO NEIGHBORS

Linda Masters
Openlands, Chicago, IL, USA

Many people are instinctively drawn to live near nature. They are attracted to the scenery, the seasonal changes and the privacy it provides. However there is often a lack of understanding about the impacts that their property maintenance regimes can have on the natural area. In the case of ravine ecosystem neighbors, the impacts can be quite extreme.

Ravine ecosystems are naturally erodible systems and are located at the bottom of the watershed. When the uplands are developed and more impervious surfaces are expanded, the rainwater is often shunted towards a ravine. With homeowners this often takes place in the form of graded lots sloping towards the ravine edge or lawns mowed right to the edge. Buffers planted with approved native species can often offset many of impacts of these cultural activities.

When Openlands took ownership of a one mile stretch of lakefront in the decommissioning of Fort Sheridan, it included 3 ravine systems. Bartlett Ravine has 25 neighbors on the north side living in typical suburban size lots in close proximity to the ravine edge. While their Homeowner Association governing documents include a required ravine edge buffer consisting of approved native plants, many were not installed or were in degraded conditions.

Partnering with the Alliance for the Great Lakes through a National Fish and Wildlife grant, Openlands has had the opportunity to open up a dialogue with our neighbors to discuss the condition of their property and how it affects Bartlett Ravine. This presentation will discuss the neighbor outreach process and the results.

Contact Information: Linda Masters, Openlands, 25 East Washington, Suite 1650, Chicago, Illinois 60602 USA,
Phone: 312-863-6278, Fax: 312-863-6251, Email: lmasters@openlands.org

THREE TIPS FOR SUCCESSFUL COMMUNITY ENGAGEMENT: INSIGHTS FROM THE GREAT LAKES

Caitie A. McCoy
Illinois-Indiana Sea Grant, Chicago, IL, USA

Successful environmental restoration is accompanied by successful community engagement. Community engagement minimizes conflict by including public values in decisions, increases public support for specific restoration actions, and builds long-term environmental stewardship locally. However, engagement can be difficult for large-scale agency actions like restoration because technical decisions are often made at state and national levels by leaders that live far from the restoration site.

Some agencies have helped bridge this gap by partnering with local community groups or local government. Others have hired community involvement specialists to act as a liaison between communities and agencies. These solutions are well-known and even commonplace. Yet there is even more an agency can do to successfully engage the community, for a relatively small investment. These lessons are inspired by outreach work performed for Great Lakes Legacy Act projects across a number of Areas of Concern, including the Grand Calumet River in northwest Indiana, the Sheboygan River in Wisconsin, the Buffalo River in New York, and the St Louis River in Duluth, Minnesota.

Through lessons learned from partnerships with community groups across Areas of Concern, three tips for successful community engagement in environmental restoration are offered: 1) get out there and meet people, 2) make restoration relevant, and 3) don't forget the children. Examples of how these tips have helped make community engagement successful in Areas of Concern will be shared.

<u>Contact Information</u>: Caitie A. McCoy, Illinois-Indiana Sea Grant, Liaison to U.S. EPA Great Lakes National Program Office, Chicago, IL. 60604 USA, Phone: 312-886-1430, Fax: 312-886-6869, Email: cmccoy2@illinois.edu

NAPA SONOMA MARSHES RESTORATION PROJECT – COASTAL ECOSYSTEM RESTORATION THROUGH COLLABORATIVE PARTNERSHIPS

Jeff McCreary
Ducks Unlimited, Inc. Rancho Cordova, CA, USA

The San Francisco Bay is the largest estuary system on the Pacific coasts of North and South America. The Estuary's northern half, San Pablo Bay, is one of three large bays that comprise the greater San Francisco Bay. Prior to large-scale European settlement beginning in 1850, the entire San Francisco Bay was ringed by extensive, miles-wide tidal marshes. By the 1950s, nearly 85% of these marshlands had been diked or filled. In the lower floodplains of San Pablo Bay's Napa River and nearby Sonoma Creek, low-lying areas comprise approximately 40,000 acres of mudflats, estuarine and palustrine wetlands, salt ponds, riparian corridors, and vast expanses reclaimed for agriculture and development. Most of this area was diked off for agricultural and commercial salt production.

In the 1990's, the State of California's Department of Fish and Game (DFG) purchased nearly 9,000 acres of the region's former salt ponds for them to become an integral part of the second largest restoration project in the country, known as the Napa Sonoma Marshes Restoration Project.

The Project's objectives are to restore a combination of tidal, muted tidal, and managed wetlands through multiple actions including levee breaches to support critical wetland and floodplain habitats for the benefit federally listed fish and wildlife species, diadromous fishes, waterfowl, shorebirds, other wetland dependent fish and wildlife species, and people. Thousands of acres are now restored, thousands are currently being restored, and thousands more are soon to follow.

This Project exemplifies ecosystem restoration as it includes nearly all of the lower Napa River floodplain and is also coordinated with multiple adjacent tidal restoration projects along the San Pablo Bay shoreline. The successes and progress of this Project is the result of years of work through a multi-partner effort that brought together Federal (including ARRA), State, and local government agencies, non-profit organizations, private corporations, and private foundations and their associated funding.

Contact Information: Jeff McCreary, Ducks Unlimited, Inc., 3074 Gold Canal Drive, Rancho Cordova, CA 95663 USA, Phone: 916-852-2000, Fax: 916-852-2200, Email: jmccreary@ducks.org

USING ORGANIC ENGINEERING PRINCIPLES TO ADDRESS ECOSYSTEM VALUES IN THE BOTTOM LINE

David D. McGehee
Emerald Ocean Engineering, Pensacola Beach, FL, USA

Organic engineering is the integration of engineering with natural processes to efficiently and sustainably provide economic, environmental and social benefits. Traditionally, an engineer's responsibility to assure quality on a project and control costs for the owner implied a narrow focus on the deliverables specified in the contract and the billable invoices submitted to the owner. Organic engineering also considers the project's broader and longer-term cost to society and how it impacts the surrounding environment. Organic designs are functional, efficient, resilient, adaptive, and in many cases, incorporate living components. Case studies of constructed projects, as well several as cutting-edge conceptual designs, will be presented and examined from the perspective of these criteria. Examples include a recreated saltmarsh, a reef breakwater, a living bank protection, and a marina.

Contact Information: David D. McGehee, Managing Director, Emerald Ocean Engineering LLC, 107 Ariola Drive, Pensacola Beach, FL 32561 USA, Phone: 850-212-4111, Email: bigwave@emeraldoe.com

A CASE FOR AN ADAPTIVE MANAGEMENT APPROACH TO ECOSYSTEM MANAGEMENT FOR THE MISSISSIPPI RIVER: MOVING FROM COMPLIANCE DRIVEN OUTPUTS TO STEWARDSHIP DRIVEN OUTCOMES.

Patrick S. McGinnis
The Horinko Group, Washington, DC. USA

Over the last twenty-five years, public investment in programs and projects designed to produce ecosystem recovery outcomes has been sufficient to assess the relative value and importance of a variety of approaches in the Upper Mississippi River Valley. Likewise, the value of more effectively leveraging and integrating restoration and management efforts across organizational and jurisdictional boundaries seems warranted, but to date, not realized. Historically, many outputs have been place-based and focused more on reclamation and rehabilitation of local features, rather than system or process-based. Restoration benefits are often claimed, but seldom measured. Performance monitoring where it occurs is the exception. Current institutional arrangements and agency missions suggest that some form of integrated adaptive management is achievable and could present a more efficient reflective and incremental alternative to one-off ouputs.

Resource objectives attainable through mitigative action to achieve regulatory compliance may have local or system benefits, but they are arguably no substitution for continuous stewardship supported across organizations. If we are to move more effectively toward system management, a number of current assumptions need to be put to the test. Too often, loose references are made to 'existing' river and ecosystem management efforts creating the incorrect perception that there is actually a management platform in place. Upon closer examination, what is found is a piece-meal effort to manage independent narrowly focused and unaligned programs (flood reduction, navigation, public lands, private lands conservation, water supply, recreation), not the actual aquatic ecosystem.

A history of interagency coordination and favorable institutional arrangements could make the Upper Mississippi River Valley a preferred landscape for launching an adaptive management model for resource stewardship. Finding a foothold for piloting adaptive management may be less complicated and more attainable under existing authorities than the current narrative and resource conversation would indicate. A number of current programs and new initiatives hold significant promise for establishing an adaptive management platform that could be integrated sufficiently across organizations to realize a first generation integrated resource management starting point. The practicality of doing so will depend on the willingness of organizations to come together and make the case. The urgency for action to sustain the resiliency of the system can be tied to protecting the very natural capital that most regional economic development is dependent upon.

Contact Information*:* Patrick S. McGinnis, Water Resources Division, The Horinko Group, 2300 N Street NW, Suite 2130 Washington, DC 20037 USA. Phone 202-955-5580, Mobile: 618-520-7060, Email: patrick.mcginnis@thehorinkogroup.org

SUSTAINING AQUATIC ECOSYSTEMS IN AGRICULTURAL WATERSHEDS

Dennis McGrath
The Nature Conservancy, Lansing, MI USA

As commodity agriculture intensifies to meet growing world demands for food and energy, watershed conditions decline, driven primarily by altered watershed hydrology that leads to intensified flooding, and nutrient and sediment pollution, affecting people and nature.

Traditional and newly evolving conservation measures used in conjunction with production agriculture (best management practices or BMP) are known to reduce the impacts from agricultural production. Those practices, however, are not managed with large-scale watershed outcomes in mind; there is no existing context for how field-level, farm by farm activity adds up to a watershed solution. As a consequence the scope of the problem remains undefined yet millions of dollars are spent to "fix" it.

A project team from LimnoTech, The Nature Conservancy and Michigan State University is developing an outcome-based watershed strategy using biological response curves that link BMPs to environmental outcomes for warm water streams and coastal waters in the Great Lakes.

Using a series of watershed models and targeted tools, the team is able to quantify the ecological benefits of agricultural BMPs and determine an outcome-based optimization of those practices in select watersheds (i.e. to put in BMPs in the right amount at the right place at the right time to improve watershed and coastal ecosystem function).

The team is using this information to test a series of "transactions" with various sectors of agriculture (fertilizer retailers, farmers, drain commissioners, farm certification program, food supply chain standards) to drive change at a watershed scale.

Contact Information: Dennis McGrath, The Nature Conservancy, 101 East Grand River Avenue, Lansing, MI 48906, USA, Phone: 517 316 2251, Email: dmcgrath@tnc.org

LARGE SCALE ECOSYSTEM RESTORATION USING WETLAND MITIGATION BANKING IN MS AND LA

Nelwyn McInnis
Mitigation Program Manager, Mississippi and Louisiana Field Offices, The Nature Conservancy

The Nature Conservancy has utilized wetland and stream mitigation as a valuable conservation tool to help conserve critical biodiversity elements in ecologically strategic locations. Following detailed conservation planning, TNC has used the need to mitigate for infrastructure projects to establish mitigation banks and work with partners to fund acquisition, restoration and long-term management in important and targeted landscapes. These projects filled important gaps within existing conservation areas, connected different blocks of intact habitats, enabled needed land management and re-established natural processes, achieving ecological benefits that would not have been possible had they been comprised of isolated stand-alone bank sites. TNC mitigation projects in Mississippi have protected and restored over 6,500 acres within and near the Pascagoula River, the largest un-dammed river (by volume of water) in the continental U.S. In St. Tammany Parish, Louisiana, TNC has been involved in the restoration and management of over 12,000 acres of threatened longleaf pine savanna and related natural communities. Primary credit generating activities include removal of hydrologic barriers, removal of invasive and off-site species, planting with indigenous species, prescribed burning, and stream and riparian buffer restoration and preservation. Primary wetland habitats involved include longleaf pine flatwood/savanna, bayhead swamp, and bottomland hardwood.

Contact Information: Nelwyn McInnis, , The Nature Conservancy, Northshore Field Office, P. O. Box 1657, Abita Springs, LA 70420, Phone: 985-320-9284, Email: nmcinnis@tnc.org

JOINT ECOSYSTEM MODELING (JEM) STANDARDS-DRIVEN SOFTWARE DEVELOPMENT: BENEFITING GREATER EVERGLADES AND THE NATION

Craig Conzelmann[1], *Stephanie S. Romañach*[2], *Kevin Suir*[1], *Christina Hunnicutt*[1], ***Mark McKelvy***[3] and *Sumani Chimmula*[4]

[1]U.S. Geological Survey, Lafayette, LA, USA
[2]U.S. Geological Survey, Gainesville, FL, USA
[3]Cherokee Nation Technology Solutions, LLC, Lakewood, CO, USA
[4]University of Louisiana, Lafayette, LA, USA

Called by some "a living laboratory", the Greater Everglades restoration efforts act as an incubator for ecological modeling ideas, which influence resource management across the nation. The South Florida-based Joint Ecosystem Modeling (JEM) community has facilitated collaboration between federal and state agencies, universities, and other organizations, resulting in well-defined data standards and the release of numerous modeling and visualization tools. Introduction of the Comprehensive Everglades Restoration Plan (CERP) NetCDF metadata conventions has enabled agencies to reuse models, data manipulation and visualization tools, and source code from JEM. Further, JEM has developed several ecological models for assessment and planning efforts across the Everglades, as well as the cross-platform EverVIEW Data Viewer (EverVIEW).

The ability to visualize model output greatly impacts the decision-making and model design process, because it allows researchers to quickly identify problem areas and target resources more effectively. By producing standards-compliant output, local and national agencies are able to leverage the EverVIEW platform, resulting in increased confidence in both the models, and the management decisions they inform. For example, the Louisiana Coastal Protection and Restoration Authority recently completed an extensive coastwide ecological modeling effort. Incorporating CERP conventions, the upper trophic and ecosystem services model outputs were easily visualized and assessed with EverVIEW.

Impressed by the standards-compliant visualization platform, multiple agencies are working to extend the functionality of EverVIEW. Everglades National Park (ENP) utilizes the EverVIEW Transect Tool to assess stage outputs from various hydrological models. User-defined transect lines are used to generate charts of stage values as a function of distance from transect origin, with custom landmark points to ground the data in reality. Likewise, the Natural Resource Conservation Service (NRCS) has funded the development of six ecosystem services models and the EverVIEW Reporting Tool for the Lower Mississippi Valley (LMV) regional assessment, through its Conservation Effects Assessment Program. Adherence to standards ensures both the models and the Reporting Tool are useful to resource managers outside the LMV region. By developing the EverVIEW Climate Envelope Modeling Tool, the US Fish and Wildlife Service, US Geological Survey, University of Florida, and ENP were able to geospatially visualize the output of predictive models describing potential climate change effects on 26 threatened and endangered vertebrate species occurring in the Greater Everglades, and easily share their findings via common web data standards.

JEM tools benefit both a targeted audience and the wider resource management community. With this in mind, JEM remains committed to its standards-driven development philosophy, knowing that its products will be relevant to restoration efforts well beyond the South Florida region.

Contact Information: Craig Conzelmann, National Wetlands Research Center, U.S. Geological Survey, 700 Cajundome Blvd, Lafayette, LA 70506, Phone: 337-266-8842, email: conzelmannc@usgs.gov

VISUALIZING UPPER TROPHIC AND ECOSYSTEM MODELING OUTPUTS WITH EVERVIEW TO INFORM THE DECISION PROCESS IN COASTAL LOUISIANA

Craig Conzelmann[1], *Carol Parsons Richards*[2], *Kevin Suir*[3], *Sumani Chimmula*[4] and ***Mark McKelvy***[3]
[1]U.S. Geological Survey, Lafayette, LA, USA
[2]LA Office Coastal Protection and Restoration, Baton Rouge, LA, USA
[3]Five Rivers Services, LLC, Colorado Springs, CO, USA
[4]University of Louisiana, Lafayette, LA, USA

State and Federal resource management agencies must periodically review and revise policies regarding ecological restoration and management. As the science of predictive modeling in coastal environments matures, these agencies are driven to include this new science into planning and decision making processes. Such is the case with the Louisiana Coastal Restoration and Protection Authority (CPRA) who enlisted a suite of predictive models to better inform the decisions leading to an updated 2012 Master Plan for ecosystem restoration and hurricane protection in coastal Louisiana. A portion of the modeling effort focused on ecosystem metrics based on either a single organism (ex: alligator, river otter), a combination of organisms (ex: three waterfowl species) and other ecosystem related metrics (ex: storm surge attenuation). With literally tens of thousands of modeling inputs and outputs, data visualization plays an important role in identifying where decision makers should focus when sifting through such large data stores. Borrowed from the Greater Everglades Joint Ecosystem Modeling community, EverVIEW, a standards compliant data viewer, was extensively used to visualize and compare modeling inputs and outputs. This visualization platform allows the user to view modeling output spatially and temporally using a 3D global environment and provides a table viewer for inspection of data at the modeling cell level. Using the EverVIEW software allowed CPRA managers to perform quality review on model inputs and outputs which included the ability to assess the decision rules of specific models and locate data anomalies. Recent additions to the platform include tools which allow the user to quickly generate difference maps along with a reporting tool allowing a user to generate spatial and temporal statistics. As resource managers continue to struggle with the challenges surrounding large-scale resource management, standards compliant assessment and visualization tools will continue to be valuable assets.

Contact Information: Craig Conzelmann, National Wetlands Research Center, U.S. Geological Survey, Lafayette, LA 70506 USA, Phone: 337-266-8842, Fax: 377-266-8616, Email: conzelmannc@usgs.gov

ADAPTIVE MANAGEMENT STRATEGIES FOR CONTROLLING EXOTIC PLANT SPECIES

Chad McKenna[1]*, Ondrea Hummel*[2] and *Todd Caplan*[1]
[1]GeoSystems Analysis, Inc, Albuquerque, NM, USA
[2]U.S. Army Corps of Engineers, Albuquerque, NM, USA

Floodplain habitat restoration along regulated rivers is often complicated by exotic plant species invasions. Exotic plant control, therefore, is becoming an integral component of many floodplain habitat restoration and adaptive management programs. The Albuquerque District Corps of Engineers contends with many (more than 10) different species of aggressive exotic tree, forb and grass species in its Middle Rio Grande Restoration Program. The absence of flooding due to river regulation along the 20-mile project reach has enabled non-native trees, including Russian olive (*Elaeagnus angustifolia*), Siberian elm (*Ulmus pumila*), tamarisk (*Tamarix* sp.), and Tree of Heaven (*Ailanthus altissima*) to invade and dominate many portions of the floodplain, and their dense cover promote significant wildfire risk. When mechanical fuels treatments are implemented to remove these non-natives, soil disturbances promote the spread of a whole suite of annual and perennial herbaceous weeds. Other more recent species introductions such as Ravenna grass (*Saccharum ravennae*) have become management priorities since the restoration project began and can aggressively invade restored habitats.

Since large-scale floodplain restoration projects were first implemented in 2004, the Corps has been performing monitoring and research to determine the most effective methods for preventing exotic species from re-establishing dominance in these treated areas. The results obtained from these research and monitoring studies are being integrated into new treatment specifications for further restoration program phases, both to fine tune fuels treatment plans and for follow up adaptive management techniques.

Contact Information: Chad McKenna, GeoSystems Analysis, Inc, 3150 Carlisle Blvd NE, Suite 107, Albuquerque NM, 87110 USA, Phone: (505) 830-6039, Email: chad@gsanalysis.com

MODELS FOR CRANBERRY BOG STREAM AND WETLAND RESTORATION

Martin J. Melchior*, Nick Nelson* and *Greg Orum*
Interfluve, Madison, WI, USA

The Eel River restoration project is the first example of active cranberry bog restoration in Massachussetts. Prior to restoration, the Eel River headwaters had been in cranberry culture for over 150 years. The stream was dammed and former sloped fens were converted to cranberry culture through the application of sand and management of dikes and water control structures. Design of the restoration project began in 2005 and construction was completed in July 2010. The Eel River project included restoration of 40 acres of Atlantic white cedar swamp and minerotrophic fen habitat, sphagnum moss restoration, fish and wildlife passage culvert replacements, removal of small dams, raptor perch habitat construction, 8,000 feet of new stream channel construction, over 1,000 pieces of large woody habitat, and stormwater detention and infiltration ponds. Habitat for salter Brook Trout, Bridle Shiner and Eastern Box Turtle, Massachusetts special concern species, were constructed.

The Tidmarsh Farms restoration site is a 400 acre retired cranberry bog. Plans are being completed for 250 acres of wetland restoration and 20,000 feet of stream channel restoration, including fish passage restoration for blueback herring, American eel and alewife. This project incorporates the Living Observatory, a collaboration among the project owners, Massachusetts Division of Ecological Restoration, MIT, various universities and project partners in which remote sensing techniques will be incorporated into visitor experience to both monitor ecological recovery and educate the public regarding cranberry bog restoration.

As cranberry bogs are retired in the U.S., alternatives to traditional passive revegetation and restoration approaches are valuable. This talk examines the design and construction challenges faced in developing a repeatable template for large scale cranberry bog stream and wetland restoration.

Contact Information: Martin Melchior, Inter-Fluve, 301 South Livingston Street, Madison, WI 53703 USA, Phone 608-354-8260, Email: mmelchior@interfluve.com

RIVERINE HABITAT RESTORATION FOR THE SHEBOYGAN RIVER AREA OF CONCERN

Martin J. Melchior[1], *Tom Sear*[2], *Stacey Hron*[3] and *Scott Horzen*[4]
[1]Inter-Fluve, Madison, WI, USA
[2]Short, Elliot, Hendrickson Engineers, Milwaukee, WI, USA
[3]Wisconsin Department of Natural Resources, Plymouth, WI, USA
[4]OTIE, Sheboygan, WI, USA

The Sheboygan River Area of Concern (AOC) is one of several sites in the US and Canada listed as impaired under the U.S.- Canada Great Lakes Water Quality Agreement. The EPA, State of Wisconsin, City of Sheboygan and Sheboygan County have cooperated in developing, funding and implementing a Remedial Action Plan for the Sheboygan AOC. As part of the process for removing Beneficial Use Impairments and ultimately delisting the project area, the cooperators have undertaken significant dredging operations to remove PCBs and other contaminants from river sediment.

This talk focuses on the design and construction challenges for the final phase of the project; a $5 Million project addressing the improvement of riparian wetland habitat conditions within the AOC project limits. The Sheboygan AOC Habitat Restoration Project included the excavation of island and shoreline areas to remove Phragmites and reed canarygrass infestations. Wildwood Island, a large island in the lower Sheboygan River, was excavated and rebuilt using large wood and bioengineering techniques. Floodplain wood was used to encourage sediment deposition and small island formation. Boulder and large wood placement was used to improve fish habitat within the river, and depositional features were constructed to provide targeted access areas for anglers and boaters. In heavily used parks, riparian areas were converted from turfgrass to native vegetation. A large DOT mitigation pond was converted to a more complex series of stormwater detention basins and wetlands, and heavily used angling areas were modified with fishing piers and expanded or modified native riparian vegetation. Bird habitat was created, including heron nesting platforms, osprey platforms, owl nests, bluebird houses and wood duck boxes. Turtle habitat was incorporated as floodplain and riverside wood, and snake hibernacula were also designed and constructed as part of wetland restoration components.

Contact Information: Martin Melchior, Inter-Fluve, 301 South Livingston Street, Madison, WI 53703 USA, Phone 608-354-8260, Email: mmelchior@interfluve.com

IMPORTANCE OF VARIATION IN FOREST RESTORATION

***Lilia del Carmen Mendizábal-Hernández**, Juan Alba-Landa, Juan Márquez Ramírez, Héctor Cruz-Jiménez* and *Elba Ramírez-García*
C.A. Recursos Genéticos Forestales, Univerisdad Veracruzana, Xalapa, Veracruz, México

Soil erosion, disgenic use of natural forests, loss of biodiversity, lack of genetic diversity management, global warming and climate change require a paradigm shift in the restoration, conservation and commercial use of forests, where the basis of an alternative change is supported by the proper management of the variation present forest species and the offspring of their parents so that low cross early to avoid inbreeding and search processes increases in genetic diversity and allelic frequencies as complements rather than conflicting between use and conservation of forests, *Pinus greggii* Engelm. in this case shown by the variation has been used to establish two provenance/progeny tests in two places, one altitudinal, climatic and edaphically ideal and other marginal within the natural range of the species in which testing and adaptation of the sources used offer flattering results in soils lose their fertility.

As part of the tree improvement program, in 1994 were established two provenance/progeny tests of the species (Alba-Landa *et al*., 1998; Alba-Landa *et al.,* 2007) for 2005 was made the first seed collections of such plantations. Four years after two tests were established from these collections: one in Barranca Honda Municipality Las Vigas de Ramirez, Veracruz México (Diaz *et al.,* 2012) and another in Cerro de León in Villa Aldama, Veracruz México (Gutierrez *et al.,* 2012) both plantations, within three years of its establishment in the field began producing cones.

This precocity can be exploited to perform controlled crosses and get individuals with enhanced features. To which we evaluated the growth in height and diameter to determine the existence of differences between the sources of seed source and between the families of each, and their survival.

We found highly significant differences among provenances and families so it is possible to select a second generation that includes the best returns for marginal sites established under biological and statistical designs recommended.

Contact Information: Lilia del Carmen Mendizábal-Hernández, C.A. Recursos Genéticos Forestales, Univerisdad Veracruzana, Xalapa, Veracruz, México. Parque Ecológico El Haya, A.P. 59, Phone: 2288 8185728, Email: lmendizabal@uv.mx

RESTORATION MINIMALISM

Ken Mierzwa
GHD Inc., Eureka, CA, USA

In recent years restoration projects have tended to become increasingly complex. Attention to detail is essential at the final design stage, but at earlier conceptual stages, excessive control may be counterproductive. When addressing stochastic systems, control may indeed be an illusion. Deep understanding of spatial and temporal dynamism and ecosystem-level processes can be to a large extent intuitive and abstract. Walking a project site in the rain and watching hydrology in action or visiting multiple reference sites may be keys to understanding processes and creating a successful design. Understanding landscape-level processes and historic landscape context can facilitate a restoration design requiring less long-term maintenance. Economic and policy factors can then be considered as part of a feasibility analysis. Several case studies demonstrate that conceptual minimalism, in the sense of eliminating non-essential distractions during the early stages of restoration design, can be an effective strategy. As in other fields of human endeavor, this may require learning the "rules" well enough that they can be allowed to fade into the background or sometimes even be challenged. Modern philosophies and ancient wisdom offer useful metaphors to guide this process.

Contact Information: Ken Mierzwa, GHD Inc., 718 Third Street, Eureka, CA 95501 USA, Phone: (707) 499-5794, Email: ken.mierzwa@ghd.com

MATCHING MULTIPLE STAKEHOLDER GOALS TO RESTORATION OPPORTUNITIES IN A GREAT LAKES COASTAL WATERSHED

Nicholas Miller[1], *Tom Bernthal*[2], *John Wagner*[1], *Gary Casper*[3] and *Joanne Kline*[4]
[1]The Nature Conservancy, Madison, WI, USA
[2]Department of Natural Resources, Madison, WI, USA
[3]University of Wisconsin-Milwaukee Field Station, Saukville, WI, USA
[4]Department of Natural Resources, Milwaukee, WI, USA

Along the wetland-rich west shore of Lake Michigan's Green Bay, a diverse group of partners in the Duck-Pensaukee watershed prioritized wetland restoration and protection opportunities based on each site's potential to provide an array of ecosystem services. Partners include The Nature Conservancy, Environmental Law Institute, Wisconsin Department of Natural Resources, St. Paul District of the Army Corps of Engineers, and other local, state, tribal, and federal conservation interests. While a diversity of partners working together can strengthen projects and outcomes, it also presents challenges in the form of diverse missions, goals, and approaches.

With input from partners and experts, we identified seven ecosystem services that are important to this watershed and that match the array of partners' goals, including flood abatement, water quality improvement, shoreline protection, surface water supply, carbon storage, fish habitat, and wildlife habitat. We then prioritized key areas within the watershed (subwatersheds) that had experienced the greatest historical loss in a subset of these services (water quality improvement, flood abatement, surface water supply, and carbon storage). Finally, specific sites were ranked according to their potential to meet individual and collective partner goals, expressed in terms of the seven ecosystem services.

This GIS-based framework builds from methods developed throughout the Great Lakes region and addresses statewide priorities (e.g., Wildlife Action Plan), wetland regulatory concerns, and local watershed conservation goals. Through this approach, partners may target sites that meet their own goals and the collective goals of the larger partnership. Further, restoration investments may be made in a way that is relevant across multiple scales, from the individual site, to the subwatershed, to the overall watershed.

This project also serves as one of several pilots – and the only one in the Great Lakes coastal area – being carried out nationwide that seek to demonstrate how to formalize the "watershed approach" to compensate for mitigation under the Clean Water Act §404 Program. The aims of this nationwide project are to improve the integration of ecological information and proactive planning into the mitigation site selection process, and to align §404 mitigation actions with watershed-specific, non-regulatory conservation priorities.

<u>Contact Information</u>: Nick Miller, The Nature Conservancy in Wisconsin, 633 West Main Street, Madison, WI 53703 USA, Phone: 608-251-8140, Fax: 608-251-8535, Email: nmiller@tnc.org

REEF FLAT RECOVERY FOLLOWING LARGE-SCALE REMOVAL OF INVASIVE ALGAE

***Dwayne Minton*[1]**, *Eric Conklin*[1], *David Spafford*[2], *Manuel Mejia*[1] and *Kim Hum*[1]
[1]The Nature Conservancy Hawaii, Honolulu, HI, USA
[2]Botany Department, University of Hawai`i at Manoa, Honolulu, HI, USA

The invasive alien alga (IAA), *Avrainvillea amadelpha*, has fundamentally altered the extensive, shallow reef flats of Maunalua Bay, Hawai`i, transforming a diverse, productive mosaic of native algal and seagrass communities into a sediment-laden monoculture of alien algae. With the support of the American Recovery and Reinvestment Act, the local community and The Nature Conservancy, along with government, academic, and business community partners, removed 27 acres and over three million pounds of invasive algae between March 2010 and May 2011. A coalition of scientists monitored the recovery of local physical and ecological processes and native species within the project area to determine the viability of large scale IAA removal as a reef flat restoration technique in Hawaii.

Following removal, cover of *A. amadelpha* dropped from 56.9 ± 2.7% to 4.2 ± 1.1%. Initially silt trapped by IAA remained entrained within the project area, but eventually began to flush from the bay following a series of high wave events. Sediment depth and the amount of silt significantly decreased following IAA removal. Native algal diversity has significantly increased, and the cover of native algae has gradually increased following removal. For approximately 20-months post-clearance, the recovering community was on the desired trajectory toward a native-species dominated reef flat community. By 24-months, however, the significant patches of IAA were regrowing within the project area, and resulted in a shift of the recovery trajectory toward the original IAA-dominated community that existed prior to removal. Using the information collected as part of this monitoring effort, the local community has initiated a series of maintenance actions that to remove these patches.

Overall, removal of *A. amadelpha* has successfully restored the natural processes to the area cleared of IAA. While recovery of the native community has progressed at a slower than anticipated rate, and IAA regrowth has required additional management actions, data suggest recovery is gradually occurring, and that large-scale removal of IAA may be a viable restoration option for reef flat communities in Hawai`i.

Contact Information: Dwayne Minton, The Nature Conservancy Hawai`i, 923 Nu'uanu Ave., Honolulu, HI 96817,
Phone: 808-729-1789, Fax: 808-545-2019, Email: dminton@tnc.org

RIVER, FLOODPLAIN AND OTHER - HABITAT OPTIMIZATION MODELS FOR ECOSYSTEMS (HOME)

John T. Monahan, *Wayne S. Wright*[2] and *Ross Hendrick*[3]
[1]GeoEngineers, Inc., Bellingham, WA, USA
[2]GeoEngineers, Inc. Seattle, WA, USA
[3]Public Utility District No. 2 of Grant County, Ephrata, WA, USA

The Bonneville Power Administration (BPA), at the direction of the Northwest Power and Conservation Council (NPCC), together with Federal Agencies (e.g. U.S. Bureau of Reclamation and Army Corps of Engineers) and Federal, State, Tribal and local partners are spending more than $500 million annually on salmon recovery in the Columbia and Snake River basins. Hundreds of physical habitat restoration projects, instream flow enhancement actions and other projects have been funded and completed, with uncertain results.

The protection of salmonids species and critical habitat under the U. S. Endangered Species Act have placed additional pressure on water resource managers, fisheries managers, floodplain managers and others to quantify how much habitat enhancement results from stream, floodplain, wetlands, and estuarine habitat restoration projects. Further, understanding the combined effects of physical habitat changes together with instream flow enhancements have challenged project proponents and agencies responsible for monitoring.

GeoEngineers has developed new tools that combine the analytical and predictive power of HEC-RAS (U.S. Army Corps of Engineers) with the habitat quantification capabilities of tools like the Physical Habitat Simulation System (PHABSIM; U.S. Geological Survey) within a Geographic Information System (GIS) framework. These tools provide geospatial analytical power and visualization capabilities that make quantification of habitat optimization possible throughout the design, project evaluation, and monitoring phases. We will present the evolution of this new tool and how it has already been used to assist federal regulators to find common ground and agreement.

Contact Information: John T. Monahan, GeoEngineers, Inc., 600 Dupont Street, Bellingham, WA, 98225, USA, Phone: 360-647-1510, Fax: 360-647-5044, Email: jmonahan@geoengineers.com

THE GREAT LAKES RESTORATION INITIATIVE – PROGRESS TO DATE

Michael Moorman
USDA Natural Resources Conservation Service, Washington, DC, USA

Natural Resources Conservation Service (NRCS) assists farmers in the Great Lakes Basin to implement proven, science-based conservation systems on their lands. Through these systems of practices, farmers are able to voluntarily conserve soil, water, air, plant, and animal resources while maintaining agricultural productivity and profitability.

Through the Great Lakes Restoration Initiative (GLRI), NRCS is using a targeted approach to achieve results with conservation programs in the Great Lakes Basin. Efforts in the eight Great Lakes states are focused on 39 priority watersheds(8-digit HUCs) and on three of the five GLRI Action Plan focus areas (1. invasive species; 2. nearshore health and nonpoint source pollution; and, 3. accountability, education, monitoring, evaluation, communication and partnerships). The GLRI funding EPA provides to NRCS, $24.1 million in 2012 and approximately $75 million since 2010, supports action plan goals primarily through three NRCS conservation programs: Conservation Technical Assistance Program, Environmental Quality Incentives Program, and Wildlife Habitat Incentives Program.

Beginning in 2012, and continuing in 2013 and 2014, NRCS is targeting priority small watersheds where phosphorus inputs have been related to the occurrence of Harmful Algal Blooms in the Great Lakes. The 69 targeted sub-watersheds (12-digit HUCs) are located within 39 larger priority areas above and encompass portions of the Maumee River, Saginaw River, and Lower Fox River watersheds. These priority small watersheds were selected based on their potential for high impact phosphorus reduction practices, presence of watershed management plans, percentage of agricultural land, and local interest. In fiscal year 2012, $10 million of the $24 million in GLRI funding received by NRCS from EPA was devoted to this highly targeted approach.

Contact Information: Michael Moorman, Great Lakes Coordinator, USDA NRCS, 1400 Independence Avenue, SW, Washington, DC 20250, Phone: 202-690-2196, Email: michael.moorman@wdc.usda.gov

CLIMATE CHANGE AND SEA LEVEL RISE IMPACTS AT PORTS AND A CONSISTENT METHODOLOGY TO EVALUATE VULNERABILITY AND RISK

***Laura Moran*[1]**, *Greg Reub*[2], *Jon Campbell*[3] and *Steven Messner*[1]
[1]ENVIRON International Corporation, Novato, CA
[2]ENVIRON International Corporation, Olympia, WA
[3]ENVIRON International Corporation, Los Angeles, CA

A growing number of public and private entities, including a growing number of Port authorities, are evaluating potential impacts from climate change and are developing procedures to incorporate the financial and other risks into their investment decision making processes. This presentation explores an evaluation framework for climate change adaptation with a case study at one Port that incorporates information from historical tide measurements and storm events, sea level rise projections, digital elevation surveys of near-shore areas, and localized protection/armoring not reflected in elevation surveys to develop more detailed and accurate projections of sea level rise on Port facilities and areas adjacent to Ports. After inclusion of key infrastructure, ecological, and land use information into a GIS model of the area, the projections can then be used to more accurately assess vulnerabilities and risks from sea level rise, storms, and floods in Port areas. Ports are a critical intersection point of global commerce and are highly vulnerable to future increases in sea level rise and storminess. Much is potentially at stake - approximately 75% of all global trade by weight occurs by maritime transport and 59% by value. The presentation also explores a methodology to evaluate risks in a common financial format as part of a Net Ecosystem Services Analysis (NESA). It considers the unified NESA valuation as a powerful framework that can incorporate the full suite of issues (social, economic and environmental) for decision making when quantifying costs and benefits across a variety of land use types.

Contact Information: Laura Moran, ENVIRON International Corporation, 773 San Marin Drive, Suite 2115, Novato, CA 94998 USA, Phone: 415-899-0731, Fax: 415-899-0707, Email: lmoran@environcorp.com

CENTRAL EVERGLADES PLANNING PROJECT

Matthew J. Morrison[1], *Thomas Teets* [1], *Kimberley A. Taplin*[2] and *Kevin Wittmann*[2]
[1]South Florida Water Management District, West Palm Beach, FL, USA
[2]United States Army Corps of Engineers, Jacksonville, FL, USA

The Everglades ecosystem encompasses a system of diverse wetland landscapes that are hydrologically and ecologically connected across more than 18,000 square miles in southern Florida. In 2000, the U.S. Congress authorized the Federal government, in partnership with the State of Florida to embark upon the Comprehensive Everglades Restoration Plan (CERP) to further protect and restore the remaining Everglades ecosystem.

Since 2000, much progress has been made to restore and protect this precious ecosystem. Construction has begun on the first generation of CERP projects already authorized by Congress. These include the Picayune Strand Restoration, Indian River Lagoon South and Fran Reich Preserve (Site 1 Impoundment) projects. Project Implementation Reports have been completed for the second generation of CERP projects and are awaiting Congressional authorization. These projects include the Biscayne Bay Coastal Wetlands-Phase I, Broward County Water Preserve Areas, Caloosahatchee River West Basin Storage Reservoir, and C-111 Spreader Canal projects. These initial CERP projects are intended to provide ecological benefits and set the conditions along the margins of the system that help insure increased water flows to the interior of the system will not cause adverse effects.

The next critical and timely step for implementation of the CERP is the Central Everglades Planning Project (CEPP). The CEPP planning effort has been nominated and included in the National Pilot Program for Feasibility Studies designed to better align the project development process with national priorities. This pilot initiative for the CEPP provides an opportunity to test principles that have been outlined in the *USACE Recommendations for Transforming the Current Pre-Authorization Study Process* (January 2011). This new process includes greater, more interactive and concurrent involvement from the Vertical Team (South Atlantic Division, Headquarters, and Assistant Secretary of the Army's office) at multiple points throughout the study with clearly defined decision points that are more predictable, more efficient and takes significantly less time than the current planning process.

The CEPP will utilize new science and advanced planning tools to develop the initial increment of project features that provide for storage, treatment and conveyance of additional freshwater south from Lake Okeechobee, removal of canals and levees in Water Conservation Area 3 and incorporate seepage management features to retain water within the natural system. These projects make up the heart of CERP aimed at restoring more natural quantity, quality, timing and distribution of water flows to the remaining portions of the "River of Grass".

Contact Information: Matthew J. Morrison, Everglades Policy and Coordination, South Florida Water Management District, 3301 Gun Club Road, West Palm Beach, FL 33401, USA, Phone: 561-682-6844, Email: mjmorris@sfwmd.gov

OVERVIEW OF BINATIONAL APPROACHES TO ADDRESSING NUTRIENTS AND IMPACTS IN LAKE ERIE

Michael W. Murray[1] and *Raj Bejankiwar*[2]
[1]National Wildlife Federation, Great Lakes Regional Center, Ann Arbor, MI, USA
[2]International Joint Commission, Great Lakes Regional Office, Windsor, Ont., Canada

The Great Lakes have been susceptible to varying degrees to cultural eutrophication, in particular Lake Erie, the shallowest, warmest, and naturally most productive of the lakes. With various human activities following extensive settlement in the basin, nutrient loads (and eutrophication) increased, leading to extensive impacts (including harmful algal blooms) by mid-late 1960s. These developments helped spur the U.S. and Canadian Governments to sign the Great Lakes Water Quality Agreement (GLWQA) in 1972, which had an emphasis on addressing phosphorus loadings (in particular point sources) to the lakes, and included phosphorus reduction targets for Lake Erie and Lake Ontario. Shortly thereafter, the International Reference Group on Great Lakes Pollution by Land Use Activities was created under the GLWQA (and administered by the International Joint Commission (IJC)), and in numerous subsequent reports identified approaches and programs to control contaminants (including phosphorus) from nonpoint sources. Following the second revision to the GLWQA in 1987, nutrient loadings have been addressed in particular through Lakewide Management Plans (LaMPs), and in 2011, the Lake Erie Binational Nutrient Management Strategy was released through the Lake Erie LaMP. In 2012, the IJC developed the Lake Erie Ecosystem Priority for focused attention by its boards for the current triennial period, with review papers in progress on various topics, including identifying the existing regulatory/legislative framework in the basin, as well as developing a framework to identify nutrient load reductions necessary to meet ecosystem targets. In addition, numerous other nutrient-related efforts have also been underway, including at local, subbasin, state and regional levels. This paper will briefly highlight key aspects of the historical developments as well as key issues and approaches being pursued in ongoing binational efforts to address current nutrient loads and impacts in Lake Erie.

Contact Information: Michael W. Murray, National Wildlife Federation, 213 W. Liberty St., Suite 200, Ann Arbor, MI, 48104, USA. Phone: 734-887-7110, Fax: 734-887-7199, Email: murray@nwf.org

RESTORING AQUATIC HABITAT IN THE LITTLE RAPIDS AREA OF THE ST. MARYS RIVER

***T. R. Naperala*[1]**, *J. Hagan*[2], *Julie Sims*[3] and *M.J. Donahue*[4]
[1]URS Corporation, Traverse City, MI, USA
[2]Eastern Upper Peninsula Regional Planning and Development, Sault Ste. Marie, MI, USA
[3]National Atmospheric and Oceanic Administration, Ann Arbor, MI, USA
[4]URS Corporation, Southfield, MI, USA

Historically there were four major rapids within the St. Marys River: Big Rapids, Little Rapids, West Neebish Rapids and East Neebish Rapids. Alterations to facilitate shipping channelized the Neebish Rapids and the Little Rapids resulting in a flattening of the gradient between Lake Huron and the tail of the Big Rapids. The Little Rapids area has been identified as a potential restoration site that could address the fish and wildlife Beneficial Use Impairment (BUI) as a measure toward de-listing the St. Marys River as an Area of Concern (AOC). Restoration of the Little Rapids area may be achieved by replacing sections of the existing causeway that blocks flow with a bridge or culvert structure.

While mitigation of lost rapids habitat is proposed to restore ecological function to areas within the historic footprint of the Little Rapids, it is unlikely that this will result in the redevelopment of classic whitewater rapids. However, restoration of ecological function (e.g., spawning, nursery and foraging habitat for a variety of fish species) is both desirable and feasible. Since restoration of a classic rapids habitat is not feasible due to the loss of gradient, many of the ecologically important microhabitats may be attainable when sufficient flow is by removing portions of the existing causeway. Attainable high quality habitat will have some of the following characteristics: rough substrate (cobble/gravel); high velocity (>1.5 fps); and adequate depths (>2 feet). Since the area currently has rough substrate and a complex bathymetry (i.e. depths vary from >10 feet to exposed rock islands). Peripheral, micro habitats, adjacent to these areas are also important and expected to form.

The Eastern Upper Peninsula Regional Planning and Development Commission received Great Lakes Restoration Initiative (GLRI) funds for the project and selected URS Corporation to perform the design and analysis phase of the project. The end result of the study will be a design that provides for flow under the causeway while minimizing impacts to island residents, such as traffic delays due to construction, and maximizing areas with high velocities and shallow depths.

The St. Marys River is an ecologically diverse area with numerous species that could benefit from the proposed restoration. Determining effective restoration designs and assigning them “value” was a challenge that required an interdisciplinary approach. The causeway requiring modification provides islanders their only access to the mainland. Maintaining uninterrupted service was a requirement of the project. These challenges- and “lessons learned” will be discussed.

Contact Information: Troy R. Naperala, URS Corporation, 10850 Traverse Highway, Suite 3365, Traverse City, Michigan 49684 USA, Phone: 231-922-4301, Fax: 231-932-7594, Email:Troy.Naperala@urs.com

PRIORITIZING IN-STREAM BARRIER REMOVAL IN GREAT LAKES TRIBUTARIES

Thomas Neeson[1], *Peter McIntyre*[1], *Stephanie Januchowski-Hartley*[1], *Matthew Diebel*[2], *Patrick Doran*[3] and *Jesse O'Hanley*[4]

[1]Center for Limnology, University of Wisconsin, Madison, WI USA
[2]Wisconsin Dept. of Natural Resources, Madison, WI USA
[3]The Nature Conservancy, Lansing, MI USA
[4]Kent Business School, University of Kent, Canterbury, UK

Rivers in the Great Lakes basin are highly fragmented due to the presence of thousands of in-stream barriers (dams and road-stream crossings). For migratory fishes such as walleye, lake sturgeon, and coaster brook trout, these barriers restrict breeding migrations and limit access to historical riverine spawning grounds. The removal or modification of in-stream barriers can restore migratory pathways for these species, but the costs (financial, species invasions) and benefits (access to breeding habitats) differ among potential mitigation projects. The restoration community lacks a transparent method for comparing these costs and benefits to assess which barrier removal projects would offer the greatest return on investment. To address this problem within the Great Lakes basin, we are undertaking a three-phase project with the goal of providing a decision support tool for prioritizing barriers for repair and removal. In the first phase, we developed the most comprehensive database to date of the location of dams (n=7,091) and road-stream crossings (n=268,818) in the basin. In the second phase, we created a predictive statistical model to estimate the passability of potential barriers for different fish guilds. In the third and final phase, we are currently developing mathematical optimization models to determine the most efficient barrier repair/removal strategies to maximize the amount of available breeding habitat. We will discuss key factors that drive barrier prioritization, future data needs, and the strengths and limitations of an optimization-based approach to river restoration planning.

Contact Information: Thomas Neeson, Center for Limnology, University of Wisconsin, Madison WI 53706 USA, Phone: 608-262-3088, Fax: 608-265-2340, Email: thomas.neeson@gmail.com

"CITY AND REGION": ECOSYSTEM RESTORATION ON URBAN RIVERS

Patrick Nunnally
River Life Program, Institute for Advanced Study, University of Minnesota, St. Paul, MN, USA

"Urban river ecosystem restoration." Is this phrase an oxymoron along the lines of "jumbo shrimp" or does it point to a necessary, and very challenging "new frontier" where the values of ecosystem restoration and of urban systems must somehow be brought together?

For people with this author's professional background in urban planning and design, ecosystem restoration is a somewhat problematic notion. It is understood that biological and physical sciences can describe processes by which ecosystems function, and that those processes can be intentionally altered to try to achieve management and/or scientific goals. Too often, though, there seems to be a bifurcation between human and natural systems, with human systems regarded as always corrupting, damaging, or otherwise harming ecosystem processes.

This paper does not argue that human systems don't harm ecosystems, particularly the ecosystems of large rivers where they pass through cities. Instead, using the metropolitan region of the Twin Cities of Minneapolis and St. Paul, Minnesota, it argues that future aquatic ecosystem work must find a way to factor human dimensions of ecological change directly into designed research, management, and policy responses. The Twin Cities, where the Minnesota, Mississippi, and St. Croix Rivers come together, is home to some 3 million people. But it also is the location of two units of the national park system, a national fish and wildlife refuge, at least three river-oriented state parks, three large local park systems, each with substantial riverfront acreage, and some half a dozen watershed management districts. Because of the ways that rivers work, dynamic, flowing downhill, and so forth, much of the water in the Mississippi River comes through this region.

This paper argues that, rather than turn elsewhere, to non-urban regions, for sites for ecosystem restoration, that planners, researchers, and managers would do well to consider more deliberately the difficult challenges posed by urban river systems. Several reasons will be explored in more detail:

- The world as a whole is becoming more urbanized; the impacts of urban dwellers are more widespread than ever, both for good and for ill.
- There can be important reasons to conduct urban work, in terms of being able to illustrate to urban populations the benefits of attempting to restore ecosystems.
- The impacts of urban spaces and processes on terrestrial and aquatic ecosystems should be understood more specifically, so those impacts can be mitigated, and/or so that adaptation strategies can be developed.

New directions in research, policy, and management, such as are recommended here will require the development of new skills. Future river and ecosystem restoration professionals will be required to work across professions, and to explain their work to nonspecialists more than ever before.

Contact Information: Patrick Nunnally, River Life Program, Institute for Advanced Study, University of Minnesota, Phone 612-626-7014, Email pdn@umn.edu

IMPROVING THE ROUGE RIVER GREAT LAKES AREA OF CONCERN (AOC) - FISH AND WILDLIFE HABITAT IMPROVEMENT THROUGH DAM REMOVAL

John O'Meara[1], *James Ridgway*[2], *Karen Mondora*[3] and *Kelly Cave*[4]

[1]Environmental Consulting & Technology, Ann Arbor, MI, USA
[2]Alliance of Rouge Communities
[3]City of Farmington Hills, MI, USA
[4]Wayne County Public Services

The Alliance of Rouge Communities (ARC) over the last two years has substantial progress toward eliminating the Benthos and Fish and Wildlife Habitat Beneficial Use Impairments (BUIs) for the Rouge River AOC. At the focal point of this work have been two dam removal projects within the watershed. Under the Great Lakes Restoration Initiative (GLRI), the Danvers Pond Dam Removal and Stream Restoration Project located in Farmington Hills, Michigan and the Wayne Road Dam Removal and Habitat Improvement Project, located in Wayne, Michigan were completed. Theses project had been identified by the as two of the priority projects within the watershed to address the habitat and population BUIs within the AOC.

The projects hydrologically reconnect approximately 30 miles of the Rouge River (125 miles of its tributaries) to the Great Lakes system and, in so doing, address three of the Rouge River AOC Beneficial Use Impairments (BUIs): 1) Loss of Fish and Wildlife Habitat, 2) Degradation of Fish and Wildlife, Populations, and 3) Degradation of Benthos. The projects feature two inter-related and mutually-supporting components: 1) removal of the Dams to provide for fish passage, and 2) related ecosystem restoration improvements to restore habitat for fish and terrestrial wildlife.

In the Danvers Project the dam acted as a barrier to fish passage and promoted the accumulation of sediment within the pond, which contributed to the degradation of the creek. With the implementation of the project, the existing dam was removed and a naturalized water course was created. The former impoundment was restored as an open area connected to the stream dissipating and storing flood flows. The completion of the Project is providing reduction in sedimentation within the creek and the naturalization of the stream channel and corridor to create habitat conditions for fish and wildlife. The removal of the dam and the enhancements allows unencumbered fish passage, creates a natural buffer of native vegetation, improved habitat and water quality in the creek. Construction occurred summer 2012 at a cost of $500,000.

Removal of the Wayne Road Dam reconnected the River to the Great Lakes system for the first time in over a century. Construction occurred fall 2012 at a cost of $1million and included the following elements: 1) Remove the Wayne Road Dam hydrologically reconnected 22 miles of to the Great Lakes system and facilitated fish passage and 2) Provided ancillary benefits e.g., grade control, bank stabilization/ erosion control, recreational use, sport fishing and canoe access.

These projects combined with observed changes in the hydrologic regime provide ample opportunity for the significant and positive impact on the aquatic ecology of the Rouge River AOC and address BUIs.

Contact Info: John O'Meara, P.E., Environmental Consulting & Technology, Inc., 2200 Commonwealth Blvd., Suite 300, Ann Arbor, MI 48105, Phone 734-769-3004, Email: jomeara@ectinc.com

SOIL RECOVERY IN PRAIRIE RESTORATION: IS LAND MANAGEMENT WORKING?

C. E. Palmer[1] and *L. Egerton-Warburton*[2]
[1]Northwestern University and The Chicago Botanic Garden, Glencoe, IL, USA
[2]The Chicago Botanic Garden, Glencoe, IL, USA

Above ground characteristics are often the sole factors used to set goals for, and assess the outcomes of, restoration work in prairie ecosystems. However, in neglecting to assess belowground ecosystem health, we may be missing half of the puzzle. Little is known about the impacts of management on belowground prairie life. Nonetheless, with two thirds of prairie life occurring belowground, soil is an integral part of prairie ecology, and needs to be addressed in the evaluation of the integrity of these important ecosystems. In this study, I ask how land management affects belowground soil quality. In addition, I ask whether soil quality components occur together as expected. I address these questions by using non-metric multidimensional scaling and a path analysis to determine the relationship between the duration of management and the biotic and abiotic soil properties at 15 different restored and remnant prairies around the Chicago region. Specifically, I use the molecular genetic tool, real-time quantitative polymerase chain reaction (qPCR), to evaluate the effects of land management on levels of bacteria, fungi, and the phylum of vital plant-root symbionts, *Glomeromycota*, in prairie restorations in the Chicago region. I also assess the impacts of land management on soil nutrient content, carbon:nitrogen (C:N) ratios, and water stable aggregate size distribution. Preliminary results suggest that C:N ratios increase with increasing duration of management. Additionally, results suggest that C:N ratios in restored prairies approach those of reference restorations and reference remnants with increasing duration of management. Thus, preliminary results suggest that Chicago area land management is improving belowground soil quality. Finalized results, including all other measured soil properties, will also be discussed. Finally, I evaluate whether any single component of soil quality could act as a surrogate for others, which are more costly or difficult to measure. While this research serves as a case study specific to Chicago and Great Lakes Area restoration efforts, ultimately an understanding of how land management affects soil quality may be useful for a range of prairie restoration efforts, from small prairie plantings scattered throughout backyards and byways of the Midwestern U.S., to large-scale ecosystems reestablished on old agricultural fields, to global efforts to restore temperate grasslands and other natural areas.

Contact Information: C. E. Palmer, Northwestern University and the Chicago Botanic Garden, 1000 Lake Cook Road, Glencoe, IL 60022 USA, Phone: 773-909-8937, Email: coreypalmer2013@u.northwestern.edu

QUALITY ASSURANCE GUIDANCE FOR ENVIRONMENTAL DATA COLLECTION ASSOCIATED WITH HABITAT RESTORATION AND INVASIVE SPECIES PROJECTS

Craig J. Palmer[1], *Louis Blume*[2] and *Molly Middlebrook Amos*[1]
[1]CSC, Alexandria, VA, USA
[2]USEPA GLNPO, Chicago, IL, USA

Over the past several years, funding has been provided through the Great Lakes Restoration Initiative (GLRI) for hundreds of projects to undertake habitat restoration and invasive species control projects in the Great Lakes region. Each of these projects relies on the collection of reliable environmental data during project planning, project implementation, and follow-up monitoring activities. To assist with these efforts, an interagency committee was formed to provide quality assurance (QA) guidance to GLRI participants for their environmental data collection efforts. The overall goal was to build upon the expertise and experiences of QA experts from different federal agencies involved in the GLRI program – each with their own approach and agency requirements regarding QA.

The collection of environmental data for habitat restoration and invasive species projects offers many unique challenges. In particular, many measurements are based on observations by crew members such as species identifications and counts, gender determinations, and estimates of cover, condition, or age classes. Sample vouchers are often required as accuracy checks on species identifications. Field instruments such as GPS or water quality probes are important to data collection efforts. Unique measurements are often conducted including the use of sound recordings, photographs, or videography. Traditional data collection through sample collection and subsequent sample processing and laboratory analysis also is important.

After a review of QA planning activities by GLRI participants, interagency committee members determined that QA guidance was needed in four areas: 1) establishing quality objectives, 2) achieving quality objectives, 3) evaluating data quality, and 4) data management. The selection of quality objectives is the most common QA activity overlooked during planning activities despite the fact that these objectives drive all subsequent QA activities. Quality objectives are traditionally expressed in terms of data quality indicators such precision, bias, representativeness, comparability, completeness and detectability. However, quality objectives for classification variables used in ecological measurements are often best described in terms of tolerances.

This presentation will consider how to address these four areas requiring attention as well as exploring the importance of 1) training, certification, and follow-up assessments using standard operating procedures; 2) data being assessed against project quality objectives to ensure usability and to identify limitations on use; and 3) data management procedures being in place to support data verification and validation activities.

Contact Information: Craig J. Palmer, CSC, 1012 Legacy Drive, Boulder City, NV, 89005. USA, Phone: 702-293-6871, Fax: 702-895-3094, Email: cpalmer22@csc.com

LCA MISSISSIPPI RIVER HYDRODYNAMIC AND DELTA MANAGEMENT FEASIBILITY STUDY

Carol Parsons Richards and *Bren Haase*
Coastal Protection and Restoration Authority of Louisiana, Baton Rouge, Louisiana, USA

The Mississippi River Hydrodynamic and Delta Management Feasibility Study combines two of the six large-scale and long-term restoration concepts in the Louisiana Coastal Area (LCA) 2005 Report. Every year, the Mississippi River transports millions of cubic yards of sediment to the mouth of the river and into deep gulf waters. In addition, excess nutrients are diverted offshore, instead of filtering through wetlands for assimilation, creating a hypoxic zone in the Gulf of Mexico. The lack of sediment, freshwater, and nutrients into the coastal wetlands has reduced soil accretion rates to a rate lower than what is needed to offset relative sea level rise. The goal of this project is to develop a sustainable restoration plan for the lower Mississippi and surrounding basins by using river resources to increase wetland habitat, while allowing for the coexistence of flood control and navigation. This project will synthesize an unprecedented amount of existing data and reports, as well, as collect new data. Multi-dimensional models will be integrated with a one-dimensional model to examine flow and river fluxes, morphology change, sediment content, and particle size distribution as a function of location, flow and depth and local morphology, scour and shoaling of the river bed, salinity intrusion, and the concentrations of key nutrients that may factor into gulf hypoxia and wetland health. The feasibility process and final report, heavily guided by the Louisiana Comprehensive Master Plan for a Sustainable Coast (2012), will evaluate large-scale restoration features to greatly increase Mississippi River sediment into coastal areas.

Contact Information: Carol Parsons Richards, Coastal Protection and Restoration Authority of Louisiana, Planning Division, Baton Rouge, Louisiana, Phone: 225-342-9430, e-mail: Carol.Richards@la.gov

A FUNDER'S PERSPECTIVE ON THE VALUE OF COMMUNICATIONS

Arthur Pearson
Gaylord and Dorothy Donnelley Foundation, Chicago, IL, USA

A primary goal of the foundation's communications work is to cultivate ongoing public discussion regarding its two primary funding areas: land conservation and artistic vitality. Within land conservation, the foundation focuses its efforts within specific initiatives:

Calumet Land Conservation
Lowcountry Land Conservation Partnership
Local Food Production
Next Generation of Chicago Region Conservation Leaders
Charleston Regional Planning

In 2012, the foundation launched a new website, along with a social media campaign including Facebook and Twitter. With these tools, the foundation aspires to share and receive information about its initiatives and the work of its grantees; to connect grantees to each other; to connect the work of the foundation and its grantees to the broader public.

Initially, the foundation relied exclusively upon Google Analytics to measure the impact of its Web 2.0 efforts, tallying clicks on blog posts and shared links, website traffic, and social media engagement numbers. In 2013, the foundation intends to take measurement further. We want to learn more about who we are reaching, how they relate to our "fan base", how they respond to the content we share, and what they say about us. We'll experiment with adding "sentiment" analysis into our measurements. SocialSprout and IceRocket are two tools we might employ to monitor responses to our online engagement.

We may consider adding a Social Media upgrade to our Meltwater contract (online news clip service) so we can monitor when and how our issues are discussed in *user-generated* content (as opposed to media). We will explore purchasing advertising and/or post sponsorship on Facebook, Twitter, and/or Google AdWords as a means of increasing our audience.

The presentation will include a summary of what we have learned and how communications adds value to our grantmaking initiatives.

Contact Information: Arthur Pearson, Director – Chicago Program, Gaylord and Dorothy Donnelley Foundation, 35 E Wacker Drive, Suite 2600, Chicago, IL 60628, Phone: 312.977.2700, Email: apearson@gddf.org

LOUISIANA'S 2012 COASTAL MASTER PLAN: MOVING FROM PLANNING TO IMPLEMENTATION

Natalie S. Peyronnin*, Kirk Rhinehart, Mandy Green* and *Karim Belhadjali*
Coastal Protection and Restoration Authority, Baton Rouge, LA, USA

Louisiana is in the midst of a land loss crisis that has claimed 1,880 square miles of land since the 1930's. If aggressive, large-scale actions are not taken, Louisiana could potentially lose an additional 1,750 square miles of land in the next 50 years, resulting in an increase in expected annual damages from hurricane surge flooding to over $23 billion. The 2012 Coastal Master Plan utilized a state-of-the-art systems approach to coastal planning and a science-based decision making process that resulted in a plan that effectively invests limited financial resources to make the greatest progress toward achieving a sustainable coast.

A series of integrated, coast wide predictive models were developed to provide data for a new planning tool which was used to identify the suite of projects that would make the greatest progress toward meeting the Master Plan objectives, while considering uncertainties in future environmental conditions. Recognizing that the success of the plan hinges on stakeholder support as well as science, the State has also implemented a comprehensive outreach plan to obtain input and feedback from the public, science and engineering community, Federal and state agencies, NGOs, and elected officials. Through this science-based process, Louisiana developed a funding and resource constrained plan that recommended a specific list of restoration and protection projects and achieved wide-spread support. The 2012 Coastal Master Plan was unanimously approved by the Louisiana Legislature.

The master plan is a long-term plan for the coast with clear economic, social and environmental benefits. The Master Plan will decrease potential damages from storm surge by $5.3 to $18 billion depending on the future environmental conditions. Implementation of projects in the Master Plan may result in no net loss of land after 20 years and an annual net gain of land after 30 years.

Now that we know what we can achieve, it is imperative to have expedited and reliable implementation. To be prepared for the complexity and magnitude of implementing this effort, resources must be organized and coordinated to expedite delivery of the risk reduction and land building projects described in the plan. Funding must be secured and projects need to undergo engineering and design so they are "shovel-ready" once the funding is available. Prioritization of projects must occur on a regular and transparent basis. Adaptive management is built into the legislation for the Master Plan, which requires the plan to be updated every five years based on the best available information. An adaptive management framework will ensure that the master plan objectives are achieved by guiding adjustments to planning, policy and implementation. It is equally important to monitor and report on our progress through an expansive monitoring network, defined performance measures, and report cards.

Contact Information: Natalie Snider Peyronnin, Coastal Protection and Restoration Authority, 450 Laurel Street, 12th Flood, Baton Rouge, LA 70803 USA, Phone: 225-342-8786, Email: natalie.snider@la.gov

AN NGO PERSPECTIVE ON THE EVOLVING ROLE OF NGO'S IN LOUISIANA COASTAL RESTORATION

Steven Peyronnin
Coalition to Restore Coastal Louisiana, Baton Rouge, LA, USA

Founded twenty-two years ago by diverse interests including lawyers, ecologists, churches, fishermen, environmental non-profits, landowners, and business interests, the Coalition to Restore Coastal Louisiana (CRCL) is the state's only non-profit focusing solely on conservation, restoration, and protection for the entirety of the Louisiana coastal zone. Given its breadth of membership and focus area in addition to the simplicity of its mission, CRCL is thus in a unique position to comment on the role of NGO's in Louisiana coastal restoration. In its beginning, CRCL's goals were fairly straightforward though perhaps lofty: initiate federal involvement, establish a programmatic effort directed at stemming wetland loss, and create dedicating funding for this program. The forward momentum of this effort has produced an overlay of increasingly comprehensive attempts at coast-wide restoration culminating in the state's current master planning process, ultimately sparked by the storm season of 2005.

At present, NGO's increasingly collaborate with each other to address institutional challenges at the state and federal level, address conflicts between the local, state, and federal governments, even each other, and are essential for identifying gaps in information and in process. Another result of the 2005 storms was an increase in the perceived value of collaboration and the logic of collective action. Among NGO's, this has given rise to a coalition comprised of both national and local environmental groups to eliminate redundancy, amplify the impacts of campaigns requiring public participation, leverage funds, and speed information sharing. In order to resolve conflict between state and federal actors, NGO's have served as third party moderators and independent reviewers and investigators, in addition to having been considered as cost-share partners. It follows then that NGO's play an important role in identifying gaps in information and process. For example, NGO's are piloting approaches at improving stakeholder engagement. These approaches will be monitored closely and mined for a suite of best practices in engaging stakeholders, which will then be provided to the state for use. Also, NGO's are reviewing ways in which mitigation can be streamlined with the master planning process and projects within the state master plan can be prioritized for receipt of federal monies through various pipelines.

Although it is difficult to forecast how the current master planning process will adapt to uncertainties of restoration, it is certain that NGO's will continue to adapt to the needs of the process. It may be that implementation of the master plan sustains the coastal system, but NGO's may be called upon to enact their own restoration projects to fill in the details. With a state hiring freeze in effect, it may be necessary for NGO's to contribute to the implementation of portions of the master plan that have not been funded or for which the state is unable to hire staff.

Contact Information: Steven Peyronnin, Executive Director, Coalition to Restore Coastal Louisiana, 6160 S. Perkins, Suite 225, Baton Rouge, LA 70808 Phone: 225-767-4181, Fax: 225-768-8193, Email: stevenp@crcl.org

ECOSYSTEM RESTORATION WITH GORILLA TACTICS: RESTORATION OF GRAND LAKE ST. MARYS ECOSYSTEM THROUGH ECONOMIC DEVELOPMENT

Joseph J. Pfeiffer, Jr.
KCI Technologies Inc., Raleigh, NC, USA

Grand Lake St. Marys is a 21 square mile lake supported by a 52 square mile watershed in north western Ohio and has been an influence on the local and regional economy within Auglaize and Mercer Counties, West Central Ohio since its creation. As the health of the lake and its native habitats has thrived, so has the economy. However, the health of the lake in recent years has felt the drastic cumulative effects of gradual land use changes, related to both growth and development surrounding the immediate lake area and the agricultural industry boom within the surrounding watershed.

These impacts affected both recreational and economic activities throughout the lake communities. Although numerous plans to reduce the levels of pollution entering the lake were developed over the years, the lake's water quality continued to suffer from nutrient inputs and other water quality degradation issues leading to dangerous levels of algae microcystin toxin. These threats endanger public health and welfare. Algae blooms were of such a magnitude and duration during the summer of 2010, that the Ohio Environmental Protection Agency was forced to close the lake to all recreational activity. Overall, the lake was on the verge of a functional breakdown and ecological collapse.

A Strategic Plan was formulated to provide a framework and timeline for restoration of the lake ecosystem utilizing various projects and economic management tools to implement solutions for current and future lake improvements and revitalization. The Strategic Plan was prefaced on the developing economic opportunities and activities that stem directly and/or indirectly from restoring degraded natural resources within Grand Lake St. Marys (GLSM). The creation of an economy derived from restoration of the lake within the GLSM watershed, will provide a new direction that is both environmentally sustainable and economically viable. Recognizing and correcting problems created by current and past activities and applying a new environmental and economic paradigm to the future offers a challenging, yet unique and exciting opportunity for the communities that have come to rely on the lake and watershed.

The Strategic Plan was integrated with ongoing efforts by the OEPA, ODNR and the GLSM LRC as part of a consolidated Action Plan in 2011 culminating in the establishment of the Critical Response Actions necessary to initiate the restoration including; Chemical Treatments, Dredge Accumulated Sediments, Beneficial Use of Organic Waste, Watershed Best Management Practices, Rough Fish Removal, Lake Manager, Natural Resources Capital Improvement Program, Water pollution Control Loan Fund. Two years from its initiation, significant projects have been undertaken that have yielded both environmental and economic gains for the system.

Contact Information: Joseph J. Pfeiffer, Jr. PWS, KCI Technologies Inc., 4601 Six Forks Road, Suite 220, Raleigh NC, 27609 USA, Phone: 919-278-2500, Fax: 919-783-9266, Email: Joe.Pfeiffer@KCI.com

THE ATCHAFALAYA RIVER BASIN: CONSERVATION AND RESTORATION IN AMERICA'S LARGEST SWAMP.

Bryan P. Piazza
The Nature Conservancy, Baton Rouge, LA, USA

The Atchafalaya River Basin (ARB) begins at the confluence of the Mississippi, Red, and Atchafalaya Rivers near Simmesport, Louisiana. Like many large river systems it provides ecosystem services (biodiversity, flood control, carbon storage, navigation, oil and gas resources, forest, fish and wildlife resources) that have been used extensively by humans as well as ecosystem services for which there are few developed markets (e.g., carbon sequestration, nutrient reduction).

As a consequence of its value, a number of anthropogenic modifications have created largescale changes in the ARB for flood protection, navigation, and resource extraction. Its size was cut in half by flood protection levees after the Mississippi River Flood of 1927, when it became the principal floodway in the Mississippi River system, designed to divert Mississippi River floodwaters quickly to the Gulf of Mexico. A water control structure complex (Old River Control Structure), which was constructed at the head of the basin to halt the capture of the Mississippi River by the Atchafalaya, regulates the amount of Mississippi flow that is allowed to enter the Atchafalaya. Additionally, canals dredged to secure forest and mineral resources have altered local hydrology and created localized sediment depocenters in backswamp habitat.

Even with modification, the modern ARB still represents almost 405,000 ha (1 million acres) of uninterrupted forest, wetlands, bayous, lakes and coastal delta. As a result, the system is an expression of a unique combination of natural and anthropogenic factors which together have created a highly engineered system that still supports vast areas of remote wilderness and natural riverine processes.

These modifications, however, have created a system that is potentially unsustainable, due to a number of issues, including habitat conversion and largescale water quality problems. This fact has spurred a movement for conservation and restoration of the ARB and an opportunity to provide comprehensive science-based solutions and progressive watershed management strategies. This talk summarizes the current state of the ARB from a scientific perspective and defines the role of water management, hydrology, and decision-making in creating the problems and in designing the ultimate solutions.

Contact Information: Bryan P. Piazza, The Nature Conservancy, P.O. Box 4125, Baton Rouge, LA 70821, Phone: 225-338-1040, Fax: 225-338-0103, Email: bpiazza@tnc.org.

THE DEVELOPMENT AND IMPLEMENTATION OF DYNAMIC REPORTING THROUGH THE COASTWIDE REFERENCE MONITORING SYSTEM WEBSITE

Craig Conzelmann[1], ***Sarai Piazza***[2], *Marc Comeaux*[1] and *Christina Hunnicutt*[1]
[1]U.S. Geological Survey, Lafayette, LA, USA
[2]U.S. Geological Survey, Baton Rouge, LA, USA

Twenty two years ago, Congress authorized one of the largest restoration programs in Louisiana's history with the passage of the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA). This legislation facilitated the development of the Coastwide Reference Monitoring System (CRMS) which operates a network of 390 monitoring stations distributed across Louisiana's coastal zone. In addition to the native CRMS observational data which is valued by members of the resource management and scientific community, the CRMS analytical teams have developed many derived products which help to inform project planning and operations processes within the CWPPRA program and beyond.

A large monitoring network brings the challenge of managing and reporting on large volumes of spatial and tabular data. The CRMS Data Management Team was strategically involved from the beginning and collaboratively decided on an approach which has come to be known as the 4th paradigm. This approach states that the most cost efficient and sustainable solutions to large data management challenges are integrating technology specialists and data-intensive software development through all aspects of the project life cycle. This concept is manifested in the current release of the CRMS web application, which leverages a mapping environment to bring spatial context to dynamic reporting elements ranging from basic charts to complex down-loadable documents or report cards (http://www.lacoast.gov/crms).

The CRMS charting engine is capable of generating thousands of charts representing hydrological, vegetation, soils, and remotely sensed data. Operating across spatial scales ranging from site, multi-site, and project level, the CRMS charting engine offers users a valuable data visualization tool when dealing with large coastal data sets. Recent development has expanded beyond the single metric charts into numerous multi-metric indices which are available individually or as part of a CRMS Report Card. This talk will discuss the technology behind the development and implementation of the CRMS dynamic report cards and their dependency on the CRMS data driven charting services.

Contact Information: Craig P. Conzelmann, U.S. Geological Survey, National Wetlands Research Center, 700 Cajundome Blvd., Lafayette, LA 70506 USA, Phone: 337-266-8842, Fax: 337.266.8616, Email: conzelmannc@usgs.gov

REPORT CARDS AND MULTI-SCALE ASSESSMENTS USING LOUISIANA'S COASTWIDE REFERENCE MONITORING SYSTEM

Sarai Piazza[1], *Craig Conzelmann*[2] and *Marc Comeaux*[2]
[1]U.S. Geological Survey, Baton Rouge, LA, USA
[2]U.S. Geological Survey, Lafayette, LA, USA

In 1990, the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) was passed by Congress which authorized funding for planning and implementing restoration projects in the Louisiana coastal zone. An important component of the CWPPRA is a 20-year investment in monitoring the effectiveness of individual projects and providing an assessment of the cumulative effects of all restoration and protection projects on the coastal landscape. The Coastwide Reference Monitoring System (CRMS) is a single comprehensive wetland monitoring program that allows for ecological comparisons at site, project, hydrologic basin and coastwide scales. The CRMS network contains 390 1-km^2 sites throughout the Louisiana coastal zone each monitoring a consistent suite of water, vegetation, soil, and landscape parameters at multiple temporal frequencies.

Historically, large regional monitoring programs have had problems effectively delivering data and analytical products to the end-users in a timely fashion because data management teams commonly operate separately from the scientists, researchers, and resource managers. The CRMS program developed analytical teams that consist of scientists and information technology specialists. The teams work together to develop analytical products that are based on the needs of the natural resource user community and to deliver data in a spatially enabled web environment.

The CRMS analytical teams developed a set of indices (i.e., floristic quality, hydrologic, and submergence vulnerability) that are presented in CRMS report cards. The CRMS report cards incorporate the indices and land:water analyses to assess the effects of restoration projects at multiple scales. This talk will present the development of the CRMS indices and the multi-scale assessments available through the CRMS report card. The CRMS report cards are available on the CRMS website and are generated "on-the-fly" so that assessments are based on the most current data (http://www.lacoast.gov/crms).

Contact Information: Sarai Piazza, U.S. Geological Survey, National Wetlands Research Center, Coastal Restoration Assessment Branch, C/O Livestock Show Office, LSU, Baton Rouge, LA 70803 USA, Phone: 225-578-7044, Fax: 225-578-7927, Email: spiazza@usgs.gov

DO THE CARIBBEAN CORALS *ACROPORA PALMATA, ACROPORA CERVICORNIS* AND THE *MONTASTRAEA ANNULARIS* SPECIES COMPLEX WARRANT LISTING AS ENDANGERED ON THE ESA: A SCIENCE-BASED EVALUATION FROM THE FLORIDA KEYS

William F. Precht*, Steven L. Miller, Leanne M. Rutten* and *Mark Chiappone*
Dial Cordy & Associates, Inc., Miami Lakes, FL, USA

Population estimates for *Acropora cervicornis* in the Florida Keys appear stable and large, ranking as high as 15^{th} among all corals in the Florida Keys, with over 10 million colonies estimated in 2012. There is no evidence of continued decline since the 2006 ESA Threatened Listing. The size structure of the population also remains unchanged over the period of our study in the Florida Keys. Population estimates for *Acropora palmata* in the Florida Keys appear stable since 2005, but remain much reduced overall since declines started in the late 1970s. Relative to the abundance of other corals in the region, *A. palmata* is among the least abundant. This is due in part to the narrow depth range and limited habitat distribution of this species. The size class distribution of the Florida Keys population includes both small and large individuals. Relative to *A. cervicornis*, the population status of *A. palmata* in south Florida is two-orders of magnitude smaller, with most of the population reduced to a handful of high-density thickets. Since 2006, however, this species has been relatively stable in Florida and there are no new data that warrants the reclassification of this species to Endangered.

Montastraea annularis is relatively common and was ranked in the middle among corals in terms of abundance in 2005 (30 out of 47), moving up significantly in 2009 to 13^{th} out of 43, and 12^{th} out of 40 in 2012. Population numbers in 2005 were 5.6 million (SE 1.7), with 11.5 million (SE 2.5 million) in 2009, and 24 million (SE 10.1 million) in 2012. No evidence of decline was observed in total population number. The larger number of *M. annularis* in the Florida Keys is related to the greater abundance of shallow patch reefs in the former area, where the species is most commonly found. With over 6,000 patch reefs in the Florida Keys and the large number of corals present, listing this species as Endangered is not warranted. *Montastraea faveolata* is one of the top-ten most abundant scleractinian corals. Population estimates were 39.7 million (SE 8 million) in 2005, 21.9 million (SE 7 million) in 2009, and 47 million (SE 14.5 million) in 2012. The size-class distributions and partial mortality estimates for *M. faveolata* are similar among years. In the Dry Tortugas, *M. faveolata* ranked seventh most abundant in 2006 and fifth most abundant in 2008, with population numbers of 36.1 million (SE 20 million) and 30 million (SE 3.3 million), respectively. Size class distributions are similar to what was seen in the Florida Keys. With the large number of colonies present, especially in the smaller and medium size classes, and the wide distribution of the species in the region, among multiple habitat types and depths, listing of the species as Endangered is not warranted. *Montastraea franksi* is relatively common and typically found in deeper habitats than *M. faveolata* and *M. annularis*. Absolute numbers for 2005 were 8 million (SE 2.2 million), for 2009 0.3 million (SE 214,000), and for 2012 0.4 million (SE 0.3 million). These population estimates document that *M. franksi* is relatively uncommon in shallower reef habitats through the Florida Keys, but common in deeper reef habitats. We have also seen *M. franksi* in patch reef habitats. With large population numbers, listing the species as Endangered is not warranted.

Contact Information: Bill Precht, Dial Cordy & Associates, Inc., Miami Lakes, FL, Phone: 305- 924-4274, Email: Bprecht@dialcordy.com

RESTORING COASTAL LOUISIANA IN THE FACE OF AN UNCERTAIN FUTURE

Denise Reed
The Water Institute of the Gulf, Baton Rouge, LA, USA

Louisiana has lost approximately 1,900 square miles of land since 1932. In response to this, the Louisiana Legislature unanimously adopted Louisiana's 2012 Comprehensive Master Plan for a Sustainable Coast which calls for $50 billion to substantially increase flood protection for communities and make strides toward creating a sustainable coast over the next 50 years. Implementing such an ambitious plan will require ongoing adjustments to changing conditions and, to the extent possible, anticipating the consequences of potential changes.

Restoring a deltaic system like coastal Louisiana requires consideration of not just sea-level rise, but also potential changes in tropical storm frequency, intensity and tracks. Clearly specific predictions about where storms will make landfall in the future and when the impacts will occur are not possible. Several assumptions can be made in planning to account for these effects. An 'annual average' effect could be identified based on the long-term record of the effects of previous storms. Alternatively specific storm impacts could be characterized and systematically or stochastically introduced into predictions of landscape change. However, for some elements of the coastal system, such as barrier islands, the interval available for recovery between storms can be as important in determining the net change as the effects of individual storms.

Changes within the watershed must also be considered. For Louisiana this is particularly challenging due to the continental scale of the Mississippi watershed. Climate forecasts tend to predict changes in land cover and precipitation regimes regionally. How these effects combine to influence the delivery of freshwater and sediment to the coast is highly uncertain but critical to planning for deltaic restoration.

This presentation will explore different approaches for considering climate changes into restoration planning and how restoration decisions can be responsive, or adaptive, to the cumulative effects of many changes.

Contact Information: Denise Reed, Chief Scientist, The Water Institute of the Gulf, 301 North Main Street, Suite 2000, Baton Rouge, LA 70825, Phone: (225) 227-2715, Email: dreed@thewaterinstitute.org

USING REGENERATIVE STORMWATER CONVEYANCE SYSTEMS TO RESTORE STREAM CHANNELS AND CREATE AQUATIC AND TERRESTRIAL HABITAT

Stephen J. Reiling and *Steve Saari*
District Department of the Environment, Washington, DC, USA

The District of Columbia Department of the Environment (DDOE) has installed four Regenerative Stormwater Conveyances (RSCs) in the District and is planning the installation of others. RSC systems are open-channel, sand seepage filtering systems that utilize a series of shallow aquatic pools, riffle-weir grade controls, native vegetation and an underlying sand channel to slow stormwater velocities, infiltrate stormwater, recharge groundwater, and treat pollutants through chemical and biological processes. RSCs also reduce erosive forces on the banks of the streams where they are installed and positively impact the ecology of an outfall area by creating conditions favorable to aquatic macroinvertebrates and other wildlife. In urban areas such as the District, there is a legacy of hundreds of highly eroded first-order ephemeral tributaries, predominantly fed by stormwater runoff. These gullies can be over 20 feet deep, have little or no aquatic life, and pose significant safety and stability hazards to adjacent areas. RSCs have the potential to address this situation in a cost-effective manner as well as provide significant water quality improvement in receiving waters.

DDOE was recently awarded a grant through the National Fish and Wildlife Foundation to install and monitor the efficacy of RSCs in an ultra-urban watershed in order to establish this stormwater management technique as a Chesapeake Bay Program best management practice. RSCs have proven effective at reducing flow velocities; however, there is currently little data documenting their capability of reducing pollutant loads. If monitoring results support their water quality promise, RSCs will speed nutrient reduction in densely developed areas because (1) RSCs restore habitat and enhance aquatic resources, thus returning ecological function to impaired streams and (2) opportunities to apply RSCs will continue to emerge as public water utilities work to replace aged sewer infrastructure buried next to, and leaking into, streams throughout the Chesapeake Bay Watershed.

<u>Contact Information</u>: Stephen J. Reiling, Watershed Protection Division, District Department of the Environment, 1200 First Street NE, 5th Floor, Washington, DC USA, Phone: 202-442-7700, Fax: 202-535-1363, Email: stephen.reiling@dc.gov

LOUISIANA COASTAL RESTORATION: PRIVATE SECTOR PERSPECTIVE

David Richard
Stream Companies, Lake Charles, LA, USA

Eighty percent of Louisiana's coastal wetlands are owned by private entities. The degradation of these wetlands by huge hydrologic processes has been and continues to challenge coastal restoration efforts in Louisiana. Geologic changes also continue to challenge restoration efforts for large and small scale projects.

Working with government agencies, private landowners are faced with a multitude of challenges that include private land rights, mineral rights and the multitude of issues associated with surface and sub-surface uses.

Public projects constructed on private lands benefit the public resources in in bountiful Louisiana coastal wetlands. Efficient projects that benefit private and public sections are integral in the restoration of coastal Louisiana.

Contact Information: David Richard, Stream Companies, P. O. Box 40, Lake Charles, LA 70602 USA, Phone: 337-433-1055, Fax: 337-439-2170, Email: drichard@streamcompany.com

BIOENGINEEREED OYSTER REEFS FOR SUSTAINABLE SHORELINE PROTECTION & ECOSYSTEM RESTORATION IN THE GULF OF MEXICO

Jon D. Risinger*, Steven G. Hall*[2]*, Tyler Ortego*[3] and *Mike Turley*[4]

[1]MWH Global, Baton Rouge, LA, USA
[2]LSU & LSU AgCenter, Baton Rouge, LA, USA
[3]ORA Technologies, Baton Rouge, LA, USA
[4]Wayfarer Environmental Technologies, Hunt Valley, MD, USA

Coastlines around the world are sinking, washing away from a mix of natural and anthropogenic factors. The problem is especially stark in Louisiana, where 65–90 square kilometers of coastline disappear every year (Coast 2050). It is estimated that 10,000 to 13,500 square kilometers of land around the Mississippi delta—an area roughly the size of Connecticut—will be submerged by 2100 (Blum and Roberts, 2009).

Oysters are said to be ecosystem engineers, dominating structural and ecological components of estuaries and fueling coastal economies—one or a few species can produce reef habitat for entire ecosystems (Beck, 2011). But the study of oyster reef effects on wave energy and coastal erosion is a relatively new science, led by engineers at the LSU AgCenter. Bioengineered oyster reefs provide a method to create a living shoreline with self-sustaining qualities that differentiate them from traditional nearshore rock breakwater structures. Such systems can effectively dissipate wave energy and promote sediment accumulation, allowing new land to form where native grasses can take root. Oyster growth on these manufactured reefs reinforces their structural integrity and, in turn, increases wave energy dissipation and shoreline protection.

Beyond shoreline protection, artificial oyster reefs promote a raft of additional ecosystem benefits. First, oyster reefs can serve as marine broodstock sanctuaries, supplying millions of larvae each year that will grow to harvestable size within several years—oysters are, after all, a delicacy. Oysters are a key species for the survival of many plant, fish, and wildlife species. The reefs also provide ecosystem services like water filtration and carbon sequestration potential. Finally, because oyster reefs are not static, but grow vertically within the intertidal zone, they can readily respond to sea level rise and land subsidence.

Those who recognize the coast as a living ecosystem know that acknowledging that fact and protecting and utilizing the biological and ecological systems is a logical and efficient way to achieve multiple objectives. These objectives include erosion protection and wave reduction, as well as the creation of habitat for living resources, such as birds and fish stocks. Oyster reefs have high surface area (for growth), but generally have less mass, or density, per unit area. Compared to conventional hard technologies, this means they tend to have less impact on the surrounding ecosystem. By allowing flow-through, they enhance sediment accretion and erosion protection in a more ecologically friendly manner. Ultimately, the development and maintenance of living shorelines and biologically dominated non-rock reef alternatives can provide multiple lines of fiscally and environmentally responsible protection against land loss in coastal Louisiana, and beyond. This presentation highlights research and case studies…

Contact Information: Jon D. Risinger, MWH Global, Baton Rouge, LA, 70809, USA, Phone: 254.231.8445,
Email: jon.d.risinger@mwhglobal.com

MAN-MADE TREE ISLANDS FOR RESTORATION PURPOSES IN THE EVERGLADES

*Leonard Scinto, **Andres Rodriguez**, Alexandra Serna* and *Michael Ross*
Southeast Environmental Research Center, Florida International University, Miami, FL

The Everglades is composed of several ecosystem components that contribute to its diversity. Tree islands comprise relatively little area, but are numerous and a vital element of the landscape. Hydrological modifications have adversely affected tree islands, leading to a decrease in numbers. Man-made tree islands could simulate conditions of natural tree islands, and could potentially be used for restoration.

Man-made tree islands were constructed in the Loxahatchee Impoundment Landscape Assessment (LILA) located at the Arthur R. Marshall Loxahatchee National Wildlife Refuge in Boynton Beach, Florida, US. Tree islands were constructed under semi-controlled hydrologic conditions using two substrates: peat and limestone. Changes in soil elevation were measured using Sedimentation Erosion Tables (SETs) positioned at higher and lower elevations exposed to shorter and longer periods of inundation, respectively, within the tree islands. Soil accretion was measured using feldspar marker horizons positioned in the same plots in which the SETs were located. Measurements were repeated yearly from 2009 to 2012. SETs show net subsidence, greater at high (-3.03 cm ± 2.33) than low elevations (-0.52 ± 2.13), and greater in the peat islands (-4.49 cm ± 2.45) compared to the limestone islands (-1.56 ± 0.73). In contrast, accretion was less than subsidence resulting in net elevation loss on LILA tree islands.

Soil building was partially estimated from triplicate litter traps which were collected bimonthly from August 2010-2011 and indicate variations in litter production with season, elevation, and tree island substrate. Annual decomposition rates were estimated using decomposition bags installed in August 2010 and collected in different months after installation. Organic matter (litter) decomposition showed faster mass losses at lower (wet) elevations. Soil development is a slow process at LILA (< 1 cm y-1), but more rapid at higher elevations where trees are maximally productive. Accretion rates appear to be higher in sites were more litter is being produced. Within a tree island the higher elevations generally had higher biomass, litter fall, and NET litter inputs. Peat substrate favor a more productive tree island plant community, but peat islands tend to subside more than limestone islands. The fate of man-made tree islands appears to be closely related to the original substrate with which they are constructed. This study documented dynamics of several tree island processes that may be crucial in the success or failure of man-made tree islands, and can be applied to environmental management.

Contact Information: Andres F. Rodriguez, Southeast Environmental Research Center, ECS 112, Florida International University, 11200 SW 8th Street, Miami FL 33199, Phone: 305-348-1284, Fax: 305-348-4096, Email: arodr760@fiu.edu.

PRIORITIZING HABITAT PROJECTS IN AREAS OF CONCERN

Karen Rodriguez
U.S EPA, Chicago, IL, USA

Under the Great Lakes Restoration Initiative, the Areas of Concern program has kicked in to high gear. Several significant habitat restoration projects have been completed to date, and many more are underway or in planning phases. This talk will present over all planning, prioritizing and budgeting as well as project level details in places such as Sheboygan, WI, White Lake, MI and Buffalo, NY, for habitat restoration projects in AOCs across the basin.

Contact Information: Karen Rodriguez, U.S EPA, 77 W. Jackson Blvd (G-17J), Chicago, IL 60604, Phone: 312-353-6571, Email: rodriguez.karen@epa.gov

AN ADAPTIVE MANAGEMENT EXAMPLE FROM THE EVERGLADES: THE DECOMPARTMENTALIZATION PHYSICAL MODEL

Barry H. Rosen[1], *C. Saunders*[2], *F.H. Sklar*[2], *J. Harvey*[3], *L. Larson*[3], *S. Wilcox*[4], *S. Newman*[2], *J. Trexler*[5] and *D. Ho*[6]

[1]U.S. Geological Survey, Orlando, FL, USA
[2]South Florida Water Management District, West Palm Beach, FL, USA
[3]U.S. Geological Survey, Reston, VA, USA
[4]U.S. Army Corps of Engineers, Jacksonville, FL, USA
[5]Florida International University, North Miami, FL, USA
[6]University of Hawaii at Manoa, Honolulu, HI, USA

Restoration of the south Florida Everglades is a massive and complex undertaking with numerous socio-ecological challenges. The ultimate goal is the hydrologic restoration of the quantity, quality, timing, and distribution of water deliveries to the landscape while maintaining drainage, flood control, water retention, water supply, irrigation, and transportation for the more than 7 million people that inhabit south Florida. To balance the needs of the ecosystem and society, an adaptive management approach is an integral part of the Comprehensive Everglades Restoration Plan (CERP). This approach utilizes best available science and adaptive assessment for planning, implementation, and modification as more information is obtained.

The US Army Corps of Engineers and the CERP have identified the need to better understand the ecological and biological benefits of restoring historic sheet flow, which is widely recognized as a critical mechanism in rebuilding the patterned, corrugated landscape of the pre-drainage Everglades. Historically, water velocities were greater than 2 cm s^{-1}, several-fold higher than measured in the current system, and served to redistribute sediment to build landscape patterning and topography. Today, in most areas of the system, reduced or nonexistent sheetflow coupled with either drainage or impoundment has steadily degraded the linear patterning and microtopography. The resulting loss of connected, deep water sloughs equates to a reduction in the aquatic productivity and ecological connectivity those habitats once provided in sustaining trophic foodwebs. To date, our understanding of the mechanisms of landscape formation and degradation has been limited to small-scale experiments and large-scale modeling. Scientific and engineering uncertainties remain over the extent to which the ridge and slough landscape can be restored with greater sheetflow and, furthermore, what role canals play in altering landscape responses to sheetflow.

The DECOMP Physical Model (DPM) is a large-scale field test designed to address uncertainties associated with the Comprehensive Everglades Restoration Project (CERP) Water Conservation Area (WCA) 3 Decompartmentalization and Sheet Flow Enhancement Project (DECOMP), specifically to reduce the environmental risks and aid in the science behind alternative project designs. The project couples the construction and operation of hydrologic features and design alternatives with a comprehensive hydrological and ecological monitoring plan. The intent is to coordinate the operation of the hydraulic features with the collection of monitoring data in a statistically robust manner to reduce uncertainty.

Contact Information: Barry H. Rosen, U.S. Geological Survey Office of the SE Regional Director, 12703 Research Parkway, Orlando, FL 32826 USA, Phone: 407-803-5508, Fax: 407-803-5505, Email: brosen@usgs.gov

RESTORATION LESSONS FROM BARTEL GRASSLAND AND TINLEY CREEK WETLANDS

Joseph Roth
Openlands, Chicago, IL, USA

The Bartel Grassland and Tinley Creek Wetlands restoration sites lie adjacent to each other in south Cook County, Illinois. Together the two sites comprise approximately 900 acres of restored native grassland in a developed urban landscape within 30 minutes of downtown Chicago. Openlands, a private not-for-profit conservation organization, has worked with the Forest Preserve District of Cook County, U.S. Army Corps of Engineers – Chicago District, Audubon – Chicago Region, Bartel Grassland Volunteers, and Illinois Nature Preserves Commission since 2001 on the implementation of the Bartel Grassland and Tinley Creek Wetland restoration projects.

Native plant communities being restored at Bartel Grassland and Tinley Creek Wetlands include emergent wetland, sedge meadow – wet prairie, wet prairie – mesic, and dry mesic. Control of cool-season grass and invasive species, mapping and disablement of extensive drainage tile systems, removal of reforestation areas and hedgerows, and planting (plugs and seed) of native species were key restoration tasks completed as a part of both projects. Monitoring of the plant communities, grassland bird nesting, and frogs is being conducted at both sites. Hydrologic monitoring is being conducted at Tinley Creek Wetlands.

The subjects discussed in this presentation will include the different techniques utilized to implement the restoration tasks listed above, which restoration techniques have worked well, which techniques not as well, and the public outreach and information measures utilized by the project partners for both projects.

Contact Information: Joseph Roth, c/o Openlands, 25 E. Washington Street, Suite 1650, Chicago, Illinois, USA,
Phone: 312-863-6275, Fax: 312-863-6251, Email: jroth@openlands.org

A LOWER TROPHIC LEVEL FOOD WEB MODEL TO SUPPORT UNDERSTANDING AND EVALUATION OF ECOLOGICAL RESPONSES WITHIN THE LOW SALINITY ZONE OF THE SAN FRANCISCO ESTUARY

Shaye Sable[1], *Kenneth Rose*[2], *Wim Kimmerer*[3], *Steve Bartell*[4] and *Eugene Maak*[5]
[1]Dynamic Solutions, LLC, Baton Rouge, LA, USA
[2]Louisiana State University, Baton Rouge, LA, USA
[3]Romberg Tiburon Center, San Francisco State University, Tiburon, CA, USA
[4]Cardno ENTRIX, Maryville, TN, USA
[5]US Army Corps of Engineers, Sacramento District, Sacramento, CA, USA

A version of the comprehensive aquatic systems model (CASM) was developed to simulate daily growth processes and food web interactions among important lower trophic level (LTL) populations in the low salinity zone (LSZ) of the San Francisco Estuary. The LSZ is a well-studied and important ecological region in the San Francisco Estuary that is ideal for the development and calibration of the ecological model because it has extensive data and information available for model inputs, parameterization, and testing.

The LTL food web model is comprised of two phytoplankton populations and nine consumer groups that include multiple populations of particle-feeding zooplankton, a predatory copepod, *Corbula* clams, mysids, and a pelagic fish group. Daily population growth is determined by bioenergetics-based equations, and daily inputs for light, temperature, depth, nutrients, suspended sediments, and particulate organic matter differentially modify maximum photosynthesis and consumption of the populations. Field data and outputs generated by the EFDC hydrodynamic and water quality models were used as the environmental inputs to the model, and the daily predicted biomasses were calibrated to biomass data collected from the LSZ in 2004 using an automated program called PEST. The calibrated model showed that phytoplankton growth was light-limited in 2004 and had to be subsidized from outside of the LSZ in order to support the LTL food web. The calibrated model was used to evaluate food web responses and changes in energy cycling due to changes in suspended sediment loads and differential changes to primary production over the year.

Although there are ongoing hydrodynamic modeling studies for the Sacramento San Joaquin River Delta, and several ongoing efforts to develop population models for listed fish species in the San Francisco Estuary, a major gap in the modeling efforts to date are those that deal with the dynamics that connect the hydrodynamics to the fish (i.e., LTL dynamics). The LTL food web model begins to fill this gap and can address fundamental questions such as how energy is cycled; how much LTL production is supported within the system; and how does LTL production vary under different environmental conditions. The CASM was specifically developed so that it can be used to address issues such as the potential top-down effects of invasive *Corbula* clams and the bottom-up effects of water quality changes, such as ammonium loading from sewage treatment plants, on the LTL food web.

Contact Information: Shaye Sable, Dynamic Solutions, LLC, 450 Laurel Street, 1060 North Tower, Baton Rouge, LA 70801, USA, Phone: (225)-490-0090, Email: ssable@dsllc.com

3-DIMENSIONAL HYDRODYNAMIC NUMERICAL MODELING OF GALVESTON BAY USING THE 3-DIMENSIONAL ADAPTIVE HYDRAULICS (3D-ADH) CODE

***Gaurav Savant**, Charlie Berger* and *Jennifer N. Tate*
Dynamic Solutions LLC, Knoxville, TN, USA

The Engineer Research and Development Center (ERDC) has been developing the mass conservative finite elements based 3D shallow water hydrodynamic, sediment and nutrient transport numerical model Adaptive Hydraulics. As part of its validation procedure 3D ADH was applied to Galveston Bay to study the impacts of channel deepening on hydrodynamics and the consequences salinity intrusion into the bay on oyster beds in the northern bay. The numerical model results were studied to analyze impacts if any deepening the navigation channel would have on tidal behavior and salt concentration throughout the bay. 3D ADH has the capability to refine and/or coarsen the user generated mesh to transiently focus on the regions requiring additional resolution based on the hydrodynamics as well the transport processes. This presentation will provide an overview of the entire ADH software and will focus on the application of 3D ADH to the study of Galveston Bay.

Contact Information: Gaurav Savant, Dynamic Solutions LLC, 6421 Deane hill Dr, Suite 1, Knoxville, TN 37919, Phone; 601-634-3213, Email: gsavant79@yahoo.com

HYDRODYNAMIC MODELS AS TOOLS FOR ECOLOGICAL RESTORATION ON THE UPPER MISSISSIPPI RIVER, POOL8: A TALE OF TWO MODELS--HISTORIC AND MODERN

***Douglas J. Schnoebelen**, Brice C. Stafe, Larry J. Weber* and *Oscar M. Hernandez*
IIHR-Hydroscience and Engineering, The University of Iowa, Stanley Hydraulics Laboratory, Iowa City, IA, USA

The Upper Mississippi River Basin (UMRB) supports a large and diverse ecosystem that also includes a long history of significant hydrologic and geomorphic impacts. In particular, the hydrology and the hydraulics of the system are the key drivers for numerous biological, chemical, and physical processes. The natural state of the UMRB has changed dramatically from a historically meandering river to a series of navigation pools. In the reach of the UMRB upstream of Rock Island, Illinois, (which is the reach where Pool 8 for this study located), large expanses of water classified as either impounded areas or backwaters were formed in the lower half of each navigation pool. Habitat restoration efforts to restore or improve impacted areas have required significant resources (hundreds of millions of dollars).

Computer generated hydrodynamic models are important tools in bridging the gap between ecologists and engineers for habitat restoration. Hydrodynamic models can provide essential data to ecologists on parameters such as: discharge, velocity, residence time, bed shear stress, Froude number, and water depth (to name a few) which are the primary parameters of hydrodynamics. Hydrodynamic models are tools that allow biologists and river managers to simulate a range of scenarios in which they can better understand the flow regimes of the river, along with spatial and temporal distribution of the hydrodynamic properties which can affect biota. Hydrodynamic models can guide in making comparisons to real world events, which can tell us if the model results or field data (or both) are in error.

New 2-D hydrodynamic models have been developed by researchers at the University of Iowa, Lucille A. Carver Mississippi Riverside Environmental Research Station (LACMRERS), for Pool 8 near La Crosse WI, for modern and pre-impoundment flow conditions. The reference condition concept is particularly important to adaptive management and restoration. A seamless digital elevation model was constructed from historic 1890 river maps and modern bathymetric surveys. Changes in discharge, depth, and velocity in main channel, side channel, and backwater areas were compared. The model sensitivity to roughness and bed topographic changes were investigated. A quantitative comparison was made for numerous flow conditions for both modern and historic conditions.

Contact Information: Douglas J. Schnoebelen, IIHR-Hydroscience and Engineering, The University of Iowa, Stanley Hydraulics Laboratory, 320 S. Riverside Drive, Iowa City, IA, 52242, USA, Phone: 319-335-6061, Fax: 319-335-5238,
Email: douglas-schnoebelen@uiowa.edu

DAYLIGHTING OF SCHOONMACHER CREEK AS PART OF THE WESTERN MILWAUKEE FLOOD MANAGEMENT PROJECT

Jennifer B. Wright[1], ***Heather E. Schwar***[2], *Joel C. Marshall*[2] and *Troy E. Deibert*[2]
[1]Milwaukee Metropolitan Sewage District, Milwaukee, WI, USA
[2]HNTB Corporation, Milwaukee, WI, USA

The Western Milwaukee Project is the final major project in a series of flood management projects conducted by the Milwaukee Metropolitan Sewage District (MMSD) on the Lower Menomonee River. The entire Lower Menomonee River project will remove approximately 300 structures from the 100-year floodplain. Located in the cities of Wauwatosa and Milwaukee, WI, the Western Milwaukee project will reduce flood risk along the urbanized State Street corridor by lowering floodplains to increase storage, constructing a levee and floodwall to contain flood waters, and improving interior drainage systems.

This presentation will focus on one portion of the multi-phased Western Milwaukee project called Phase 2A, which is located in an industrial area once occupied by a Sears distribution warehouse. Phase 2A will lower the floodplain, and by removing a culvert originally constructed to convey Schoonmacher Creek under the Sears building, will daylight a portion of Schoonmacher Creek to the Menomonee River, replacing it with a more natural, low-gradient confluence. The proposed modifications consist of removing approximately 400 feet of a 5.5 feet by 9 feet concrete box culvert and constructing a headwall at the new outfall with a flap gate, apron and wing walls. A riprap basin at the outfall, followed by a series of step pools, was designed for energy dissipation. A channel with rock substrate and bioengineered banks will be incorporated into the reconstructed creek confluence. The Schoonmacher Creek daylighting, in combination with the proposed Menomonee River bank design, is designed to act as a wide tributary confluence as opposed to the conveyance channel that currently exists. During flooding events, aquatic species, especially fish, can seek refuge in lower velocities found along the floodplain edge.

Post-project vegetation includes early succession native hardwood communities on upland and high floodplain areas, shrub communities in regularly flooded riparian areas and tall-grass prairie in less regularly flooded areas. Levees would be vegetated with a no-mow grass mix. The restoration will promote the development of wetland and riparian habitat areas through appropriate grading and vegetation and provide a park-like setting in this urban area.
The estimate of probable construction cost for the Phase 2A portion of the project is approximately $5.7 million.

Contact Information: Jennifer B. Wright, Milwaukee Metropolitan Sewage District, 260 West Seeboth Street, Milwaukee, WI 53204 USA, Phone: 414-225-2097, Fax: 414-221-6801, Email: jwright@mmsd.com

Heather E. Schwar, HNTB Corporation, 11414 Park Place, Suite 300, Milwaukee, WI 53224-3526 USA, Phone: 414-410-6827, Fax: 414-359-2315, Email: hschwar@hntb.com

QUANTIFYING POTENTIAL FLOODPLAIN RESTORATION BENEFITS IN THE UPPER MISSISSIPPI RIVER BASIN, USA

Michael T. Schwar[1] and *Eileen Fretz*[2]
[1]Montgomery Associates: Resource Solutions LLC, Cottage Grove, WI, USA
[2]American Rivers, Washington, DC, USA

It is widely accepted that reducing floodplain encroachment and allowing rivers and streams more room to adjust to the effects of flood flows can provide societal and environmental benefits associated with moderated hydrologic regime including reduced the risk of flood losses, enhanced nutrient processing and habitat improvement. At this point in time, however, it is often difficult to quantify these benefits or clearly identify where the benefits are accrued. As part of an effort to support increasing implementation of nonstructural flood management solutions such as levee removal in the Upper Mississippi River Basin (UMRB), American Rivers and Montgomery Associates have developed an analysis technique using continuous hydrologic models to evaluate flood reduction benefits from restoring floodplain storage along UMRB streams and rivers. Specifically, we used long-term runs of three existing Hydrologic Simulation Program-Fortran watershed models to generate flows for a series of wetland implementation scenarios. By comparing the characteristics of the various scenarios we were able to evaluate the relationship between restored floodplain volumes and hydrologic characteristics throughout the watershed. We also developed a method to extrapolate these results and estimate the benefits of potential site-specific projects across the UMRB.

This presentation will provide a technical description of the modeling methodology, describe general insights the multi-watershed analysis provided, and explain the regression-type analysis developed to provide planning-level estimates of proposed project benefits. In addition, we will describe the application of this methodology to provide comparable planning-level evaluations of benefits from proposed restoration projects in terms of nutrient processing and habitat functions.

Contact Information: Michael T. Schwar, Montgomery Associates: Resource Solutions LLC, 119 South Main Street, Cottage Grove, WI 53527 USA, Phone: 608-839-4422, Fax: 608-839-3322, Email: mike@ma-rs.org

SHEBOYGAN RIVER AREA OF CONCERN HABITAT RESTORATION PROJECTS

***Thomas Sear*[1]**, *Stacy Hron*[2], *Marty Melchior*[3], *Gary Casper*[4] and *Scott Isaacs*[5]
[1]Short Elliott Hendrickson, Inc., Milwaukee, WI, USA
[2]Wisconsin Department of Natural Resources, Plymouth, WI, USA
[3]Inter-Fluve, Inc., Madison, WI, USA
[4]Great Lakes Ecological Services, LLC, Slinger, WI, USA
[5]City of Sheboygan Department of Public Works, Sheboygan, WI, USA

The Sheboygan River flows 81 miles through eastern Wisconsin and discharges into Lake Michigan at the City of Sheboygan. In 1985, the U.S. Environmental Protection Agency designated the lower Sheboygan River and Harbor an Area of Concern (AOC) because of water quality and habitat degradation that had occurred due to urbanization and the historical discharge of industrial pollutants into the river. The City of Sheboygan, Sheboygan County and the Wisconsin Department of Natural Resources (WDNR) are currently implementing three habitat restoration projects along the lower Sheboygan River that address habitat related Beneficial Use Impairments (BUI's) associated with its designation as an AOC. Using fish, wildlife and other AOC data collected as part of preliminary studies funded by the Great Lakes Restoration Initiative (GLRI), the Sheboygan River AOC Fish and Wildlife Technical Advisory Committee identified seven habitat restoration projects to address impairments within the AOC that focus on degradation of fish and wildlife populations and loss of fish and wildlife habitat. Three project sites, encompassing 73 acres and nearly 2 miles of shoreline, were targeted for habitat restoration along the lower Sheboygan River, and include the: (1) Kiwanis Park Shoreline Site, (2) Wildwood Island Area Site, and (3) Taylor Drive/Indiana Avenue Site.

Although degradation issues vary by location, the causes of the habitat related BUIs include stream bank erosion, sedimentation, habitat fragmentation, invasive plants, urban land use, and urban storm water impacts. Restorative measures at the three project sites include: (1) shoreline stabilization and development of habitat using woody debris (anchored log jams and log benches); (2) bioeningeered bank stabilization; (3) conversion of a wet detention basin into a wetland system, including the construction of a reptile hibernaculum; (4) removal of invasive plants and restoration with native species; (5) strategic placement of boulders and gravel banks within the river to provide fisheries habitat and address sediment issues; and (6) the placement of numerous bird / bat houses and nesting platforms. In addition, long-term management of invasive species is being addressed within the entire AOC and is an integral component of the habitat restoration projects. The improvements being made at each project site are designed to enhance habitats for migratory and shore bird stopover and breeding, herptile breeding, warm water fisheries, and fish and wildlife populations.

Construction, which is being funded by the GLRI, was initiated in June 2012 and is scheduled to be completed in spring 2013. Construction management oversight is being led by the City of Sheboygan, with support provided by the WDNR, Sheboygan County, and the SEH Project Team, who developed the final design and construction documents.

Contact Information: Thomas Sear, Short Elliott Hendrickson, Inc., 5395 North 118th Court, Milwaukee, WI 53225-3085 USA, Phone: 414-465-1214, Fax: 888-908-8166, E-mail: tsear@sehinc.com.

BROWN BRIDGE DAM REMOVAL AND RIVER RESTORATION, TRAVERSE CITY MI

Andy Selle[1], *Frank Dituri*[2], *Brett Fessel*[2], *Steve Largent*[3] and *Nate Winkler*[4]
[1]Inter-Fluve, Madison, WI, USA
[2]Grand Traverse Band of Ottawa and Chippewa Indians, Traverse City, MI, USA
[3]Grand Traverse Conservation District, Traverse City, MI, USA
[4]Conservation Resource Alliance, Traverse City, MI, USA

The Brown Bridge Dam was built in 1921 and is 1600' long earthen fill dam with 32' of head. The dam impounds over 200 acres but affects the Boardman River for over 3 miles upstream. The dam is located on the Boardman River, a world reknown cold water fishery in Traverse City, MI. Following a comprehensive study in 2009, the Brown Bridge Dam was slated for removal. A diverse assemblage of state, federal, tribal, county, city, and interested NGOs formed an Implementation Team (IT) that moved forward with implementing the results of the study.

Investigation for removal centered largely on the management of sediment that had accumulated as a delta deposit in the upper impoundment. Over 11 feet deep at its maximum and with a length of 1.3 miles, the wedge of deposited sand included over 200,000 CY of potentially mobile material. The migrating edge of the delta was still over a mile above the dam itself. Depth of refusal surveys quantified the volume of material in the delta and verified the location of the pre-dam channel that guided restoration efforts. Observations from intact stretches of the river informed the type of habitats (pools, riffles etc) that likely existing below the delta deposit in the old channel. In addition, large wood was identified early as an important habitat element for river function. The design phase of the project focused on matching project goals of restoration and minimal impact to downstream reaches with the available budget for construction. Restoration focused on "uncovering" the pre-dam channel and associated habitat. Dividing elements of the project into needs and wants, the IT arrived at a design that blended elements of both active and passive restoration and sediment management to achieve the stated goals of the project.

Removal of the dam began in August 2012 with substantial completion in early January 2013. The project encountered a number of challenges during construction, detailed in the presentation. Sediment management within the delta proceeded largely as planned utilizing careful sequencing and controls on pond elevation. Sediment migration into the lower portion of the impoundment, below the delta, was minimized, though 23,000 CY of material was excavated from this area. The project utilized large wood for bank stabilization in areas of high erosion potential, but otherwise has proceeded without substantial bank treatments. Large wood was added for habitat complexity and re-vegetation efforts are underway.

Contact Information: Andy Selle, Inter-Fluve inc. 301 Livingston St, Madison WI 53703, Phone: 425.218.8370, Email: aselle@interfluve.com

RISING TIDE: ADAPTING EVERGLADES ECOSYSTEM RESTORATION TO CLIMATE CHANGE

Dawn Shirreffs
National Parks Conservation Association, Hollywood, FL, USA

At 1.5 million acres, Everglades National Park is the third largest park in the lower 48 states and protects the largest wilderness area east of the Rocky Mountains. The park encompasses includes the largest freshwater sawgrass prairie in North America and the largest protected mangrove ecosystem in the Western Hemisphere. Everglades National Park represents part of the greater Everglades, a 100 mile long, 50 mile wide shallow, freshwater "River of Grass" that historically flowed south from Lake Okeechobee through the freshwater sloughs and prairies to the Gulf of Mexico and Florida Bay.

Everglades National Park is extremely vulnerable to sea level rise. The entire park lies at or close to the level of the sea with sixty percent of the park is at less than three feet above mean sea level. Studies project that sea level could rise between 7 inches to 23 inches by the end of this century* If these projections prove accurate, 10% to 50% of the park's freshwater marsh would be transformed by salt water pushed landward by rising seas. Such rising sea levels could cause irreparable harm to mangrove areas, coastal wetlands, tidal flats, and inland freshwater marshes, as well as to the many species that inhabit the area and have devastating impacts to infrastructure within the Park. Unabated sea level rise could also push salt water into the Everglades and threaten the principal source of freshwater for the underlying Biscayne Aquifer, which is the source of drinking water for close to seven million people in South Florida and already experiencing saltwater intrusion.

In 2000, Congress authorized the Comprehensive Everglades Restoration Plan (CERP), a massive landscape level and multi-billion dollar undertaking to restore America's Everglades. Since the National Academy of Scientists urged the modification of CERP to address sea level rise in 2008 federal and regional partners have begun to develop new models to understand impacts to habitats, species and hydrology within the ecosystem. CERP plans going forward will benefit from the additional analysis which has been undertaken to predict sea level rise scenarios, land loss projections and possible community-level impacts. The U.S. Army Corps of Engineers have developed guidance including the "Sea-level Change Considerations for Civil Works Programs". Regional and local government initiatives are also being coordinated to mitigate impacts, some of which complement and support ecosystem restoration as a top priority but numerous challenges remain.

Climate change has made expediting CERP implementation even more essential. Removing the canals and levees will restore natural flows to the park, increase the Everglades' capacity to store water and help create a freshwater head that would act as a barrier against the landward push of saltwater. Restoration is crucial to making the Everglades ecosystem and local communities more resilient to climate change.

*Intergovernmental Panel on Climate Fourth Assessment Report, February 2007
http://www.ucsusa.org/assets/documents/global_warming/IPCC-WGI-UCS-summary-72dpi.pdf

<u>Contact Information</u>: Dawn Shirreffs, National Parks Conservation Association, 450 N. Park Rd., #301, Hollywood, FL 33021 USA, Phone: (954)961-1280 ext 402, Email: dshirreffs@npca.org

OUTSIDE THE BOX IN HABITAT RESTORATION FOR HAZARDOUS SITE REMEDATION

***Joseph Shisler**, Gary Markiewicz, Doug Partridge, Lora deMarffy* and *Cassie Brachfeld*
ARCADIS, Cranbury, NJ, USA

Hazardous site remediation offers an opportunity for habitat restoration. The site remediation creates conditions which are not associated with normal restoration procedures since they have to meet remediation objectives: for example, capped areas, riprap channels, excavations, and maintained areas. The presentation will provide several examples associated with these conditions and compared with developed restoration plans. Modifications in plans to meet the remediation conditions are addressed along with adaptive management procedures that were implemented to increase habitat diversity and utilization. A comparison with "cook book" approaches to "outside the box" applications will be addressed to the context of meeting mitigation requirements while decreasing the costs associated with construction.

Contact Information: Joseph Shisler, ARCADIS, Cranbury, NJ 08512-3698 USA, Phone: 609-860-0590 x245, Fax: 609-860-0491, Email: joseph.shisler@arcadis-us.com

LARGE-SCALE, HIGH-DIVERSITY RESTORATION AS A THREAT-REDUCTION STRATEGY IN A HIGH-PRIORITY, FRAGMENTED CONSERVATION LANDSCAPE

John A. Shuey
The Nature Conservancy of Indiana, Indianapolis, IN, USA

The Kankakee Sands Conservation Area is focused on a cluster of large ecosystem remnants in NW Indiana and adjacent Illinois. Scattered remnants include high-quality examples of sand prairie, herbaceous wetland, black oak barrens and pin oak flatwoods. These remnants collectively support populations of most of the original biota, but many species persist as precariously small, isolated populations. The primary threats in the region are derived from extreme habitat conversion to agriculture resulting in habitat fragmentation, reduced habitat size, and disrupted population structure. Because of the geographic proximity of key remnants, the site provides a unique opportunity to use restoration as a strategy to address threats to biodiversity.

As a strategy at the site, restoration should: 1, create expanded habitat for species that were trapped on the ecosystem remnants, and 2, restore connectivity between artificially fragmented communities and metapopulations. Philosophically, we approached this by addressing “landscape attributes” across intervening areas, as defined by recognizable and repeating patterns of ecological communities across ecological gradients. In our case the physical gradient is the near surface water table which undulates over and under the sandy soils of the site. We defined ecological communities as including all associated species, including plants and animals, including invertebrates. Because the restoration was defined as a *strategy designed to achieve specific a-priory conservation outcomes*, we arrived at the following restoration decisions:

- Near surface hydrology would be restored to maximize interplay of the water table over the soil surface. This would maximize the complexity of the wetland/upland mosaic.
- To maintain the integrity of local plants, only local genotype plant materials would be used.
- We would restore the entire plant community – over 600 species – in order to in order to establish host plants for rare insects we know nothing about.
- To kick-start the “landscape patterning” across the restoration, seed mixes that emulate natural plant communities were designed for the range of soil types and hydrologic conditions across the site.
- Some difficult to establish plant species that create community matrices as well as critically rare species would be raised as plugs and planted into the restoration to ensure establishment.
- To enhance restoration species richness, we used very low seeding rates of the highly aggressive warm season grasses that dominate most restorations (¼-½lb/ac total for the 3 sp.)

Had we defined our a-priory strategy (restoration) outcomes differently, our operational decisions would have been altered accordingly. But by viewing restoration as a strategy designed to produce specific ecological outcomes, our restoration design diverges sharply from typical plans where restoration is defined as the “goal”.

Since 1996, we have acquired over 8,000 acres and restored over 6,000 acres at Kankakee Sands, creating a contiguous conservation area exceeding 20,000 acres. In 2014, we hope to initiate a detailed assessment of restoration (strategy) success across the site.

Contact Information: John A. Shuey, The Nature Conservancy of Indiana, 620 E Ohio Street, Indianapolis, IN 46202 USA, Phone: 317-951.8818, Email jshuey@tnc.org

RIVERINE WETLAND HABITAT RESTORATION USING A FULL MANAGEMENT TOOL BOX

Brandy Siedlaczek[1], *Merrie Carlock*[1] and *John O'Meara*[2]
[1]City of Southfield, Southfield, MI, USA,
[2]Environmental Consulting & Technology, Ann Arbor, MI, USA

The Valley Woods Restoration Project on the Rouge River applied multiple restoration actions to bring about urban habitat revitalization. The Rouge River Watershed represents the most urbanized watershed in Michigan, and encompasses much of metropolitan Detroit. The watershed has been the focus of restoration efforts by local government and multiple stakeholder and stewardship groups. The foundation of these efforts has been to restore native habitat with wetland restoration, invasive species management and flood plain preservation. The Valley Woods Restoration is one of these regional efforts.

The project restored the riparian corridor, wetlands and upland habitat while also improving stormwater quality and conveyance. This resulted in the creation and protection of 10 acres of river flood plain wetlands and an attractive and functional storm water structure as a component of a park entrance. The synergy created by both elements achieved a holist restoration.

The existing wetland was a mixture of forested and emergent areas with limited open water, in need of restoration. The wetland was transverse by ditches that artificially drained of the surface soil horizon. Vegetation was dominated by reed canary grass and phragmites. Restoration efforts were needed that incorporated management tools to remove thatch build up from invasive plant material, liberate the native seed bank, and restore the hydrologic function of the wetlands.

Invasive species management was achieved through the use of multiple management tools; herbicide, controlled burn, excavation, and hydrologic control followed by filling ditches to restore the soil hydrology. Traditional herbicide treatments were followed by excavation and landfill disposal of areas where invasive root systems (up to 5 feet in depth) were located. The increased water depth provided a greater assurance against root zones reestablishment. Increased surface water provided additional pond habitat. Areas not excavated received subsequent herbicide treatments. A controlled burn was conducted to remove the biomass from the entire restoration area. Next, ditches were filled to restore the soil hydrology and seasonal flooding. A storm water outfall on the north side of the wetland was diverted during high flow through the wetland. Finally, the wetlands were planted and over seeded to re-establish native vegetation.

The wetland restoration was married with conversion of an existing concrete channel adjacent to the river. During storm events the channel overflowed onto the adjacent slope, flooding a pedestrian walkway. This caused continual erosion problems to the embankment, undermined and damaged the walkway, contributed to pollution, erosion and sedimentation within the stream channel and preventing access to the river trail. The reconstruction integrated native plantings and water conveyance methods to improve aesthetics, water quality, public safety, and promote the public use and enjoyment of the river corridor.

Contact Information: Brandy Siedlaczek, Stormwater Coordinator, City of Southfield, 26000 Evergreen Road, Southfield, MI 48037, Phone 248-796-4806, Email: bsiedlaczek@cityofsouthfield.com

STRATEGIC COMMUNICATIONS

Lucila P. Silva
Brown and Caldwell, Inc, Baton Rouge, LA, USA

The focus on health and environmental communications to inform and involve the public in the US can be traced to the early 1970's. These goals echo back to far-reaching environmental and right-to-know legislation, most notably the National Environmental Policy Act's and the Superfund Amendment and Reauthorization Act's public participation provision and the community right-to-know requirements of the Emergency Planning and Community Right-To-Know Act of 1986.

Science-informed decision making allows us to apply objective and credible information within the public forum so that we can make good sound decisions. Integrating science and policy is key toward positive change. Scientists have the knowledge and officials provide policy direction and leadership for societal responses to challenges and enact appropriate legislation.
Collaboration and partnerships between individuals, communities, agencies, scientists, and elected officials are key. Our acceptance depends on how we engage stakeholders, craft our message and communicate our science. Establishing a broad-based multidisciplinary team to develop a Shared Vision and a communication plan is vital to good and effective communications.

Engagement of a science communicator to bridge the science and decision making process in order to organize information in an easily understood framework is another approach for effective communications.

Message Mapping as a tool is a very effective way to identify stakeholders, their questions, and underlying concerns. In addtion, Message Mapping guides the practitioner in identifying supporting facts and in crafting very effective messages.

Contact Information: Lucila P. Silva, Brown and Caldwell, Inc, 451 Florida St, Suite 1050, Baton Rouge, LA, USA, Phone: 225-456-2505, Fax: 225-456-2501, Email: lsilva@brwncald.com

LANDSCAPE PLANNING FRAMEWORK FOR RESTORATION AND PROTECTION OF JUVENILE SALMON HABITAT USING THE COLUMBIA RIVER ESTUARY ECOSYSTEM CLASSIFICATION

Charles A. Simenstad[1], *Mary F. Ramirez*[1], *Allan H. Whiting*[2], *Haley M. Dillon*[2], *Phil C. Trask*[2] and *Sandra E. Coveny*[2]
[1]University of Washington, Seattle, WA, USA
[2]PC Trask & Associates, Inc., Portland, OR, USA

Restoration actions ostensibly contribute to a broad ensemble of ecosystem goods and services. The urgency and efficacy demanded in restoring threatened and endangered species habitat is not well served by ad hoc, opportunistic approaches to restoration and conservation. Strategic planning is critical, and especially so in the case of juvenile anadromous fishes that must adapt to complex land-margin landscapes with varying spatial and temporal habitat quality and quantity as they migrate from their natal watersheds to the coastal ocean. With the support of the Bonneville Power Administration and US Army Corps of Engineers, we are developing a landscape ecology-based approach to enable strategic planning for restoration and preservation of juvenile salmon habitat restoration in the Columbia River estuary. We use the hierarchical Columbia River Estuary Ecosystem Classification (CRE Ecosystem Classification) as the basis of an organizational ‘framework’ for identifying, recommending and selecting spatially-explicit restoration and preservation “targets,” where these target sites in the estuary would provide the most likely benefit to specific at-risk Columbia River salmon stocks (ESU). Our goal is to integrate emerging scientific understanding of juvenile salmon habitat requirements and genetics in the estuary, landscape ecology conservation principles, existing geomorphic tools, and input from a knowledgeable external science advisory team.

The third level in the CRE Ecosystem Classification hierarchy broadly partitions the estuary into eight reaches, corresponding to significant differences in landscape, hydrologic, geologic, geomorphic and ecological characteristics, and also reflects variation in juvenile salmon entry into and rearing in the estuary. Subsequent levels in the hierarchy—Ecosystem Complex (Level 4) and Geomorphic Catena (Level 5)—involve more geomorphic detail and higher spatial resolution descriptors that allow identification and delineation of different juvenile salmon habitats; the highest resolution (Level 6) is based on land cover/use data. We draw on biological attributes of Level 6 that are used to classify Level 5 *sub-catena* that we then merge into *fish habitat catena* based on juvenile Chinook salmon (*Oncorhynchus tshawytsacha*) habitat requirements. Using landscape metrics to quantify the structure, composition, distribution and organization of existing and potentially restorable *fish habitat catena* throughout the estuary, this framework will allow managers and practitioners to strategically identify and rank the types and locations of *fish habitat catena* of highest priority for restoration and conservation. This proactive, scientifically-based process is anticipated to advance more strategic restoration and preservation opportunities that can be effectively incorporated into Pacific salmon recovery actions.

Contact Information: Charles A. Simenstad, School of Aquatic and Fishery Sciences, Box 355020, University of Washington, Seattle, WA 98195-5020 USA, Phone: 206-543-7185, Fax: 206-685-7471, Email: simenstd@u.washington.edu

EVERGLADES RESTORATION 2000-2012: LESSONS LEARNED

Fred H. Sklar[1], *Agnes McLean*[2], *Walter Wilcox*[1], *Chris Madden*[1] and *Tom Teets*[1]
[1]South Florida Water Management District, West Palm Beach, FL, USA
[2]Everglades National Park, Homestead, FL, USA

There is much to be learned from the Federal-State partnership that was created in 2000 to restore the Everglades by reflecting upon the planning, implementation and monitoring elements of the Comprehensive Everglades Restoration Plan (CERP). To be clear, there is no "silver-bullet" solution or approach that works everywhere. Every ecological restoration effort is unique in terms of its geo-political, socio-economic, and biogeochemical underpinnings. However, there might be elements associated with 1) Modeling, 2) Communicating, 3) Implementation and 4) Assessment that have broad application. 1-Modeling: Models are used in restoration projects for finding solutions. Conceptual and simulation models are the two most important models used for restoration, but they solve very different sets of questions. Issues and complexities are highlighted in a discussion of CERP ecosystem monitoring (Adaptive Assessment and Monitoring), screening (iModel), Adaptive Management (Decomp Physical Model) and final design (the C-111 West Spreader Canal project). The biggest issue for all these models is that they tend to focus on the science associated with restoration ecology rather than the socio-economic realism associated with ecological restoration. 2-Communicating: Effective communication across institutions, NGO's, professional societies, and stakeholders can be the "Achilles Heel" of a restoration project. A restoration program without translators or facilitators can be undermined by cultural and political perceptions, 3-Implementation: State and Federal processes can become out of sync in terms of funding, cost-sharing, scheduling, and design. This happens because there is a big difference between partners that participate in and regulate restoration planning and those that share costs and the responsibilities of implementation. Implementation is very closely entwined with communication, but it is also intertwined with regulatory and legal processes. 4-Assessment: Assessment is important for all restoration projects as a learning tool, but it is essential for all large restoration program with "incremental adaptive implementation" or comprised of various smaller projects. Monitoring, as part of assessment, is used to manage-adaptively (an educated trial-and–error approach to evaluate environmental impacts of constructed features and their operations). Evaluation, as part of assessment, is more experimental and is used to adaptively-manage (an organized, scientific means for identifying and addressing key uncertainties). This last evaluation step can bring the whole restoration process full circle and feed-back to the original assumptions of the simulation and conceptual models, potentially making new restoration recommendations. What is the most important lesson to be learned from the Everglades? It is that restoration will not proceed without a societal vision and it cannot succeed without an integrated socio-economic solution, shaped by ecosystem science and driven by sustainable environmental engineering.

Contact Information: Fred H. Sklar, Everglades Systems Assessment, South Florida Water Management District, West Palm Beach, FL, 33414, USA, Phone: 561-682-6504. Email: fsklar@sfwmd.gov

REMEANDERING/RESTORING THREE MILES OF SPRING CREEK WITHIN 650 ACRES OF THE HADLEY VALLEY PRESERVE

Thomas E. Slowinski[1] and *Joseph Roth*[2]
[1]V3 Companies, Woodridge, IL, USA
[2]Openlands, Chicago, IL, USA

Will County, which is located southwest of Chicago, Illinois, is one the most rapidly urbanizing counties in the Midwest. The Forest Preserve District of Will County (FPDWC) has been involved in the preservation of Spring Creek and its resources since 1930. The Spring Creek Greenway holdings of the FPDWC now consist of approximately 1,925 acres over the 8-mile stream corridor. The Hadley Valley Preserve (658 acres) is one of 4 preserve systems within the Spring Creek Greenway.

The FPDWC, in conjunction with the Illinois State Toll Highway Authority, U.S. Army Corps of Engineers, Openlands, and V3 Companies, are in the process of restoring over 500 acres within the Hadley Valley Preserve to native plant communities. A major element of the Hadley Valley restoration effort is the restoration of nearly 3 miles of incised Spring Creek to its former meandering course. The restoration of the creek channel has added approximately 2,000 feet to Spring Creek within Hadley Valley Preserve.

The presentation will focus on the investigation, planning, design and construction aspects of the restoration project, how adaptive management was applied by engineers and ecologists who worked together in the Design-Build process, and the results of vegetative, hydrology and aquatic monitoring have been since 2008.

Contact Information: Thomas E. Slowinski, Vice President, Wetlands & Ecology, V3 Companies, 7325 Janes Avenue, Woodridge, IL 60517, USA, Phone: 630-729-6285, Fax: 630-724-9202, Email: tslowinski@v3co.com

IMPLEMENTATION OF THE PLATTE RIVER ELM CREEK COMPLEX FLOW-SEDIMENT-MECHANICAL ADAPTIVE MANAGEMENT EXPERIMENT

Robert A. Mussetter[1], *Merri Martz*[2] , *Jason Farnsworth*[3] and ***Chadwin B. Smith***[3]

[1]Tetra Tech, Inc., Fort Collins, CO, USA

[2]Tetra Tech, Inc., Seattle, WA, USA

[3]Headwaters Corporation and Platte River Recovery Implementation Program, Kearney NE, USA

The Platte River Recovery Implementation Program (Program) was initiated on January 1, 2007 between Nebraska, Wyoming, Colorado, and the Department of the Interior to address endangered species concerns in the central and lower Platte River. Prior to upstream water development, the Platte River had a wide, braided planform characterized by shallow flow and a highly-mobile, sand bed with bare sand bars that provided valuable habitat for Program's target species that include the whooping crane, piping plover, interior least tern, and pallid sturgeon. Over the past century, the river has narrowed and deepened to an essentially single-thread channel, the primary banks have stabilized with thick vegetation, and a variety of native and introduced species have established on mid-channel sand bars, eliminating key habitat. The intent of the Program is to rehabilitate the Platte River back towards a braided channel morphology with sand bars free of vegetation, increased channel widths and unobstructed views that provide suitable habitat for the target species.

The authors developed and are currently in the 2nd year of implementation of a three-year Flow-Sediment-Mechanical (FSM) "Proof of Concept" adaptive management experiment at the Program's Elm Creek Complex in Central Nebraska. The experiment was designed to test several hypotheses about the expected response of the river to FSM actions that include management of the flows and sediment supply, primarily through augmentation, and mechanical treatment to remove vegetation and destabilize islands and channel banks, to restore the river toward the desired, braided morphology. The experiment is being conducted through detailed field monitoring of the response of the channel geometry, bed topography, substrate characteristics and vegetation within the Complex to selective clearing of islands by discing and spraying with herbicides under a range of flow conditions that include near-record, natural high flows during the first year and near-record low flows during the second year of the experiment. The field data are being analyzed using multi-variate statistical techniques to identify the key drivers of response, and one- and two-dimensional hydraulic and sediment transport models are being developed and calibrated to the field data to provide tools for Program use in predicting river response to future FSM actions. The effects of a separate, but related, Sediment Augmentation Pilot Experiment that is being conducted by the Program in the reaches upstream from the Elm Creek Complex to identify methods of restoring the bed material sediment balance in the overall restoration reach is also being considered in the experiment.

Contact Information: Robert (Bob) Mussetter, Tetra Tech, Inc., 3801 Automation Way, Fort Collins, CO USA, Phone: 970-223-9600, Fax: 970-223-7171, Email: bob.mussetter@tetratech.com

INDEPENDENT SCIENCE ON A LARGE SCALE – A PANEL DISCUSSION

Chadwin B. Smith[1], *David Marmorek*[2], *John Nestler*[3] and *Kent Loftin*[4], *Robb Jacobson*[5], *David Galat*[5] and *Philip Dixon*[7]

[1]Headwaters Corporation, Lincoln, NE, USA
[2]ESSA Technologies Ltd., Vancouver, BC, Canada
[3]Environmental and Fisheries Services, Vicksburg, MS, USA
[4]SynInt, Inc., Hobe Sound, FL, USA
[5]USGS, Columbia, MO, USA
[6]University of Missouri, Columbia, MO, USA
[7]Iowa State University, Ames, IA, USA

The purpose of this session is to provide a discussion forum for the role of independent science in large-scale ecosystem restoration and species recovery programs. The panelists are all members of the Platte River Recovery Implementation Program's (Program) Independent Scientific Advisory Committee (ISAC). This is a unique opportunity to have the entire science panel from a large-scale species recovery program convene at NCER and engage with the audience in a discussion about the role of independent science in ecosystem restoration, including the use of adaptive management as an organizing framework and process for the scientific work conducted in large-scale programs.

The Platte River Program ISAC members will each deliver a short introduction of their background, their work on the Platte specifically, and their work as members of independent sciences panels in other systems. The moderator will pose questions to the panel to begin discussion about their experience with independent science and peer review in large systems, examples of how to (and how not to) effectively use independent science to help with management decision-making, and creative ways to engage independent science review in the process of implementing ecosystem restoration programs.

This session is aimed at participants in large-scale ecosystem restoration and species recovery programs that utilize science panels, peer review, and other forms of independent science. This session is being organized as a panel discussion, so interaction with the audience is key and an interchange between the panelists and audience will be the focus. The panel is comprised of members of the Platte River Program's ISAC, but all members have a wealth of independent science experience in numerous other systems and will be able to provide a broad perspective for the audience on how to successfully integrate independent science into management and decision-making.

Contact Information: Chad Smith, Headwaters Corporation, 4111 4th Avenue, Suite 6, Kearney, NE 68845 USA, Phone: 402-261-3185, Email: smithc@headwaterscorp.com

THINKING LIKE A WATERSHED: USING A WATERSHED APPROACH TO IMPROVE WETLAND AND STREAM RESTORATION OUTCOMES

Jessica Wilkinson[1], ***Mark P. Smith***[2], *Nicholas Miller*[3], *Sally Palmer*[4] and *Kathleen Owens*[5]

[1]Environmental Law Institute, Washington, D.C., USA
[2]The Nature Conservancy, Boston, MA, USA
[3]The Nature Conservancy, Madison, WI, USA
[4]The Nature Conservancy, Nashville, TN, USA
[5]The Nature Conservancy, Rome, GA, USA

The use of watershed scale analysis and planning can effectively inform the siting and type of wetland and stream restoration to help align these projects to address broader watershed scale issues and desired outcomes.

Wetland and stream restoration and protection projects are undertaken for a variety of reasons, but primarily to mitigate impacts to wetlands from development or land use change and to further the goals of non-regulatory fish and habitat conservation programs. Using a science-based analysis of watershed characteristics relevant to wetland and stream restoration projects and combining such analysis with a stakeholder process to clearly define watershed needs can improve overall outcomes of individual wetland and stream restoration projects. Such a watershed approach provides an efficient means to help achieve the goals of local communities and of existing regulatory and non-regulatory programs and therefore more effectively contribute to achieving larger societal goals such as improved water quality, habitat and flood attenuation.

We will present an overview of a recently published handbook that provides a practical guide to using a watershed approach to implementing wetland and stream restoration projects. This includes an overview of the spectrum of different watershed approaches and their relative ability to achieve improved outcomes at the watershed scale. The presentation will highlight representative examples of the different approaches and review some of the common elements employed when taking a watershed approach for wetland and stream restoration. These examples will demonstrate how explicitly linking watershed planning techniques with existing wetland and stream protection restoration planning tools can increase the likelihood of having restoration projects contribute to meeting watershed-scale needs and desired outcomes. In addition, aligning project proposals to a broadly accepted plan can reduce the time and expense in getting the necessary project approvals.

Contact Information: Mark P Smith, North America Freshwater Program, The Nature Conservancy, 99 Bedford St, Boston, MA 02111 USA, Phone: 617-532-8361, Fax: 617-532-8461, Email: mpsmith@tnc.org

BENTHOS AND PLANKTON WITHIN WAUKEGAN AREA OF CONCERN: POTENTIAL FOR FURTHER LOCAL RESTORATION

Paul D. Sokoloff[1] and *Bill Bolen*[2]
[1]Battelle, Duxbury, MA, USA
[2]USEPA-GLNPO, Chicago, IL

The Great Lakes Areas of Concern (AOCs; http://www.epa.gov/greatlakes/aoc/) are severely degraded areas within the Great Lakes Basin where beneficial uses of water or biota have been listed as impaired or where environmental criteria have been exceeded and impairment is likely. Waukegan Harbor AOC is located in extreme northeast Illinois, within the City of Waukegan, on the western shore of Lake Michigan. In 1975, polychlorinated biphenyls (PCBs) were discovered in Waukegan Harbor sediments. In 1990 remediation efforts began in Waukegan Harbor, this effort led to the removal of approximately 1 million pounds of PCB contaminated sediments. Remediation efforts in Waukegan Harbor have continued in an effort to have the harbor delisted as an AOC. The Waukegan Harbor AOC has a list of beneficial use impairments (BUIs) that must be addressed to improve overall water quality. The BUIs include degradation of benthos, zooplankton, and plankton populations. To address the BUIs, Battelle collected, analyzed and characterized the benthic and the plankton communities of the Waukegan Harbor AOC.

In addition, in order to assess whether these communities were degraded in comparison to river and harbor areas that are not considered AOCs, a non-AOC reference site was established in Burns Harbor. The Shannon-Weaver Diversity Index was used to calculate the plankton community in both harbors. The Waukegan Harbor AOC demonstrated a plankton community consisting of large-cell zooplankton, rotifers, soft-algae phytoplankton, and diatoms with significantly greater diversity than similar communities sampled in Burns Harbor. The Shannon-Weaver Diversity Index calculated for Waukegan Harbor suggests that not only is the community diverse, having a large number of species, but that it has a high evenness value, indicating the relative abundance of rare and common species. The Shannon-Weaver Diversity Index for the infaunal benthic community calculated for Waukegan and Burns Harbors did not differ significantly, suggesting that no significant difference exists between the infaunal benthic communities of the two sites. The results suggest that the restoration efforts in Waukegan Harbor have improved the water and habitat quality, moving the harbor closer to the goal of being delisted.

Contact Information: Paul D. Sokoloff, Environmental Solutions, Battelle, Duxbury, MA 02332 USA, Phone: 781-952-5367, Fax: 614-458-0864, Email: sokoloffp@battelle.org

WILDLIFE COMPONENT OF THE CONSERVATION EFFECTS ASSESSMENT PROJECT (CEAP) – GREAT LAKES AND WESTERN LAKES ERIE BASIN EFFORTS

Scott P. Sowa[1], *Matthew Herbert*[1], *Sagar Mysorekar*[1], *Mary Fales*[1], *Kim Hall*[1], *Anthony Sasson*[2], *August Froelich*[2], *Carrie Vollmer-Sanders*[3], *Lizhu Wang*[4], *A. Pouyan Nejadhashemi*[5], *Stuart Ludsin*[6], *Jeffrey Reuter*[7], *Jeff Arnold Rewa*[8], *Mike White Rewa*[8], *Mari-Vaughn Johnson*[9] and *Charles Rewa*[10]

[1]The Nature Conservancy, Lansing, MI, USA
[2]The Nature Conservancy, Dublin, OH, USA
[3]The Nature Conservancy, Angola, IN, USA
[4]International Joint Commission, Windsor, ON, Canada
[5]Michigan State University, East Lansing, MI, USA
[6]The Ohio State University, Columbus, OH, USA
[7]Ohio Sea Grant, Columbus, OH, USA
[8]USDA, Agricultural Research Service, Temple, TX, USA
[9]USDA, Natural Resource Conservation Service, Temple, TX, USA
[10]USDA, Natural Resource Conservation Service, Beltsville, MD, USA

Agriculture dominates the landscape in the southern Great Lakes. The key to helping freshwater biodiversity here is increasing “Best Management Practices” or BMPs, such as no-till farming, filter strips, and cover crops. But moving farmers into these practices carries a cost. And until recently, we were not able to predict the response of native species to reductions in sediment and nutrients from BMPs, a crucial gap. With so many acres of farmland, crucial questions remain: How many acres of BMPs do we need to see an improvement in freshwater biodiversity? And, where do those BMPs need to be placed in the watershed? If we can answer those questions, we can make the best decisions about where to invest, and we will know what kinds of ecological outcomes to anticipate. These questions are also important to the U.S. Department of Agriculture, which funds many farmers to initiate BMPs. The USDA Natural Resource Conservation Service established the Conservation Effects Assessment Project, or CEAP, to measure outcomes from federally funded BMPs, and CEAP has funded both the Great Lakes and Western Lake Erie Basin CEAP efforts.

For the Great Lakes CEAP effort The Nature Conservancy (TNC) worked with Michigan State University and the Michigan Department of Natural Resources to successfully relate SWAT modeling outputs to fish community data in the Saginaw Bay watershed of Lake Huron. From this work we are able to predict biological outcomes likely to result from different levels of BMP implementation, which are now being used by local partners to establish realistic ecological and conservation action goals and priorities. For the Western Lake Erie Basin CEAP, TNC is partnering with the USDA Agricultural Research Service (ARS), which developed SWAT, and the Ohio State University, and Ohio Sea Grant, to expand and improve on the Great Lakes CEAP. Specifically, for WLEB we are adding the following improvements:

- Modeling will be done at a finer resolution, NHDPlus catchments or reaches
- Drain tiling will be emphasized in the modeling process, crucial for accuracy in WLEB
- Both fish <u>and</u> aquatic macroinvertebrates will be used as biological endpoints for models
- The project will incorporate outputs from another model developed by USGS and used by EPA, called SPARROW, which will increase integration of these complimentary models

This talk will cover the methods, results, and application of the Great Lakes and WLEB CEAP efforts.

<u>Contact Information:</u> Scott P. Sowa, The Nature Conservancy, Michigan Field Office 101 East Grand River Ave., Lansing, MI 48906 USA, Phone: 517-316-2255, Fax: 517- 316-9886, Email: ssowa@tnc.org

DEVELOPING CREATIVE PARTNERSHIPS IN THE MAUMEE AOC TO RESTORE HABITAT IN AN URBAN WATERSHED

Kristina E. Patterson *Presented by:* ***Kyle Spicer***

Partners for Clean Streams, Toledo, OH, USA

The Maumee Area of Concern (AOC) is a complex, large conglomeration of many watersheds and partial watersheds, within the context of a much larger Maumee River watershed and the western basin of Lake Erie. Land use ranges from highly industrialized to rural with intense agricultural use outside of the Area of Concern but with a direct impact on the AOC. Within the urban areas of the AOC successful restoration of habitat is complex and challenging.

Partners for Clean Streams (PCS), the non-profit organization spearheading the local efforts for the Maumee AOC, began developing systematic inventories of potential habitat restoration projects in the urban and suburban areas of the AOC in 2007. This effort led to identifying properties with high restoration potential that were not currently being pursued by partner organizations (such as the regional Metropark). With concept plans in hand, The Boy Scouts of America agreed to collaborate with PCS in pursuing restoration designs and implementation on their large 150-acre camp. The camp is situated directly along a large river in the AOC and is now surrounded by suburban development. The camp provides the additional benefits of an interested and engaged volunteer base and as an outdoor classroom for thousands of local Scouts and their families each year.

Over the course of 5 years, Partners for Clean Streams led the project from general concept to on-the-ground and in-the-water implementation. PCS leveraged in-kind support to develop a unique WRDA agreement with the Army Corps of Engineers to utilize their expertise in surveying, engineering, modeling, and design. The agreement has now been used a model for other AOCs to leverage Army Corp assistance under the RAP funding provided within the Army Corp authorizations. This agreement also allowed PCS to utilize the expertise of Research Hydrologist, Dave Derrick, with the Army Corps' ERDC Coastal & Hydraulics Lab. With such detailed modeling and engineering in development, PCS was well position to successfully win GLRI funding from U.S. EPA in 2010.

On-the-ground and in-the-water restoration took place in 2012, ranging from invasive species management to wetland restoration to streambank stabilization. Adaptive management, monitoring and education continue in 2013. Lessons learned from this creative and often complex project will inform restoration practitioners of the myriad of benefits and challenges of private-federal partnerships and restoration complexities in an urban environment.

Contact Information: Kristina Patterson, Partners for Clean Streams, P.O. Box 203, Perrysburg, OH 43552 USA, Phone: 419-874-0727, Fax: 419-874-0727, Email: Executive.Director@PartnersForCleanStreams.org

THE ROLE OF INDEPENDENT SCIENCE REVIEW IN THE ADAPTIVE MANAGEMENT PROCESS FOR LARGE-SCALE RESTORATION

Tom St Clair[1] and *Rebecca Burns*[2]
[1]Atkins, Jacksonville, FL, USA
[2]Atkins, Raleigh, NC, USA

Federal agencies and large-scale ecosystem restoration programs around the country are increasingly being challenged regarding the integrity of the science used in their decision-making processes. It is now widely recognized that the adaptive management process guiding many restoration programs would be improved by incorporating peer review and/or scientific review by independent experts. In fact, a recent Office of Management and Budget (OMB) directive and adoption of explicit independent review guidelines by many Federal agencies both demonstrate the widespread recognition that peer review is an important tool for successful restoration program implementation. The purpose of this presentation is to provide an overview of the peer review process including recruitment of technical experts, management of conflicts of interest, facilitation of review panels, management of controversy, compensation for panel members and the need for an administrative record. This presentation will include an overview of the independent science review programs used by major restoration programs and how results have influenced decision-making and implementation of these programs.

Contact Information: Tom St Clair, Atkins, 7406 Fullerton Ave, Suite 350, Jacksonville FL 32256, Phone: 904.303.0919, Email: cmstampa@hotmail.com

STORMWATER BMP AND STREAM RESTORATION IN A CITY PARK

***Jill O. Stachura*[1]**, *Pete Wright*[2] and *Jeff Herr*[3]
[1]Brown and Caldwell, Atlanta, GA, USA
[2]Gwinnett County Department of Water Resources, Lawrenceville, GA, USA
[3]Brown and Caldwell, Atlanta, GA, USA

Gwinnett County, Georgia is part of the urban metropolitan Atlanta region. In order to mitigate the adverse effects that growth has on its aquatic resources, the county has developed a comprehensive Watershed Improvement Program (WIP). The focus of the WIP is to address areas negatively affected by increased stormwater flows and ongoing land use practices from urban development. The Lilburn City Park Stormwater BMP and Stream Restoration project is part of the Jackson Creek WIP Implementation. The goals of the restoration project were to improve water quality, habitat, biology, and the overall condition and health of Camp Creek and downstream waterways. The project included a Priority 1 stream restoration and the construction of a stormwater best management project (BMP) in the former channel.

Approximately 975 linear feet of Camp Creek extends along City Hall Park in Lilburn, GA. At this location, Camp Creek has a drainage area of 7 square miles and a channel width of 30 feet and is within the FEMA 100 year floodplain. The Creek has over-widened and was actively eroding on the left bank into a walking path and other park facilities. Six stormwater outfalls directly discharged into the creek within the Park property. These stormwater outfalls have a combined drainage area of 32 acres.

Two conceptual design options were prepared for the Lilburn City Hall site:

1. To restore the creek by reshaping the pattern and stabilizing the banks
2. To recreate the entire creek within the floodplain using Priority 1 restoration methods away from the City Hall but within its property, and use the existing creek to create a cascading bioretention stormwater treatment system. This bioretention system will promote infiltration, reduce erosive velocities from the stormwater outfalls into Camp Creek and restore the function of the floodplain.

Gwinnett County and City of Lilburn elected the second approach. As part of the second approach, a trail was constructed along the new creek and connected to the Park's existing trail system. Soil excavated from the new creek was used as in the engineered media for the bioretention system. Since this material did not allow sufficient infiltration, a more permeable engineered media was identified and used in all three bioretention systems. Construction was completed in Summer 2012. Pre and post construction monitoring was performed to evaluate water quality and habitat benefits of the project and will be presented.

<u>Contact Information</u>: Jill O. Stachura, Brown and Caldwell, 990 Hammond Drive, Suite 400, Atlanta, GA 30328,
Phone: 770-673-3679, Fax: 770-396-9495, Email: jstachura@brwncald.com

OPEN SPACE IN THE URBAN JUNGLE POST-SANDY: NATIONAL PARKS, ECOSYSTEM RESTORATION AND RESILIENCY IN THE NY-NJ HARBOR REGION

Lilo H. Stainton
NY-NJ Harbor Coalition, New York, New York, USA

Ecosystem restoration in and around the NY-NJ Harbor shares certain characteristics with sister efforts around the nation, but it is also highly unique in its urban nature – from the physical challenges to the role of open space, including an iconic National Parks system that provides a skeletal structure for restoration plans, to the public's vision for a cleaner, greener harbor. This presentation will illustrate the region's history of open-space protection and the recent interest in public access and restoration – and highlight how Superstorm Sandy changed that dynamic.

Our bi-state region is home to 22 million residents and hosts 50 million annual visitors, with the most densely populated waterfront communities in the nation. It is also a region of island cities and peninsulas, with 700+ miles of coastline – more than San Francisco or Hong Kong – where nearly 80 percent of the original tidal wetlands were hardened or filled. These features, along with the highly vulnerable waterfront infrastructure and communities along our coastline, created a landscape ripe for storm destruction, as we saw with Superstorm Sandy in October.

This urban tapestry weaves in several surprising open spaces, including Jersey City's Liberty State Park and New York City's iconic Central Park. But it is Gateway National Recreation Area, the nation's first urban national park, which serves as the green thread that truly connects the region – across open water and state lines – while also linking the community to the estuary itself. While Sandy devastated many of these resources it also raised awareness about the needs of our urban coastline and triggered an influx of federal funding allocations that will be critical to the region's recovery.

Led by a broad, diverse and growing bi-state coalition of 50+ environmental justice, planning and waterfront advocacy groups (including National Parks Conservation Association) this campaign seeks to secure funding to implement a multi-agency, publicly vetted multi-beneficial restoration projects. By accessing Sandy dollars for some of these sites, the campaign seeks to help our region recover in ways that will improve the environment, grow maritime and other jobs, and improve waterfront communities in many ways – in addition to providing critical resiliency and storm risk reduction for a highly vulnerable urban coastline.

Contact Information: Lilo H. Stainton, Campaign Director, NY-NJ Harbor Coalition, 241 Water Street, New York, NY, 10038, USA, Phone: 212-935-9831 Email: lilo@harborcoalition.org

A PROTOTYPE SPLITTER APPARATUS FOR DIVIDING LARGE CATCHES OF SMALL FISH

Martin A. Stapanian and *William H. Edwards*
U.S. Geological Survey, Sandusky, Ohio, USA

Due to financial and time constraints, it is often necessary in fisheries studies to divide large samples of fish and estimate total catch from the subsample. The subsampling procedure may involve potential human biases or be difficult to perform in rough conditions. We present a prototype, gravity-fed splitter apparatus for dividing large samples of small (between 30 mm and 100 mm total length) fish. The apparatus features a tapered hopper with a sliding and removable shutter. The apparatus provides a comparatively stable platform for objectively obtaining subsamples, and can be modified to accommodate different sizes of fishes and volumes of sample. The apparatus is easy to build, inexpensive, and convenient to use in the field. To illustrate the performance of the apparatus, we divided three samples (N = 2,000) composed of four species of fish. Our results indicated no significant bias in estimating either the number or proportion of each species from the subsample. Use of this apparatus, or one similar, can help standardize subsampling procedures in large surveys of fish. The apparatus could be used for other applications that require dividing a large amount of material into one or more smaller subsamples.

Contact Information: Martin A. Stapanian, U.S. Geological Survey, 6100 Columbus Avenue, Sandusky, Ohio 44870 USA, Phone: 419-625-1976, Fax: 419-625-7164, E-mail: mstapanian@usgs.gov

INNOVATIVE APPROACH FOR USING BUILT WATER RESOURCES INFRASTRUCTURE FOR ECOSYSTEM RESTORATION

Thomas J. Maier[1], *Conrad Weiser*[1], ***John Stark***[2], *David L. Smith*[3] and *John M. Nestler*[4]
[1]U.S. Army Corps of Engineers-Pittsburgh District, PA, USA
[2]The Nature Conservancy-Ohio Freshwater Program, Dublin, OH, USA
[3]USACE-Engineer Research & Development Center, Vicksburg, MS, USA
[4]Badger Technical Services, Vicksburg, MS, USA

The U.S. Army Corps of Engineers maintains an extensive national system of Locks and Dams across the nation's navigable rivers. These systems commonly force river flows through gates, valves, or lock chambers of considerably less cross-section area than the river immediately upstream or downstream of the dam. During such times, Lock and Dams offer the opportunity to partially control the movement of fishes, particularly in the upstream direction. It is well known that small changes in dam operation or specific design features of fishways may favor or impede different species of fishes, depending upon individual species behaviors or their swimming capabilities. For example, pool and weir fishways favor surface-oriented (jumping) fish species over benthic (non-jumping) fishes. Consequently, these systems have the potential to be designed or operated to selectively favor the passage of native fishes, while impeding the movement of invasive aquatic species, as part of a watershed fish conservation or ecosystem restoration plan.

The Army Corps of Engineers' Pittsburgh District recently evaluated fish passage project feasibility at the three Ohio River lock and dam navigation facilities within Pennsylvania. Traditional fish passage structures were determined infeasible for a variety of structural, hydrologic and economic issues; yet, the District is considering whether replacement lock chambers can be redesigned to increase the passage of native fish, while reducing the spread of nuisance species, such as Asian carp, to determine if a Lock and Dam system can selectively pass different species of fishes as part of a river management plan. Literature searches revealed little prior consideration of lock design modification to favor fish passage. Any lock modifications facilitating fish passage through normal lock operations would benefit longitudinal connectivity and aquatic restoration efforts. Application of any improvement in fish passage through navigational lock chambers could extend across the majority of the Corps' 238 locks at 192 lock and dam navigation facilities on over 12,000 miles of the nation's rivers.

Contact Information: Thomas J. Maier, Pittsburgh District, U.S. Army Corps of Engineers, 1000 Liberty Avenue, Pittsburgh, PA 15222-4186 USA, Phone: 412-395-7218, FAX: 412-644-6810, Email: thomas.j.maier@usace.army.mil

SUSTAINABILITY IN THE CREATED MARSHES AT POPLAR ISLAND RESTORATION PROJECT IN MID-CHESAPEAKE BAY

Lorie W. Staver[1], *J. Court Stevenson*[1], *Jeffrey C. Cornwell*[1], *Michael Owens*[1] and *Philippe Hensel*[2]
[1]University of Maryland Center for Environmental Science, Cambridge, MD, USA
[2]NOAA, National Geodetic Survey, Silver Spring, MD, USA

Sustainability in marshes depends upon sediment accretion rates which keep up with local sea-level rise (SLR), and in most marshes accretion rates are determined by belowground biomass accumulation. The allocation of biomass is, in turn, driven by nitrogen availability, with low nitrogen conditions favoring growth of roots and rhizomes and high nitrogen conditions favoring shoot growth. At the Poplar Island Environmental Restoration Project there is a plan to create approximately 298 hectares of tidal marsh habitat using material dredged from shipping channels in upper Chesapeake Bay. Fine-grained and nutrient rich, the Chesapeake Bay dredged material is unlike the sandy, low nutrient material used in many coastal marsh restoration projects. The first wetland completed at Poplar Island was constructed using this type of locally obtained sand while subsequent wetlands were constructed with the upper Bay dredged material, providing an on-site comparison of the effects of low versus high nutrient substrates. Striking differences in the vegetation quickly developed, with higher biomass production and canopy height and lower root:shoot ratios in the dredged material marshes, and severe dieback on dredged material but not on sand. Lodging, intense muskrat grazing and high rates of fungal infection were also observed on dredged material but not on sand. We hypothesize that growth-induced silica deficiency may result from the high nitrogen supply and contributes to symptoms observed in the dredged material marshes, as it does in highly fertilized rice and sugarcane, and that a silicon amendment may help alleviate these symptoms and limit dieback. Sediment elevation tables and marker horizons have been deployed to evaluate elevation changes, which must keep up with SLR (~3.2 mm yr^{-1}) given the goal of creating self-sustaining, productive marshes.

<u>Contact Information</u>: Lorie W. Staver, University of Maryland Center for Environmental Science, P.O. Box 775, Cambridge, MD USA, Phone: 410-221-8446, Fax: 410-221-8290, Email: lstaver@umces.edu

J. Court Stevenson, University of Maryland Center for Environmental Science, P.O. Box 775, Cambridge, MD USA, Phone: 410-221-8442, Fax: 410-221-8290, Email: court@umces.edu

HYDRODYNAMIC AND WATER QUALITY MODEL FRAMEWORK TO SUPPORT RESOURCE MANAGEMENT PLANNING FOR THE SACRAMENTO SAN JOAQUIN DELTA

Silong Lu[1], *Paul Craig*[1], ***Andrew Stoddard***[1], *Christopher Wallen*[1], *Zhijun Liu*[1], *William McAnally*[1] and *Eugene Maak*[2]

[1]Dynamic Solutions, LLC, Knoxville, TN, USA
[2]US Army Corps of Engineers, Sacramento District, Sacramento, CA, USA

The Sacramento San Joaquin Delta is a unique estuarine resource that supports water supply, navigation, and recreation while maintaining a complex but fragile ecosystem. Ecosystem restoration and maintenance of an abundant supply of clean water to support agricultural and public needs have been deemed co-equal goals for planning efforts in the Delta. Long-term trends in nutrient availability have triggered questions about the sources and effects of nutrients on algal production and other ecological processes. Ecosystem models are needed to provide a scientifically credible framework to understand the complex interactions of natural conditions, regulatory controls, and resource management efforts on water quality and ecological resources. A three-dimensional hydrodynamic and water quality model -- from Carquinez Strait, through Suisun Bay and the Delta north to Verona on the Sacramento River and south to Vernalis on the San Joaquin River -- has been developed by the USACE, Sacramento District using the Environmental Fluid Dynamics Code (EFDC). The model is a fully-coupled representation of Delta hydrodynamics, sediment transport, water quality and sediment diagenesis validated to data from 2003 and 2004. Selected model results for nutrients, algae biomass (chlorophyll), and dissolved oxygen will be presented as (a) station time series and (b) for specific dates along spatial profiles running from Suisun Bay along the Sacramento and San Joaquin River channels. The Delta EFDC model provides a robust numerical modeling tool that can be used for Bay-Delta management to (a) support evaluations of proposed regulatory controls on nutrient sources and (b) provide a load-response model for a nutrient numeric endpoint framework. The results from the hydrodynamic and water quality model have also been linked to a process-based lower trophic level ecological model (CASM) to understand the effects of environmental conditions on the food web in the lower salinity zone.

Contact Information: Andrew Stoddard, Dynamic Solutions, LLC, 112 Orchard Circle, Hamilton, VA 20158, USA,
Phone: (540)-338-3642, Fax: (540)-338-3649, Email: astoddard@dsllc.com

A SAND BUDGET FOR THE SOUTHWEST SHORE OF LAKE ONTARIO

Alex Brunton[1], *Peter Zuzek*[1], *Joshua Friedman*[1], *Craig Forgette*[2] and ***Amanda Stone***[3]
[1]W.F. Baird and Associates, Oakville, ON, Canada
[2]U.S. Army Corps of Engineers Buffalo District, Buffalo, NY, USA
[3]W.F. Baird and Associates, Madison, WI, USA

Sediment transport along Great Lakes shorelines creates a rich array of habitats, ranging from sand beaches to sheltered embayments and wetlands. Availability and scarcity of sediment along these shorelines exerts physical controls which define the form and function of nearshore habitats. Shoreline erosion provides a source of coarser grained sediments to beaches and nearshore bars while finer grained sediments such as silts and clays are deposited in wetlands or deepwater zones. Understanding sediment transport dynamics in a region provides insight into the existing functionality of nearshore ecosystems and an understanding of the historic and potential future changes that may occur.

This study evaluated the nearshore sediment transport pathways of the south shore of Lake Ontario from the Niagara River in the west to Stony Point in the east. A conceptual model of the study area was developed to understand contemporary sediment movement. The model was used to understand historical change in the system and to look at potential future changes due to human modification of nearshore sediment supply. The changes in sediment availability, scarcity, and movement can then be linked to changes in nearshore ecosystems to better understand interactions between nearshore modifications and ecosystems response.

Sediment budgets were developed for the south shore of Lake Ontario using GIS data on shoreline physiography, land use, and recession rates collected during a previous study for the IJC (Baird, 2006). These sediment budgets were then used to evaluate the impact of shoreline management on terrestrial and aquatic nearshore systems. This information is being used to identify habitat changes and associated indicator species in a further stage of this study. A key goal of the ongoing study is to link changes in sediment transport and supply to nearshore ecosystem health.

Contact Information: Amanda Stone, W.F. Baird and Associates, 2981 Yarmouth Greenway Drive, Madison, WI 53711 USA, Phone: 608-273-0592, Fax: 608-273-2010, Email: astone@baird.com

THE URBAN STREAM RESTORATION OF SULLIVAN BRANCH

Eileen K. Straughan
Straughan Environmental, Inc.

The Chesapeake Bay is the largest estuary in the United States and is home to nearly 16.6 million people. The urbanization of the watershed has resulted in an increase in impervious surface, excess erosion, and stream degradation. Approximately 18.7 billion pounds of sediment are carried by streams and rivers, which flow into the bay every year (www.chesapeakebay.net). Excess sediment is one of the major causes of the degradation of the bay; choking out bay grasses, oysters, and fish.

Stream restoration or stabilization is one of the strategies implemented to halt in-stream erosion that contributes tons of sediment to the Bay annually. Stream bed and bank erosion is evident in nearly every stream where past development (buildings, parking lots, roadways) continued to occur without adequate stormwater controls. In developed areas it is common to find outfall structures that are undermined and downstream channels that are severely incised and eroded. Equally common is the observation of plumes of sediment deposited where the stream channels widen at the confluence with the Bay or another larger water body. Municipalities throughout the watershed are addressing the water quality impairments that accompany stream erosion through their National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permits by conducting watershed assessments and retrofitting existing development with stormwater management and stream restoration.

This presentation profiles a stream restoration project that employs an innovative combination of stream restoration techniques combined with traditional drainage control techniques. Although a natural channel design approach is preferred it is often difficult to apply in urbanized developed areas where the natural landscape has been significantly altered by mass grading that has changed the natural drainage areas and by the introduction of substantial areas of impervious cover, as was the case for this project. Thus, the designer combined traditional drainage design with natural channel design to achieve stability and restored aquatic habitat.

The restoration was constructed in 2009 on Sullivan Branch, an eroded headwater stream located in Prince Frederick, Maryland. The Maryland State Highway Administration (MSHA) designed and constructed this project to halt erosion occurring at stormdrain outfalls and to restore the downstream channel impacted by the erosion. The stream channel erosion occurring prior to the restoration threatened downstream wetland areas that provide habitat for rare, threatened and endangered plant species. The project was completed as part of the Maryland Route 2/4 highway improvement project designed on behalf of MSHA by the Wilson T. Ballard Company (WTBC) of Baltimore, Maryland with significant involvement and leadership from SHA staff. The geomorphic assessment and stream erosion control design for Sullivan Branch was performed under subcontract to WTBC by Straughan Environmental, Inc. (SES) of Columbia, Maryland.

Contact Information: Eileen Straughan, Straughan Environmental, Inc., 10245 Old Columbia Rd, Columbia, MD 21046 USA, Phone 443-539-2501, Fax 410-309-6160, E-mail: estraughan@straughanenvironmental.com

ADAPTIVE MANAGEMENT AND MONITORING PROGRAM DEVELOPMENT FOR THE LOUISIANA COASTAL AREA PROGRAM: PROGRESS, CHALLENGES AND OPPORTUNITIES

Michelle L. B. Meyers[1], *Gregory D. Steyer*[1], *Tomma K. Barnes*[2], *Carol P. Richards*[3] and *William P. Klein Jr.*[4]
Presented by: ***Dan Sullivan***
[1]U.S. Geological Survey, National Wetland Research Center, Baton Rouge, LA, USA
[2]U.S. Army Corps of Engineers, Wilmington, NC, USA
[3]Coastal Protection and Restoration Authority, Baton Rouge, LA, USA
[4]U.S. Army Corps of Engineers, New Orleans, LA, USA

Louisiana coastal wetlands are among the Nation's most important natural resources supporting diverse wetland habitats for wildlife and fisheries. These wetlands also support economic resources including commercial fisheries, recreation, navigation, port commerce, and oil and natural gas production. Louisiana coastal wetlands account for 90 percent of the total wetland loss occurring in the United States. The natural processes of subsidence, sea level rise, habitat switching, and erosion of wetlands, combined with widespread human alteration, have exacerbated rates of wetland loss and ecosystem degradation. In 2007, the Water Resource Development Act (WRDA) authorized the Louisiana Coastal Area (LCA) Program to address the loss of these critical wetland ecosystems. Additionally, WRDA 2007 Section 2039 and subsequent implementation guidance require the incorporation of adaptive management and monitoring (AM&M) into ecosystem restoration projects and planning. The AM&M mandate emphasizes the importance of science driving decision making and learning throughout the AM&M process in order to improve project performance.

The LCA AM&M Team, comprised of members from the U.S. Army Corps of Engineers (USACE), Louisiana Coastal Protection and Restoration Authority (CPRA), and the U.S. Geological Survey (USGS) National Wetlands Research Center, has been charged with developing the AM&M Program (Program) for LCA including project-specific plans. The Program builds upon previous programs and guidance, including the Comprehensive Everglades Restoration Plan Program Development and Implementation, Department of Interior's Technical and Application Guidance, and the draft guidance from the USACE: A Systems Approach to Adaptive Management Technical Guide. The presentation will explain the process, elements, and phases of the Program including applications to LCA project-specific AM&M plans.

The Program links science and AM to support all aspects of project development from planning through implementation. It also provides a mechanism for iterative restoration planning and management in order to address the uncertainties inherent in dynamic ecological systems and to build flexibility and learning into project designs, implementation, monitoring, assessment, and decision making. The presentation will discuss the evolution of the Program and the challenges and opportunities being faced as it moves forward.

Contact Information: Michelle L. B. Meyers, Ecologist, U.S. Geological Survey, National Wetlands Research Center, Coastal Restoration Assessment Branch, c/o Livestock Show Office, Louisiana State University, Baton Rouge, LA 70803 USA, Phone: 504-862-1374, Fax: 225-578-2255, Email: mmeyers@usgs.gov

REAL-TIME MODELING AND REPORTING OF BEACH WATER QUALITY ON THE GREAT LAKES

Laura DeCicco[1], *David Sibley*[1], *Steve Corsi*[2], *Rebecca Carvin*[2] and *Nate Booth*[1]
Presented by: ***Dan Sullivan***
[1]U.S. Geological Survey, Center for Integrated Data Analytics, Middleton, WI
[2]U.S. Geological Survey, Wisconsin Water Science Center, Middleton, WI

Beach water-quality managers are improving beach water-quality forecasts by developing statistical models that assess nearshore and tributary influences for beaches of interest. Previously, a substantial barrier to developing these new models was efficient access to relevant and current data. The USGS Environmental Data Discovery and Transformation (EnDDaT) tool accesses, integrates and formats datasets for calibrating beach water-quality models using historical observations as well as running models in an operational capacity using real-time measurements and hydrodynamic model output. The tool is built using a modern computing design that accesses data using open standards that are compliant with the Great Lakes Observing System (GLOS) Enterprise Architecture. For any selected beach, users can access historical and current data from state and federal sources including NOAA, USGS and EPA by configuring a data access profile. Locations of available data are displayed and chosen using a mapping interface. Data processing options such as moving averages, summations, and others are defined as needed for individual applications. Resulting data retrieval capabilities were defined specifically for development and operation of beach water-quality models, but are widely applicable for environmental data analysis and modeling.

Contact Information: Laura DeCicco, U.S. Geological Survey, 8505 Research Way, Middleton, WI, USA, Phone: 608-821-3857, Email: ldecicco@usgs.gov

TRIBUTARY AND NEARSHORE MONITORING FOR REAL-TIME EVALUATION OF GREAT LAKES RESTORATION

Daniel J. Sullivan[1], *Steven R. Corsi*[1], *Laura A. DeCicco*[2], *Jordan S. Read*[2] and *Charles A. Peters*[1]
[1]U.S. Geological Survey, Wisconsin Water Science Center, Middleton, WI
[2]U.S. Geological Survey, Center for Integrated Data Analytics, Middleton, WI

In support of Great Lakes Restoration Initiative (GLRI) goals, the USGS is monitoring water quality in 30 tributaries of the Great Lakes. These data will provide baseline information to monitor progress towards restoration goals, provide an understanding of sources and transport of contaminants, and assess new contaminant threats, so that the effects of future management actions can be assessed and predicted. The location of the monitoring sites is based on the National Monitoring Network for Coastal Waters (NMN) design for tributaries in the Great Lakes basin. Sampling began in 2011 and is planned to continue through at least 2014.

All of the 30 sites have water-quality sensors that measure pH, temperature, specific conductance, dissolved oxygen, and turbidity every 15 minutes. Similar to discharge and stage, the data are available in near-real-time and can be accessed through the USGS National Real-Time Water Quality portal at http://nrtwq.usgs.gov/. By having sensor data and discharge, ordinary least-squares regression models can be used to compute concentrations and loads of other water-quality constituents in real time. This makes it possible to compute instantaneous values of many constituents in real time for public safety and quick response without the lengthy delay of collecting a sample and waiting for analysis at a laboratory.

Near-shore water quality forecasting models need lots of historical and up-to-date real time data to be useful. Models used to predict bacteria concentrations at public beaches, for example, commonly need 2 to 5 years of historical data for calibration, and real-time data with as little lag time as possible (< 6 hours) are necessary in order to predict the bacteria concentrations for that day at a particular beach. To meet the needs associated with environmental modeling, the USGS developed the Environmental Data Discovery and Transformation (EnDDaT) tool with the capabilities of retrieving publicly available data resources through standard Web services, aggregating disparate data sources, and processing the data through a single Web-accessible user interface. In addition, the tool provides a variety of output formats and data visualization tools. Therefore, these capabilities aid in model development and implementation by allowing scientists to efficiently obtain, aggregate and manipulate the data necessary for these purposes.

Contact Information: Daniel J. Sullivan, Wisconsin Water Science Center, U.S. Geological Survey, 8505 Research Way, Middleton, WI 53562, 608.821.3869, FAX 608.821.3817, Email: djsulliv@usgs.gov

EVALUATING A STRATEGY TO ENHANCE BIODIVERSITY OVER A 426-HA PRAIRIE RESTORATION AFTER 10 YEARS

***Gary Sullivan*[1]**, *William Sluis*[2] and *Iza Redlinski*[1]

[1]The Wetlands Initiative, Chicago, IL, USA

[2]Trine University, Angola, IN, USA

Increasing biological diversity in restorations is critical to reestablishing many ecological functions. In large restorations, this often presents challenges in that seed acquisition is often limited by both financial resources and availability, especially of rare species or those producing little seed. To increase diversity across 426 ha of wet to dry prairie in a 1,113 ha restoration in northern Illinois, 91 species were planted in 53 30-m diameter 'nodes of diversity' to enhance a base seeding of 61 matrix species through ongoing dispersal. Twenty six nodes were planted with 50 wet prairie species (wet species), 23 nodes with 48 mesic prairie species (mesic species), and four nodes with 37 dry prairie species (dry species). Dispersal potential of node species ranged from low (gravity dispersal) to high (wind or animal-vector dispersal). After 10 growing seasons, each node was assessed for species establishment and abundance, with occurrence and abundance assessed in consecutive rings outside each node at 5-m increments to determine if dispersal from nodes was a viable means of increasing diversity across the restoration site.

Eighty node species established in at least one node, with 94 % of wet, 79 % of mesic, and 78 % of dry species found. Nodes averaged 13.7 species in wet prairie, 12.8 species in mesic prairie, and 17.3 species in dry prairie. Not all species successfully dispersed: 43 % of wet and mesic species and 46 % of dry species established in the first 5-m ring outside the nodes; 23 % of wet species, 25 % of mesic species, and 30 % of dry species established in the second ring, and 8% of wet species, 6 % of mesic species, and 28 % of dry species established in the third ring. In wet and mesic nodes, more species with higher dispersal potential established away from the center (high > intermediate > low), although this pattern was reversed in the dry nodes where more low dispersal species established further from the center. Lastly, some of the nodes developed wetter or drier than anticipated, resulting in significantly lower dispersal.

Although some species with higher dispersal potential did establish well beyond the 60-m diameter area surveyed at each node, dispersal from diversity nodes was not a viable strategy to increase species diversity across the site over a 10-year period. However, it was successful in introducing species where little seed was affordable or available in densities that promoted the establishment and expansion of viable populations. These nodes now serve as a focus for seed collection for ongoing introductions elsewhere.

Contact Information: Gary Sullivan, The Wetlands Initiative, 53 W. Jackson Blvd., Suite 1015, Chicago, IL 60604 USA, Phone: 312-922-0777 ext. 115, Fax: 312-922-1823, Email: gsullivan@wetlands-initiative.org

INNOVATIVE IN-STREAM CONTROL METHODOLOGIES FOR REDUCING NONPOINT SOURCE POLLUTION, REDUCING SEDIMENT AND ABATING PHOSPHORUS LOADINGS TO THE GREAT LAKES

Thomas R. Crane, ***Sophie Taddeo****, Gary Overmier* and *Laura Kaminski*
Great Lakes Commission, Ann Arbor, Michigan, USA

The re-emergence of harmful algal blooms (HABs) in the Great Lakes and St. Lawrence River in the last several years is threatening the integrity of the region's water resources. HABs may pose serious risk for human and animal health, and the quality and vitality of aquatic ecosystems. Federal and state governments have become increasingly concerned about nonpoint source pollution, particularly excessive phosphorus, as it appears to be the major contributor to the recent increase in the frequency and severity of HABs throughout the Great Lakes Basin.

Addressing the threat of nonpoint source pollution has required the development of targeted water quality improvement programs at the federal and state level. However, the control of agricultural nonpoint source pollution challenges legislators and land managers both financially and logistically as outcomes of policies are hard to quantify and resources are often limited. Extensive information is thus needed to identify new and cost-effective best management practices (BMPs) and successfully implement them at appropriate locations. Several researchers have evaluated the cost-efficiency and water quality benefits of a variety of individual BMPs, both upland and in-stream, but fewer studies have compared these qualities among a large array of BMP options. This poster presents a comprehensive overview of innovative in-stream BMPs used throughout the United States and Canada to reduce nonpoint source pollution and phosphorus loadings, including riparian buffers, reactive materials, and two-stage ditches. Information is provided on the costs and effectiveness of these innovative technologies and successful implementation examples are presented.

Contact Information: Sophie Taddeo, Great Lakes Commission, 2805 South Industrial Highway, Ann Arbor, MI 48105-6791, USA, Phone: 734-971-9135, Fax: 734-971-9150, Email: sophie.taddeo@mail.mcgill.ca

AN EVERGLADES RESTORATION SUCCESS STORY: THE C-111 WEST SPREADER CANAL PROJECT, FROM CONCEPT TO A WORKING RESTORATION PROJECT

Thomas Teets[1], *Jorge Jaramillo*[2], *Michael Collis*[3], *Dan Kimball*[4]
[1]South Florida Water Management District, West Palm Beach, FL, USA
[2]South Florida Water Management District, West Palm Beach, FL, USA
[3]U.S. Army Corps of Engineers, Jacksonville, FL, USA
[4]Everglades National Park, Homestead, FL, USA

The C-111 Spreader Canal Project is one of the key projects that make up the Comprehensive Everglades Restoration Plan (CERP). It is the first CERP project constructed with direct benefit to Everglades National Park (ENP) and Florida Bay. The path the project took from conceptual idea to a fully constructed operational restoration project differed from the standard Corps of Engineers' Civil Works process for most CERP projects, but resulted in the timely completion of an important Everglades restoration project. The concept of the C-111 Spreader Canal Project was initially developed during the formulation of CERP that was submitted to Congress in April 1999. Water Resources Development Act (WRDA) 2000 approved CERP as a framework for restoration of the South Florida Ecosystem. In addition, ten projects were conditionally authorized of which the C-111 Spreader Canal project was one, highlighting its importance.

The C-111 canal in south Miami-Dade County is the southernmost canal in the Central and South Florida (C&SF) Project. The canal historically served its authorized purpose providing flood protection. Unfortunately it had devastating impacts to the coastal and southern ecosystems. Impacts include damaging point source discharges to Manatee Bay, over drainage of the Model Lands, Southern Glades and ENP, particularly Taylor Slough resulting in reduced flows to Florida Bay. The objectives of the C-111 Spreader Canal Project were to correct these problems while continuing to provide flood protection and other purposes of the C&SF Project.

The initial conceptual design focused on redirecting water flowing down the C-111 eastward into a spreader canal system across the northern portion of the Model Lands and the Southern Glades. As the more detailed planning began it became evident that the original concept did not meet the objectives, particularly improving flows to Taylor Slough and Florida Bay. In addition, there was a need for a more effective venue to receive public input. Public workshops sponsored by SFWMD were held which helped to refine the design to meet the objectives as well as identify areas of flood protection uncertainties. Due to uncertainties related to the eastern area the project was split into two parts. The reformulated Western C-111 Spreader Canal Project Project Implementation Report was completed in January 2011. Due to the important benefits of this project the SFWMD expedited construction, prior to Congressional authorization. A hydraulic ridge was created reducing drainage from ENP by way of two detention areas with pump stations in the Frog Pond and Aerojet Canal areas. Construction by SFWMD was completed December 2011 and operated during Tropical Storm Isaac resulting in reduced harmful discharges to Manatee Bay and improving flows in ENP's Taylor Slough and Florida Bay.

<u>Contact Information</u>: Thomas Teets, Office of Federal Policy and Coordination, South Florida Water Management District, PO Box 24680, West Palm Beach, FL 33416 USA, Phone: 561-682-6993, FAX: 561-682-5780, Email: tteets@sfwmd.gov

EVERGLADES DEPTH ESTIMATION NETWORK (EDEN): INTEGRATING REAL-TIME NETWORKS TO PROVIDE HYDROLOGIC DATA FOR THE RESTORATION OF THE EVERGLADES

Heather Henkel[1], *Paul Conrads*[2] and ***Pamela Telis***[3]
[1]U.S. Geological Survey, Coastal and Marine Science Center, St. Petersburg, FL, USA
[2]U.S. Geological Survey, South Carolina Water Science Center, Columbia, SC, USA
[3]U.S. Geological Survey, Florida Water Science Center, Jacksonville, FL, USA

Successful restoration of the Everglades depends on restoring or approximating the former natural volume, timing, and distribution of wetland sheetflow and the corresponding response of the ecosystem. The Everglades Depth Estimation Network (EDEN) is critical to this process. A network of over 280 real-time water-level gages is maintained by multiple State and Federal agencies including the South Florida Water Management District, the U.S. Geological Survey (USGS), Everglades National Park, and Big Cypress National Preserve. The real-time water-level data are integrated with ground-elevation and real-time water-surface modeling. This integration provides scientists and managers with on-line water-depth information from 1991 to the present for the entire freshwater portion of the greater Everglades. Made available on a 400-square-meter grid spacing, EDEN offers a consistent and documented dataset that can be applied by scientists and managers to guide large-scale field operations; to integrate hydrologic and ecological responses; and to support biological and ecological assessments. The data will help measure ecosystem response for the implementation of the Comprehensive Everglades Restoration Plan.

Data from the multiple agencies are combined in the USGS National Water Information System (NWIS) database and then served real-time by NWISweb to scientists, managers, and the public. The water-level surfaces are posted on EDENweb (http://sofia.usgs.gov/eden). By combining the daily water-level surfaces with the ground-elevation model and using the accompanying EDEN applications, a full suite of hydrologic data is made available that includes: water depth, hydroperiod (computation of days since last dry), and water-surface slope. Animations include surface water elevation and water depth over time, and transects of water depth over time. EDEN's computations of these important ecological drivers provide scientists with the data necessary to examine landscape and trophic-level responses to hydrodynamic changes in the Everglades. In addition, EDENweb serves as a portal to NWISweb for all the EDEN gages. Challenges in integrating data from four agencies and in establishing, prototyping, and maintaining the EDEN network will be presented.

Contact Information: Heather Henkel, U.S. Geological Survey, 600 Fourth Street South, St. Petersburg, FL 33701 USA, Phone: 727-803-8747 x3028, Email: hhenkel@usgs.gov

REAL-TIME EVALUATION OF THE WATER-CONTROL PLAN AND ITS IMPACTS ON TREE ISLANDS IN THE FLORIDA EVERGLADES

Pamela Telis[1], *Bryan McCloskey*[2] and *Paul Conrads*[3]
[1]USGS Florida Water Science Center, Jacksonville, FL, USA
[2]USGS St. Petersburg Coastal and Marine Science Center, St. Petersburg, FL, USA
[3]USGS South Carolina Water Science Center, Columbia, SC, USA

In fall 2012, the Everglades Restoration Transition Plan (ERTP), a new water-control plan for the Central and South Florida Project, will replace the Interim Operational Plan (IOP). These water-control plans primarily regulate water levels in the Everglades for wildlife resource management and in the surrounding urban areas for flood management. Local Indian tribes have used tree islands in the Everglades for burial sites of human remains and funerary objects and have expressed strong objection to unnatural inundation of tree islands under the ERTP or future Everglades ecosystem restoration. At the request of local tribes, an application was developed that allows real-time evaluation of ERTP water levels at and near tree islands using the Everglades Depth Estimation Network (EDEN).

EDEN is an integrated network of real-time water-level gages, computer models, and web-accessible applications that generate daily water-level maps and derived hydrologic data for the freshwater part of the Greater Everglades. The EDEN data will be used to monitor water levels during the ERTP period and to compare those water levels with the water levels that occurred during the IOP period (July 2002 through initiation of ERTP in 2012) in Water Conservation Areas 3A and 3B and Everglades National Park.

Two approaches are used to compare water levels in the Everglades from the ERTP and the IOP periods, one for measured water levels at marsh gages and the other for modeled water levels at tree islands. For each month, non-exceedance probabilities for specified percentiles are plotted for daily water levels. For example, the 90th percentile water level for May indicates that all days in May during the IOP were that value or less 90 percent of the time. When the current water level during ERTP is plotted over the percentile plot, the user can compare the current water level with the statistical probabilities during IOP. For the case of tree islands, the current water level can also be compared with the maximum ground elevation to monitor when overtopping conditions occur.

A daily email notification informs stakeholders when current water levels reach specified elevations at one or more gages or tree islands. An alert is triggered for a gage when the water-level elevation equals or exceeds the 90th percentile water level for the IOP period. An additional alert is triggered for tree islands when the water level equals or exceeds the maximum tree-island ground elevation. Water managers can use these plots to document the anticipated changes in water levels under ERTP and make operational changes when necessary.

Contact Information: Pamela A. Telis, U.S. Geological Survey, Florida Water Science Center, Jacksonville, FL 32207 USA, Phone: 904-232-2602, Email: patelis@usgs.gov

SANTA ANA RIVER ARUNDO REMOVAL PROJECT: ONE PIECE OF A MUCH LARGER INVASIVE SPECIES PUZZLE

Lindsay Teunis[1] and *Hayley Lovan*[2]
[1]AECOM, Ecological and Environmental Planning Practice, San Diego, CA, USA
[2]U.S. Army Corps of Engineers, Los Angeles District, Los Angeles, CA USA

As with most Southern California watersheds, the Santa Ana River has been inundated with noxious invasive species such as *Arundo donax* (giant reed), *Tamarix* spp. (tamarisk), and *Lepidium latifolium* (perennial pepperweed), in addition to other invasive annuals. Each of these invasives represents a unique set of problems to the watershed, including modified fire regimes, water draw down, exclusion of native plants, and lack of wildlife habitat. Unlike many of its neighboring watersheds, for over two decades the Santa Ana River has been part of an aggressive program designed to tackle the enhancement of the river. A portion of the work has been funded by the U.S. Army Corps of Engineers as mitigation for impacts to riparian and floodplain habitat resulting from flood control efforts. This presentation focuses on a 250-acre invasives removal project that began in 2009—one of the latest puzzle pieces in the Santa Ana River enhancement effort. An overview of the target noxious species will be provided. The results following initial arundo biomass treatment and our overall restoration approach to meeting success standards will be described, including passive and active restoration. Our comprehensive habitat monitoring program will be reviewed, which includes monthly bird surveys, endangered species monitoring, qualitative vegetation monitoring, and an assessment of stream condition using the California Rapid Assessment Method (CRAM). Of particular note are the ongoing challenges and the adaptations made by the team to continue restoration, including complex field conditions, opportunistic invasive species, and the delicate balance between human use and ecological integrity in urbanized Southern California.

Contact Information: Lindsay Teunis, AECOM, Ecological and Environmental Planning Practice, 1420 Kettner Blvd. Suite 500, San Diego, CA 92101 USA, Phone: 619-233-1454, Fax 619-233-0952, Email: Lindsay.teunis@aecom.com

ECOSYSTEM RESTORATION IN THE LOWER COLUMBIA RIVER AND ESTUARY: THE ROLE OF THE EXPERT REGIONAL TECHNICAL GROUP

Ronald Thom[1], *Dan Bottom*[2], *Greg Hood*[3], *Kim Jones*[4] and *Kirk Kruger*[5]
[1]Pacific Northwest National Laboratory, Sequim, WA, USA
[2]National Marine Fisheries Service, Newport, OR, USA
[3]Skagit River System Cooperative, LaConner, WA, USA
[4]Oregon State Department Fish and Wildlife, Corvallis, OR, USA
[5]Washington State Department Fish and Wildlife, Olympia, WA, USA

The 2008 Biological Opinion on operation of the Federal Columbia River Power System called for the establishment of an Expert Regional Technical Group (ERTG) to assign salmon survival benefits to juvenile salmon from habitat restoration actions proposed in the lower Columbia River and estuary (LCRE). In 2009, five ERTG members, with demonstrated expertise in habitat restoration, estuarine ecology and fisheries biology, were selected. The ERTG worked with the Steering Committee (i.e., Corps of Engineers, Bonneville Power Administration, NOAA) to standardize the process for project evaluation to ensure repeatability and transparency for assigning juvenile survival benefit units (SBU's). To accomplish this, the ERTG developed the following elements: (1) the *ERTG Template for LCRE Habitat Restoration Projects* to be used by project proponents that includes all of the evaluation criteria that must be addressed by the applicant; (2) *ERTG Scoring Criteria*, which defines the criteria and the scoring process – criteria categories include the (a) opportunity for fish to access or be served by the project, (b) capacity of the project to support salmonids, and (c) the probability that the project will meet its goals; (3) algorithm for calculating SBUs described in *History and Development of a Method to Assign Survival Benefit Units*; and, (4) guidance documents for those wishing to better understand the ERTG process including *Feedback on Inputs to the Calculator to Assign Survival Benefit Units* and *Guidance on Estuary Module Actions and Subactions Relevant to the ERTG Process.* The "Calculator" is a simple model that transforms scores into the survival 'lift' for juveniles provided by the project. However, because there is presently no empirical way to determine how many additional fish survive because of a project, the calculator utilizes surrogate factors (capacity and quality) to develop SBUs. The evaluation process can be revised based on new science findings. In order to have a project scored, the steering committee initially decides which projects are carried forward through the process. This step can involve a preliminary review by the ERTG, and the project proponent can have a dialog with the ERTG that may help refine the project design. The project template is then prepared, a field trip to the site is held, and a presentation to the ERTG is made. Finally, the ERTG scores are submitted to the 'Calculator' where the SBU's are assigned. A summary report is developed that justifies project scores. At some point following construction, final SBU's will be assigned based on the performance of the project. The ERTG process appears to be effective in organizing, reviewing and scoring projects, as well as providing values of SBU's required by the Biological Opinion. Twenty-seven projects were evaluated and scored during its initial phase between June 2009 and June 2012. Independent science panel reviews were positive about the process. Through the adaptive management framework under the broader Columbia Estuary Ecosystem Restoration Program (CEERP), data on the performance of projects will be used to design and evaluate new projects.

Contact Information: Ronald Thom, Marine Sciences Laboratory, Pacific Northwest National Laboratory, Sequim, WA 98382, Phone: 360-681-3657, Fax: 360-681-3681, Email: ron.thom@pnnl.gov

DEFINING COASTAL MARSH RESTORATION SUCCESS UNDER ACCELERATED SEA-LEVEL RISE CONDITIONS

Cassondra Thomas
Cardno ENTRIX, New Orleans, LA, USA

Restoration projects set goals for determining if the project has been successful or if further mitigation is warranted. Criteria are usually based on structural aspects such as vegetation repopulation that can usually be met over short time frames (1-5 years). But more recently, functional criteria such as belowground organic matter accumulation are being proposed for assessing restoration success. However, return of function, especially for coastal wetlands restoration projects, can occur over much long time frames (50 years) making success determination difficult. In addition, the coastal system is highly dynamic and subject to extreme pulsed (hurricanes) and pressed (accelerated sea-level rise) stressors. A 50-year time frame for goal setting may be unrealistic when accelerated sea-level rise may convert a coastal marsh to open water regardless of any restoration efforts.

While attainment of structural goals is ecologically unsatisfying, from a resource management perspective, it becomes important to focus restoration success goals on the impetuous for the project. For many coastal restoration projects, shoreline protection is the underlying driver. Therefore, prevention of marsh erosion and encouragement of marsh surface accretion become the obvious functional goals from which to determine the project's success. Both of these processes are dependent upon the combination of sedimentation and plant productivity above- and belowground. These processes can be assessed on shorter time frames than other functional parameters like increased soil carbon levels. These two processes can also be actively managed during the restoration project with such activities as wrack removal and bioturbating crab exclusion (depending on project acreage). Focused functional restoration goals in combination with active management can lead to greater coastal marsh restoration success under accelerated sea-level rise conditions.

Contact Information: Cassondra Thomas, Cardno ENTRIX, 3850 N. Causeway, Suite 1130, Metairie, LA 70002 USA, Phone: 504-526-1104 , Fax: 504-526-1080 , Email: Cassondra.Thomas@Cardno.com

ENVISIONING A NEW RIVER FUTURE WITH GREATER SOCIETAL AND WILDLIFE BENEFITS

***Brad Thompson**, Randy Behm, and Dave Crane*
U.S. Army Corps of Engineers- Omaha District, Omaha, Nebraska, USA

In 2011, the Missouri River swelled and overran its banks from a flood event unmatched since the US Army Corps of engineers (Corps) began keeping flood records in 1898. The 2011 flood was triggered by the melting of record snowfall in the Rocky Mountains of Montana and Wyoming coupled with near record spring rainfall in the upper Great Plains. System runoff resulted in the filling of the six reservoirs and reservoir releases nearly 2.5 times higher than prior record flows. Significant damages occurred to the existing levee system located along the Missouri River, from Omaha, NE to Kansas City, MO.

After the 2011 event, levee rehabilitation took the form of typical levee repairs in many areas. Public Law 84-99 enables the Corps to provide emergency assistance to levee districts and communities in the form of post-flood levee repair. Levee setbacks aren't the typical PL 84-99 repair activity, but the massive flood event triggered a need to seek more innovative approaches to rehabilitating the severely damaged levee system. Many levee repairs required small (~30 acres on average) off-sets to the existing levee alignments; but in two areas on levee system L-575 large-scale levee setbacks were constructed. These setbacks occurred in Fremont County, IA between river miles 566-555. The "Iowa Highway-2" setback reconnected approximately 757 acres of historic floodplain, bringing the new total of riverward floodplain to 1,465 acres in this area. Another large setback, the "1185" setback, reconnected approximately 1,100 acres of historic floodplain, bringing the new total of riverward floodplain to 2,098 acres in this area. The Iowa Highway-2 setback will reduce the stage of the 100-year flood event by 1.5 feet near Highway-2 connecting Nebraska and Iowa, which was the most constrictive water conveyance point on the Missouri River. The 1185 setback is located across the river from Nebraska's Omaha Public Power District coal power plant and will allow the power plant to experience lower flood stages and safer operating conditions during future floods.

The sand, clay, and top soil required for construction came largely from land owned by the Corps of Engineers in the immediate vicinity of the setbacks. Over 300 acres of borrow pits, from which this material was mined, were graded and seeded to create wetland habitat areas. Through 2018, Corps of Engineers biologists will monitor these areas to ensure wetland establishment occurs.

Contact Information: Brad Thompson, U.S. Army Corps of Engineers, 1616 Capitol Ave., Omaha, NE 68102, USA, Phone: 402-995-2678; Email: bradley.e.thompson@usace.army.mil

Randy Behm, U.S. Army Corps of Engineers, 1616 Capitol Ave., Omaha, NE 68102, USA, Phone: 402-995-2322; Email: Randall.L.Behm@usace.army.mil

Dave Crane, U.S. Army Corps of Engineers, 1616 Capitol Ave., Omaha, NE 68102, USA, Phone: 402-995-2676; Email: david.j.crane@usace.army.mil

THE WALK-A-WAY SYSTEM: A MULTI-BENEFIT PLANTING REGIME FOR RIVERINE RESTORATION SITES.

Mike Thompson[1], *Dan Dey*[2], *John Kabrick*[2] and *Michael Gold*[2]
[1]Wetlands Forever, Inc., Bartelso, IL, USA
[2]Establishing Oaks in Big River Floodplains

Riverine and wetland restoration planting sites success rates have difficult obstacles to overcome. Dynamic site conditions affect success, such as hydrology, soil, landscape, plant quality and planting practices. The Walk-A-Way System provides restoration professionals with a system to address difficult restoration sites, both in design and adaptive management.

The "Walk-A-Way" system supports a restoration project fact “Sites get little or no attention after planting”. The Walk-A-Way planting system extends plant growth beyond easy reach of browsing deer, floodwaters, and vegetative competition. The multi-step sequence of the Walk-A-Way Planting System includes ground preparation; cover crop establishment; high quality tree establishment and protection barrier placement.

The Walk-A-Way system with its high survival rates, plant material with accelerated growth rate, and earlier maturation improves your project economic performance. Based on specifications for planting bottomland hardwoods at 40-50 trees/acre and utilizing an air-root pruned plant product, the Walk-Away-System can canopy one acre compared with hundreds of bare root seedlings in less time and with increased diversity. Instead of taking 20 years to produce acorns, air root pruned species like white oak fruit early! Early fruiting equates to increased wildlife food sources; improved chance for natural regeneration, and ultimately a successful restoration site.

Air root pruned products produce a vastly improved root system which results in better utilization of water and nutrients through the life of the plant. These trees give you superior plant survivability; accelerated growth rate; early fruiting and flowering. An example of air root pruned trees can be found at Forrest Keeling Nursery, Root Production Method (RPM) products. Results are improved transplant ability; increased planting success; faster biologic benefits; increased carbon sequestration; and overall project cost savings.

“Planting trees can be problematic in floodplains and riparian areas because of intense competition from herbaceous and woody plants, animal herbivory and browsing, and flooding and saturated soils. Overall, we found RPM seedlings had greater survival and growth than bare root seedlings. We suspect that this is because the RPM seedlings are larger, have bigger root systems and, thus are more competitive when out-planted. This finding is consistent with other oak plantings in uplands, where larger seedlings with bigger root systems had greater survival and growth than smaller seedlings.”

<u>Contact Information</u>: Mike Thompson, Wetlands Forever, Inc, Bartelso, IL 62218 USA, Phone: 618-204-0199,
Email: mthompson@fknursery.com

ADVANCING URBAN WATERSHED RENEWAL THROUGH THE BENEFITS OF MULTI-PURPOSE STREAM AND RIVERINE RESTORATION PROJECTS

Joel Tillery[1], *Kevin Middlebrooks*[2] and *Doug Baughman*[2]
[1]CH2M HILL, New Orleans, LA, USA
[2]CH2M HILL, Atlanta, GA, USA

Although the need for stream and riverine restoration to address historical and on-going degradation is significant, the available funding for these costly restoration projects remains very limited. The demands on local governments and resource managers for infrastructure improvements, flood risk management, water quality improvement, and stormwater permit compliance have also continued to increase. Across the country there are a number of examples where stream and riverine restoration efforts have been integrated with other economic development, recreation, and stormwater management elements to meet multiple objectives and leverage available funding. This paper provides a summary of several examples of where multi-purpose restoration projects were developed on major rivers and small streams across the southeast including projects on the Arkansas River in Oklahoma, the Chattahoochee River in Georgia, and several small streams (< 20 sq mile watersheds) in the piedmont region of Georgia. Each of the projects includes some additional community-focused elements ranging from small parks and walking trails to major whitewater venues. For the projects in the smaller watersheds, stormwater best management practices are closely integrated with the community features through the use of low impact development techniques (rain gardens, bioretention areas, permeable pavers) to improve hydrologic conditions and water quality in the receiving stream. Two of the projects also included off-stream best management practices (i.e., regional detention facilities) to further attenuate peak discharge from storm flows thereby reducing flood risk. The benefits of this approach are clear - it promotes awareness about conservation of these resources and develops citizen support for the restoration to leverage multiple funding sources to meet environmental goals and community needs, and, as a result, develops political support for continued restoration activities.

Contact Information: Joel Tillery, P.E, CH2M HILL, Lakeway One, 3900 N. Causeway Blvd, Metairie, LA 70002, USA.
Phone 504-832-9508. Email: joel.tillery@ch2m.com

KINNICKINNIC RIVER: REHABILITATION IN AN URBAN WATERSHED

Stuart C. Trabant[1], *Michael D. Harvey*[1], *Robert A. Mussetter*[1] and *David Fowler*[2]
[1]Tetra Tech, Inc., Fort Collins, CO, USA
[2]Milwaukee Metropolitan Sewerage District, Milwaukee, WI, USA

The Kinnickinnic River drains a 97 percent urbanized, 24-square-mile basin that is tributary to Lake Michigan within the boundaries of the City of Milwaukee. Currently, 38 percent of the channels in the Kinnickinnic River watershed are concrete lined, 25 percent are in closed conduits and 37 percent are unlined and eroding as a result of increased storm volume due to the increase in impervious area, increased peak flows and reduced sediment supply due to the watershed development. (Estimated 2-year peak flows increased from about 330 cfs under pre-development conditions to over 3,800 cfs under existing conditions, and 100-year peak flows increased from about 860 cfs to over 9,600 cfs). Many of the concrete-lined, supercritical flow channel segments that were constructed in the 1960s and 1970s no longer convey the 100-year design discharge (9,640 cfs at the USGS gage near S. 11th Street). Additionally, deterioration of the concrete and the desire to improve both river corridor aesthetics and ecological function, while continuing to provide appropriate levels of flood protection has motivated the Milwaukee Metropolitan Sewerage District (MMSD) to investigate replacement of the concrete-lined channels.

Tetra Tech Inc. assessed the existing physical, hydraulic and stability characteristics of the channels and developed conceptual designs for meeting the flood conveyance, channel stability, aesthetic and ecological goals through channel rehabilitation. The assessment involved geomorphic, hydrologic, hydraulic, and sediment-transport modeling and analyses of the channels and watershed. A field-based inventory of the 26 miles of channel within the watershed was conducted and all of the field data and photographs were incorporated into an ArcGIS database. Hydrologic (HSPF) and hydraulic (HEC-RAS) models were developed to assess channel capacities and provide hydraulic information for analysis of channel stability and sediment transport within the system. The results of the geomorphic, hydraulic and sediment-transport analyses were used to identify erosional and depositional problem areas and a priority listing of existing opportunities for river stabilization, rehabilitation, and enhancement. Recommended rehabilitation along the Kinnickinnic River included a rock-lined channel that incorporates (1) a sinuous low-flow channel (capacity equal to the 0.1 exceedence percentage flow on the mean daily flow-duration curve), flanked by narrow benches that will convey the 100-year peak flow with 1 foot of freeboard while supporting riparian vegetation, and (2) vertical variability that provides pool and riffle habitat for fish migrating upstream from the lake.

Contact Information: Stuart C. Trabant, Tetra Tech, Inc., 3801 Automation Way, Suite 100, Fort Collins, CO 80525 USA, Phone: 970-223-9600, Fax: 970-223-7171, Email: stu.trabant@tetratech.com

MULTIDISCIPLINARY STREAM RESTORATION OF NORTH CLEAR CREEK

Stuart C. Trabant*,* *Robert A. Mussetter* and *Michael Pierce*
Tetra Tech, Inc., Fort Collins, CO, USA

The State Highway 119/Main Street South project is a collaborative effort led by the Colorado Department of Transportation (CDOT) to design the highway corridor along the approximately 1-mile reach of the North Clear Creek valley bottom downstream (southeast) from the City of Blackhawk, CO. As part of this project, Tetra Tech developed a stream restoration design for the approximately 1.5-mile reach of North Clear Creek that will be affected by the project. The project reach is a canyon-bound stream that has been significantly impacted by historic mining activates and is located within the Central City/Clear Creek U.S. Environmental Protection Agency Superfund Site. Key objectives of the restoration design included lateral and vertical channel stability, enhanced aquatic and riparian habitat (especially for salmonid species), improved water quality, and aesthetic and recreational improvements. The design was developed to accommodate the highway improvements, pedestrian pathways, offsite drainage systems and water treatment plant facilities. Additional considerations included scour protection for infrastructure, conservation of historical mining features, slope stability and protection, and preservation of existing vegetation.

To develop the design, Tetra Tech performed a geomorphic field assessment of the project reach to evaluate the lateral and vertical stability of the existing channel and to identify the location of sediment sources. Available flood information was obtained and evaluated to quantify the range of frequently occurring flows that are most important to channel process and stability, and served as the basis for the design. A hydraulic model was developed to evaluate the hydraulic characteristics of the existing channel, and this model was then modified to represent a range of alternatives under design conditions. The results from these models were used as input to a sediment-transport analysis to assess the sediment transport balance through the project reach under existing and project conditions, and this information was used to design the planform, gradient and specific restoration features. The final design included relocation of the existing channel to accommodate the roadway, with variable bankfull channel geometry to convey flows up to about the 2-year peak flow. Numerous features were incorporated in the design to improve lateral and vertical stability, while improving aquatic and riparian habitat. The design required close coordination with the landscape architects to ensure floodplain stability, re-vegetation of the banks and overbanks, and proper hydraulic and hydrologic connectivity to the constructed wetlands, while preserving the desired aesthetic and habitat values.

Contact Information: Stuart C. Trabant, Tetra Tech, Inc., Fort Collins, CO 80525 USA, Phone: 970-223-9600, Fax: 970-223-7171, Email: stu.trabant@tetratech.com

LINKING MULTI-SCALAR STREAM MONITORING EFFORTS AND ANALYSES WITHIN A BIOPHYSICAL CONTEXT TO INFORM HABITAT RESTORATION

Nadine Trahan
Gaiaspatial, Washington D.C., USA

Considerations of fish and habitat responses to stream restoration activities will be most informative if appraised within site specific biophysical contexts at appropriate spatio-temporal scales. This requires the collection, analysis and presentation of geospatial data describing baseline and changed environmental conditions as well as some conceptual model within which multi-scalar biological and physical relationships can be appraised.

The River Styles framework is a geomorphological framework comprising such a conceptual model as well as a set of procedures to guide a four stage implementation, of which the first has been completed and will be presented here. This stage conducts a catchment-wide baseline survey of river character and behavior, classifying reaches into types to set the baseline biophysical context, by relating manifested structure to multi-scalar environmental processes, to which restoration responses are related.

Stream monitoring data representing an array of biological and physical attributes at various scales have been integrated into a GIS based River Styles classification for the Asotin watershed. The Asotin watershed is one of several Intensively Monitored Watershed (IMW) projects in the Pacific Northwest established to assess the effect of restoration actions on salmonid production at the watershed scale. Riparian enhancement and large woody debris additions are the active restoration treatments in the Asotin IMW. At the sub-catchment to reach scale, riparian enhancement treatments include a mix of short and longer term measures ranging from fencing, selective thinning, plantings and encouragement of a more diverse age and species structure along the corridor. At the reach to habitat unit scale, intensive additions of high densities dynamic woody structures (DWS) were installed to initiate and promote creation, shaping and maintenance of active bar and pool habitat by fluvial processes. Results of the trial phase of these restoration projects are presented in terms of the multi-scalar relationships inherent in 1) the inherent form-process associations of these streams, 2) expected responses from the restoration efforts and 3) actual responses identified via this monitoring and assessment framework.

Contact Information: Nadine Trahan, Gaiaspatial, Washington, D.C., Phone: 337-255-6952, Email: nadinetrahan@gmail.com

AFTER A DECADE OF PLANNING, BAIR ISLAND RESTORATION AT FULL STEAM

Dilip R. Trivedi[1], *Eric Mruz*[2], *Steve Carroll*[3] and *Lisa Stallings*[4]
[1]Moffatt & Nichol, Walnut Creek, CA, USA
[2]Don Edwards San Francisco Bay National Wildlife Refuge, Newark, CA, USA
[3]Ducks Unlimited, Vallejo, CA, USA
[4]Lifescience Inc!, Oakland, CA. USA

Bair Island is a 2,600 acre former salt pond that is part of the Don Edwards San Francisco Bay National Wildlife Refuge, the largest urban wildlife refuge in the United States. It is a haven for shorebirds, harbor seals, endangered clapper rails and salt marsh harvest mice, and once included thousands of acres of unspoiled tidal salt marsh and mudflats. An important part of South Bay ecology, environmentalists fought for decades to protect and restore Bair Island, which culminated in the purchase of the islands in 1997 with federal, state, and private funds that allowed it to be saved from landfill and development.

Local governments, environmental groups, private industry, regulatory and resource agencies, and non-profit agencies worked collaboratively to create a balanced project that received the support of all parties. Innovative contracting techniques to leverage market economics, combined with practical engineering, allowed restoration to commence within 1 year of finalizing Environmental Studies. Individual project phases were created such that various restoration elements could be implemented via discrete funding streams. The availability of material from local navigation projects and upland construction projects was leveraged such that about 1 million cubic yards of material was placed to raise grades without any cost to the restoration project.

With the economy coming to a standstill in 2008, the American Recovery & Reinvestment Act funded construction of several restoration elements that required creative re-design and contracting strategies to overcome logistical and hydraulics-related challenges. Flow control structures and diversions, coupled with public access improvements and infrastructure upgrades, were designed and constructed such that restoration could continue.

The final phases of construction are presently underway and the anticipated finish date of the restoration project is 2014. Several lessons were learned along the way, and the construction of the project is now serving as a template for the thousands of acres of restoration that is in various stages of planning and design in San Francisco Bay.

Contact Information: Dilip R. Trivedi, Dr.Eng., P.E., Moffatt & Nichol, 2185 N California Blvd., Walnut Creek, CA 94596 USA, Phone: 925-944-5411, Fax: 925-944-4732, Email: dtrivedi@moffatnichol.com

S.M.A.R.T. PLANNING IN U.S. ARMY CORPS OF ENGINEERS' RESTORATION PLANNING

Jeff Trulick
U.S. Army Corps of Engineers HQ, Washington, DC, USA

The U.S. Army Corps of Engineers (USACE) has aquatic ecosystem restoration as one of our priority mission areas for our Civil Works Program. As with any of our missions, we have a project planning phase to demonstrate the feasibility of a project with various criteria under economics, engineering and environmental acceptability. Over time, project planning has sometimes resulted in sprawling studies and expensive data collection to judge project feasibility. As part of the Civil Works Transformation effort, the USACE has developed the S.M.A.R.T. Planning initiative to reinvent the process by which we judge feasibility and obtain Congressional authorization for project implementation. What this means for our field practitioners is making decisions while tolerating a bit more risk than they may have in past studies. This also means our project partners and stakeholders may also have less detail than they may have grown used to in past studies. While it remains imperative that the USACE base its planning decisions and recommendations on the best available data, we must also make decisions while cognizant of time and money. Balancing tolerable risk with efficient decision making is the heart of the S.M.A.R.T. Planning initiative. This presentation will discuss potential policy and technical issues when deploying S.M A.R.T. Planning during a feasibility study, specifically on aquatic ecosystem restoration projects.

Contact Information : Jeff Trulick, U.S. Army Corps of Engineers HQ, 441 G Street, NW Washington, DC 20314 USA, Phone 202-761-1380 Fax: 202-7615698 Email: jeff.trulick@usace.army.mil

A REPORT CARD TO ASSESS ECOSYSTEM HEALTH OF THE GULF OF MEXICO

Larry D. McKinney[1], *William Dennison*[2], *Jack Gentile*[3], *Mark A. Harwell*[4], *Heath Kelsey*[2] and ***Wes Tunnell***[1]
[1]Harte Research Institute, Texas A&M-Corpus Christi, Corpus Christi, TX, USA
[2]University of Maryland Center for Environmental Science, Cambridge, MD, USA
[3]Harwell Gentile & Associates, LC, Cape Cod, MA, USA
[4]Harwell Gentile & Associates, LC, Port Orange, FL, USA

There is an urgent need for a graphical representation of the environmental condition of the Gulf of Mexico that is scientifically based, widely accessible, and readily understandable by policy-makers, stakeholders, scientists, and, most importantly, the American public. Because of the scale and complexity of the Gulf, achieving a healthy and sustainable Gulf of Mexico will require an extensive, sustained national effort that addresses not only the consequences of the Deep Water Horizon oil spill and the suite of devastating storms such as Hurricanes Katrina, Rita, and Ike, but also the myriad of other impacts on the Gulf from human activities and natural processes.

To capture the effects of these and many other pressures impinging on the Gulf, we have developed a conceptual framework for a Gulf of Mexico Report Card that is unequaled in the world in its scope and potential utility. We have recently surveyed several existing environmental report cards and assessed their conceptual foundations. Two basic approaches exist: one based on the Drivers-Pressures-State-Impacts-Response construct, aimed especially at synthesizing scientific indicators to inform decision-makers; and the other based on the ecological risk assessment framework, focused on the cause-effects relationships between environmental stressors and ecological effects, and aimed especially at the scientific and risk-assessment communities. Our team has integrated these two approaches to create a new Drivers-Pressures-Stressors-State-Impacts-Response (DPSSIR) conceptual framework, designed not only to reach decision-makers and stakeholders, but also to guide and focus scientific research on identifying and addressing the most important risks to the ecosystem. Moreover, the DPSSIR framework is organized hierarchically into several tiers of information, providing the structure for connecting the extensive datasets generated by scientific research and monitoring to the more integrative, synthetic metrics that effectively communicate the condition of the Gulf ecosystems.

This structure allows, for example, an elected official to ask why the health of her/his state is as it is, and being provided with the appropriate information from the more detailed, lower layers that indicate what Pressures and Stressors are of primary concern, and what may be appropriate policy and management Responses to mitigate the Pressures of concern. At the other end of the spectrum, this conceptual framework can help scientists identify uncertainties in those aspects that matter the most to the health of the ecosystem, and then allocate resources towards those studies that will best reduce uncertainties and improve critical understanding of the ecosystem.

Contact Information: Larry D. McKinney, Harte Research Institute, Texas A&M University-Corpus Christi, Corpus Christi, TX 78412 USA, Phone: 361-825-2070, Fax: 361-825-2050, Email: larry.mckinney@tamucc.edu

NOVEL ECOSYSTEMS CONCEPT – IT'S TIME TO GET REAL!

Summary: The purpose of this session is to enable dialogue around the concept of "novel ecosystems" application to large-scale restoration efforts. Restoration evokes the increasingly untenable notion that an ecosystem can be returned to some previous state and raises the subsidiary question of the date of the original condition. The world is changing at an ever-increasing and unprecedented rate and in multiple ways. Many large-scale ecosystem restoration efforts struggle with defining the goal of restoration because they continue to be trapped in the model of restoring to a previous static state. Aiming to restore to a "pristine" or "natural" state leads managers to ignore prior human impact and further exacerbates the human-nature dualism that has resulted in our current environmental state. Returning a system to even a semblance of a historic state is and will continue to be difficult. We need to approach large-scale ecosystem restoration programs with an eye to the future and managing for future change. Focusing on an uncertain past and future has created a tremendous paradox for ecosystem restoration and has stalled much needed intervention while the discussions ensue. Defining the interventions needed for the ecosystem and governance systems continue to challenge our nation. This panel discussion will define the concept of "novel ecosystems" and discuss application of the concept in several case studies and provide an overview of the work USDA NRCS has accomplished on Ecological Site Descriptions (ESD) as a decision support tool for better land restoration and management decisions.

Tentative Agenda: (1.5 hours)

15 min: Introductions and context setting for panel discussion
45 min: Panel discussion on the concept and application of "novel ecosystems" in restoration
30 min: Audience Q&A

Intended Audience: This session is relevant to the entire interdisciplinary team that works on large-scale ecosystem restoration programs. Bringing a different conceptual model to the table for ecosystem restoration implementation will be invaluable. The exchange of ideas and actual application experience will be priceless.

Session Organizer:

Cheryl P. Ulrich, PE
Weston Solutions, Inc
329 8th Street
Atlantic Beach, FL 32233
904 248 8275 (Office)
cheryl.ulrich@westonsolutions.com

Qualification of Organizer:

Ms. Ulrich is currently the Leader for Southern Division's Natural Resource Management Team which includes the geographical area of TX, LA, GA, AL, FL, LA, NC and SC for Weston Solutions, Inc. Ms Ulrich has over 20 years of experience managing large, complex civil works projects for the U.S. Army Corps of Engineers. Her last ten years with USACE was in a senior leadership position for Everglades Restoration. Ms. Ulrich has a Masters degree in Civil Engineering from University of California at Berkeley and Bachelors degree in Civil Engineering from University of Florida. She is a registered professional engineer in the State of Florida and on the Board of Directors for the Society for Ecological Restoration.

Panel Participants:

Name	Contact Information
Prof Richard J Hobbs	Australian Laureate Fellow School of Plant Biology The University of Western Australia 35 Stirling Highway Crawley, WA 6009, Australia richard.hobbs@uwa.edu.au Phone +61 8 6488 4691 Fax +61 8 6488 1108
Lauren Hallett	University of California, Berkeley Department of Environmental Science, Policy & Management University of California Berkeley 130 Mulford Hall #3144 Berkeley, CA 94720 Graduate Student lauren.m.hallett@gmail.com 510 642-1334
Keith Bowers, FASLA, RLA, PWS	Biohabitats, President 2120 Noisette Blvd, Suite 106B North Charleston, SC 29405 kbowers@biohabitats.com 843-529-3235
Susan Andrews	NRCS National Leader Soil Quality and Ecosystems at the National Soil Survey Center in Lincoln, NB susan.andrews@lin.usda.gov Office (402) 437-5687 Cell (402) 617-9774

PLANTING TIME AND AERIAL APPLICATION OF SMOOTH CORDGRASS SEED FOR RAPID REVEGETATION OF NEWLY CONSTRUCTED COASTAL MARSHES

Herry Utomo[1], *Ida Wenefrida*[1] and *Cassidy LeJeune*[2]
[1]Rice Research Station, LSU AgCenter, Crowley, LA, USA
[2]Department of Wildlife and Fisheries, New Iberia, LA, USA

Restoring Louisiana's coastal marshes is critical. During the 20th century, more than 1,800 square miles of coastal Louisiana were lost to erosion and subsidence. Without effective intervention, by 2050, another 500 square miles will be lost. One of the strategies to reverse the current coastal land loss is by creating protective terraces and new marshes. Sediment harvested from adjacent open-water sources or pumped from sea or river bottoms miles away is used strategically for constructing terrace fields, re-establishing lake rims, and creating emergent marsh areas. The size of current individual marsh-creation projects has typically ranged from approximately 200 to 700 acres. Marsh-creation projects are being implemented on an even larger scale through other restoration programs, including state-funded projects, the Clean Water Act Compensatory Mitigation Program, and the U.S. Army Corps of Engineers' Beneficial Use of Dredged Material Program, which has created more than 27,000 acres of marsh. In addition, recent state and federal comprehensive coastal planning efforts have evaluated restoration alternatives that would include tens of thousands of acres of marsh creation using dredged sediments in the near future. Developing a technology for rapid re-vegetation is crucial to support the current marsh construction projects. Direct seeding of smooth cordgrass using an airplane and airboat can be used to develop vegetation rapidly to stabilize the newly constructed marshes.

The objective of this 3-year study was to determine the most optimum time of aerial planting. The plane was calibrated by adjusting a hopper opening at a given air speed to deliver seed at the rate of 10, 20, and 30 pounds per acre. Each seeded area was a 40- by 1,000-foot strip separated by a 56-foot unplanted area. Aerial application led to an average density of 10, 22, and 32 viable seeds per square foot, corresponding closely to seeding rates of 10, 20, and 30 pounds per acre. Results indicated that direct planting can be done in the Spring (April to June) and early Fall (first week of October). An additional series of plantings is being conducted through winter and early spring. This series of planting date studies will provide a guide on how late and how early aerial seeding can be carried out in Louisiana coastal marshes.

Contact Information: Herry Utomo, Rice Research Station, LSU AgCenter, Crowley, LA, USA. Phone: 337-788-7531, Fax: 337-788-7553, Email: hutomo@agcenter.lsu.edu.

A BASIN-WIDE GREAT LAKES COASTAL WETLAND MONITORING PROGRAM

Donald G. Uzarski[1], *Matthew J. Cooper*[2], *Valerie J. Brady*[3], *Gary A. Lamberti*[2] , *Terry N. Brown*[3], *Douglas A. Wilcox*[4] and *Lucinda B. Johnson*[3]

[1]Institute for Great Lakes Research, CMU Biological Station, Department of Biology, Central Michigan University, Mount Pleasant, MI, USA
[2]Department of Biological Sciences, University of Notre Dame, Notre Dame, IN, USA
[3]Natural Resources Research Institute, University of Minnesota, Duluth, MN, USA
[4]College at Brockport, Brockport, NY, USA

The Great Lakes Coastal Wetlands Consortium was formed in 2000. The purpose of the consortium was to develop a basin-wide monitoring plan to determine the status and trends of ecosystem health of all Great Lakes coastal wetlands using indices of biotic integrity. The consortium was made up of 150 scientists, managers, and policy makers representing 50 US and Canadian organizations. The plan was finalized in 2008, and implementation for preservation and restoration purposes began in 2010. Chemical and physical parameters, vegetation, invertebrate, fish, amphibian, and bird data are being collected from randomly selected Great Lakes coastal wetlands across the basin using standardized protocols. This stratified random design was intended to inform future protection and restoration efforts. However, additional wetlands designated to receive protection or restoration funds were also sampled to evaluate the success of these efforts. Great Lakes Restoration Initiative (GLRI) programs and projects have much to gain from research as well as monitoring components and our project has been able to assume these responsibilities where applicable.

Contact Information: Donald G. Uzarski, Institute for Great Lakes Research, CMU Biological Station, Department of Biology, Central Michigan University, Brooks 127, Mount Pleasant, MI 48859. Telephone: 989-774-2505. Email: Uzars1dg@cmich.edu

CHANGE IS HARD: RESTORING STRUCTURE AND FUNCTION IN URBAN LANDSCAPES

*Brook D. Herman, **Frank M. Veraldi*** and *Robbie Sliwinski*
U.S. Army Corps of Engineers, Chicago, IL, USA

Ecological restoration has traditionally focused on restoring ecological function and structure that was lost as a result of human activities. The replacement system is then designed and implemented based on conditions that were thought to occur before human disturbance. Urban ecological restoration presents a different kind of challenge. Urban areas are considered to be socio-ecological systems, whereby the structure and function is heavily influenced by human needs and values. As a result, ecological restoration within urban areas often result in novel ecosystems and involve complex social interactions that need to be addressed during all project phases.

The U. S. Army Corps of Engineers, Chicago District, is involved with numerous ecosystem restoration projects in and adjacent to highly populated areas. I will use three projects, Eugene Field, 63rd Street Dune and Beach and Orland Tract Grassland, to elucidate the challenges and opportunities that are common to urban restoration projects. The first challenge is setting sustainable and acceptable restoration goals and objectives within highly altered landscapes, which may result in novel and yet tremendously beneficial habitat types. Eugene Field was a mix of open mowed areas and baseball fields. However, it is located along the Chicago River, making it a natural addition to the limited riparian habitat within the City of Chicago. Goals of this project included removal of fill covering a remnant wetland, installation of a rich savanna habitat within buffer areas containing older park trees and riffles within the channel of the Chicago River. The second issue is writing feasible construction performance criteria. It is critical to understand the sometimes conflicting timelines of natural succession and construction contract length limitations. The project located along the City of Chicago's Lake Michigan shoreline, called 63rd Street Dune and Beach, will be used to discuss the installation of thousands of live plant plugs at the same time attempting to control multiple invasive species. The last, and possibly most important, are the issues surrounding public perceptions of ecosystem restoration projects. Events that occurred during all three projects will be reviewed, ranging from tree removal, prescribed burning and conversion of open space to native vegetation. These events will be reviewed in the context of each project, the subsequent response of the project team and possible methods to improve early and sustained communications between the project team and interested groups and individuals. In conclusion, urban ecosystem restoration projects present unique challenges, but also novel opportunities.

Contact Information: Brook D. Herman, Chicago District, U.S. Army Corps of Engineers, 111 N. Canal St., Suite 600, Chicago, IL 60606 USA, Phone: 312-860-0122, Fax: 312-8862891, Email: brook.d.herman@usace.army.mil

REGIONAL SEDIMENT BUDGET AND SHORELINE RESTORATION ALTERNATIVES

Dan Veriotti[1] and *Erin Flanagan*[2]
[1]Baird and Associates, Chicago, IL, USA
[2]National Park Service, Denver, CO, USA

Regional Sediment Management (RSM) is a planning concept used to develop management objectives and action plans for nearshore, riverine and estuarine sediment within natural systems, such as Lake Michigan. Effective management requires broad participation from stakeholders and a study boundary definition based on the natural limits of sediment movement, not defined by geo-political boundaries. The U.S. Army Corps of Engineers (USACE) Chicago and Detroit Districts with Baird evaluated various alternatives to the existing dredging and beach nourishment practices at Michigan City Harbor, Indiana, within the context of RSM. The ultimate goal is to formulate a final Dredge Material Management Plan (DMMP) that utilizes environmentally sound dredging / placement practices and respects the ideology of RSM. A project partnership was created in 2010 between the National Park Service (NPS) and USACE Chicago District to evaluate shoreline restoration alternatives for the Indiana Dunes National Lakeshore (IDNL) shoreline located in a High Erosion Hazard Area. The Michigan City study data and findings were leveraged for Indiana Dunes. Additional updated shoreline evolution data was combined with sediment transport computer modeling throughout a larger regional area. The presentation will describe the updated analysis results and discuss the engineering guidance for evaluating potential measures that can be applied to create a stable shoreline and healthy Coastal nearshore habitat opportunities within the project area on a large scale.

Contact Information: Dan Veriotti, Baird and Associates, 125 S. Wacker Drive, Suite 300, Chicago IL 60606, USA, Phone: 312-893-5442, Fax: 312-893-5505, Email: dveriotti@baird.com

ADAPTIVE MANAGEMENT: LOXAHATCHEE MITIGATION BANK, A PUBLIC PRIVATE CONTRACTUAL RELATIONSHIP

Patrick Zuloaga and ***Georgia Vince***
Tetra Tech, Inc., Stuart, FL, USA

The Loxahatchee Mitigation Bank is a 1,256 acre parcel located in Palm Beach County, Florida. The Bank occurs within the ecologically significant East Coast Buffer adjacent to the Arthur R. Marshall Loxahatchee National Wildlife Refuge. The creation of the Bank results in large-scale restoration of degraded wetlands within the historic limits of the Florida Everglades.

In 1993, the Florida Legislature directed the Florida Department of Environmental Protection and Water Management Districts (WMD) to adopt rules governing the creation and use of mitigation banks. The legislature encouraged each WMD to develop two mitigation banks within their jurisdiction. The South Florida Water Management District (SFWMD) launched its mitigation banking program in January 1995, advertising a Request for Proposals (RFP) to develop, implement, and manage the Loxahatchee Mitigation Bank. The WMD ultimately signed a contract with a Tetra Tech to construct, operate and manage the mitigation bank.

A significant part of the RFP was that the successful bidder was required to implement the management plan prepared by the SFWMD, with no opportunity to change the plan. Between 1995 and 2009, a significant amount of data was collected, but there was a lack of significant restoration success. In 2009 it was determined that it was time to take another look at the plan to determine whether changes could be made to enhance restoration success. Subsequent actions, mandated in the revised plan as approved by the federal and state regulatory agencies, have advanced the progress at the Loxahatchee Mitigation Bank and resulted in significant improvements in the site restoration goals and successful implementation of a program that has become an award winning example of habitat restoration in South Florida.

This presentation will address the challenges faced in restoring a 1,256 acre parcel, including pre-restoration condition assessments, adaptive management, large scale successful wetland restoration, and continuing efforts to restore a substantial South Florida ecosystem to its natural state.

Contact Information: Georgia Vince, Tetra Tech, Inc. 759 South Federal Highway, Suite 314, Stuart, FL 34994, Phone: 772-781-3441, Email: Georgia.vince@tetratech.com

GROUPS DON'T ACT, INDIVIDUALS DO: BUILDING A CERTIFICATION PROGRAM

Carrie Vollmer-Sanders
The Nature Conservancy, Angola, IN, USA

When faced with large scale problems, like the water quality concerns in the western basin of Lake Erie, there are a number of stakeholders with varying values and goals. With the complexities of the issues, data, inputs and stakeholders, Lake Erie's water quality problems could be referred to as a wicked problem. Convening these broad stakeholders is not conducted often, if ever. Even within the agricultural industry the lenders, crop consultants, farmers, landowners, machinery dealers, fertilizer applicators, fertilizer salesmen do not meet to discuss agricultural matters. Convening the agricultural stakeholders is exactly what had to happen to begin to at least partially address this wicked problem in the Western Lake Erie basin.

While wicked problems may never be completely solved, the agricultural industry with leadership from the conservation community, have begun to take steps to lessen the water quality problems. This effort to establish a nutrient certification program for crop nutrient advisers and applicators began with people wanting to work together rather than at each other. These individuals were from a broad stakeholder group with no single person designing the program.

You will learn the process employed to build the commitment from stakeholders and design the nutrient certification program for agricultural service providers and how this dynamic could be recreated. If common goals are agreed upon, they can be reached even if individuals have differing values. Conservation groups, farmer groups, industry groups and government agencies do not initiate change to solve problems; individuals that work for or represent those companies/organizations do.

Contact Information: Carrie Vollmer-Sanders, Western Lake Erie Basin, The Nature Conservancy, 330 Intertech Parkway, Suite 110, Angola, IN 46703, USA, Phone: 260-665-9141, Fax: 260-665-9141, Email: csanders@tnc.org

ECOSYSTEM RESTORATION VIA PASSAGE OF LAKE STURGEON AT FIVE HYDROELECTRIC DAMS ON THE MENOMINEE RIVER

J.E. Waldrip[1], *C.A. Tomichek*[2] and *M.J. Donahue*[3]
[1]Kleinschmidt Associates, Lexington, SC, USA
[2]Kleinschmidt Associates, Essex, CT, USA
[3]URS Corporation, Southfield, MI, USA

The Menominee River forms the border between northeastern Wisconsin and the southwestern end of the Upper Peninsula of Michigan. The Menominee River is a major tributary of Lake Michigan and historically one of the largest spawning and rearing rivers for lake sturgeon. The long term goal for lake sturgeon management in the Menominee River has been to provide free passage of lake sturgeon throughout their historical range.

Great Lakes Fishery and Ecosystem Restoration, or GLFER, is the primary program of the U.S. Army Corps of Engineers (USACE) for implementing on-the-ground projects for restoration of fish and wildlife habitat in the Great Lakes basin. In direct response to the Water Resources Development Act (WRDA) of 2000, and in light of growing concern regarding the need to improve lake sturgeon recruitment and population growth in Lake Michigan, the USACE initiated a study to investigate the feasibility of safely conveying sturgeon upstream and downstream of the first five hydroelectric dams on the Menominee River to restore connectivity of historical spawning and rearing habitat.

This feasibility study was undertaken for USACE (Detroit District) by a Joint Venture involving URS Corporation and Baird and Associates. Kleisnschmidt Associates served as the principal subconsultant for the study. The project team consisted of engineers, fishery biologists, and regulatory specialists, all working together to analyze numerous upstream and downstream fish passage measures. Some of the fish passage measures that were considered are fish elevators, nature-like fishways, vertical slot fishways, close spaced trashracks, angled bar racks, louver structures, exclusion nets, induced flow devices, surface bypasses, submerged bypasses, pipeline bypass, and truck and transport methods. To determine the preferred fish passage alternative at each dam site, the project team reviewed a number of screening criteria including: potential fish passage effectiveness, potential impact on existing hydro operations, estimated construction cost, estimated operations and maintenance cost, potential flood impacts, potential impact on water quality, potential impact on aquatic and terrestrial habitat, potential for issues with hazardous waste, and potential for historical/cultural resource issues.

Each site provided unique challenges that were evaluated by the project team. This presentation will highlight the engineering analysis, biological analysis, economic analysis, regulatory review, and stakeholder engagement that went into this large scale multi-project fish passage feasibility study.

Contact Information: Jesse E. Waldrip, Kleinschmidt Associates, 204 Caughman Farm Lane, Suite 301, Lexington, South Carolina 29072 USA, Phone: 207-416-1256, Fax: 207-487-3124, Email: jesse.waldrip@kleinschmidtusa.com

NEW LONDON DAM RECONSTRUCTION

Martin J. Weber
Stanley Consultants, Inc., Minneapolis, Minnesota, USA

The impoundment formed by New London Dam, Lake Monongalia, has been and remains the focal point of the area. Lake Monongalia literally “wraps” around the City of New London and provides for fishing, boating, swimming, canoeing, and kayaking. The lake provides water for a Minnesota Department of Natural Resources fish hatchery where tons of walleye are reared annually. Visitors entering the City are greeted with signs that read, *“Welcome to New London – City on the Pond”*. The Minnesota Department of Natural Resources (DNR) owns, operates and maintains the New London Dam. The high-hazard dam had been on the DNR’s wish-list for renovation since the 1990’s due to deficiencies including substandard embankment stability, undesirable seepage, and insufficient spillway capacity. In addition, the dam’s outlet works were not reliable and strained operations staff. Failure of the dam would likely lead to loss of life and would undoubtedly lead to severe ecosystem and socio-economic impacts. Simply removing the dam was not an option as this would reduce Lake Monongalia to mud flats and eliminate what had been the identity of the city for nearly 150 years.

Stanley Consultants was integral to the three-phase project development process from inception through completion. Feasibility and alternatives analyses resulted in the selection of a “labyrinth” type fixed crest weir that occupies very little space and eliminates the need for frequent gate adjustments to maintain the lake at its desired level.

The existing ecosystem was protected and preserved through environmentally sensitive social, economic, and sustainable designs. Such designs included river and lake protection measures during construction, maintaining river flows during construction, ADA accessibility, recreation trails and portage route, State Historic Preservation Office (SHPO) recordation, re-use and double use of construction materials. The former outlet works structure was constructed of large granite masonry blocks. Demolition of the outlet works was performed in a manner that salvages the blocks which were cleaned and re-used as benches/landscape features adjacent to the new portage route. The new dam features black iron fencing and architectural enhanced concrete (river rock appearance) for improved aesthetics.

The project won the 2012 American Council of Engineering Companies (ACEC of Minnesota) *Grand Award* and Minnesota Society of Professional Engineers (MSPE) *Seven Wonders of Engineering Project of the Year Award*.

Contact Information: Martin J. Weber, P.E., Stanley Consultants, Inc., 5775 Wayzata Blvd., #300, Minneapolis, MN 55416, Phone: 952.738.4332, Fax: 952.546.4279, Email: webermartin@stanleygroup.com

APPLYING A RIVER VISION TO GUIDE RESTORATION OF TRIBAL FIRST FOODS IN WATERSHEDS OF NORTHEAST OREGON AND SOUTHEAST WASHINGTON USA

Eric J. Quaempts and *Scott J. O'Daniel* *Presented by:* ***James Webster***
Confederated Tribes of The Umatilla, Dept. of Natural Resources, Pendleton, OR, USA

The Confederated Tribes of the Umatilla Indian Reservation's (CTUIR) Department of Natural Resources (DNR) has developed a Rivervision to guide the restoration of CTUIR First Foods across the Tribes ceded rivers in SE Washington and NE Oregon, an area totaling 16,989 km^2. The vision defines restoration success in the context of traditional foods, or "First Foods," and sustained tribal use thereof. The cultural recognition of First Foods is evident in the ritualistic serving order of native species in a traditional meal. The geographic and temporal pattern of First Foods gathering is directly reflected in the serving order. The serving order is one example where traditional culture reflects a systematic spatial and temporal representation found in the landscape. Further, the CTUIR Rivervision combines the role of traditional cultural practices with contemporary science to reinforce the First Foods paradigm. Thus, ecosystem restoration requires a holistic vision that ensures management efforts return ecosystem products (First Foods) to the tribal community.

Our vision defines a healthy river as one capable of providing First Foods in support of tribal culture, and requires a dynamic river with self-sustaining and interactive physical and biological processes. Five vision touchstones inform restoration priorities, project design, and physical and biological response monitoring. A floodplain restoration project in Meacham Creek, an anadromous tributary to the Umatilla River in NE Oregon, provides an example of vision application.

Contact Information: E.Quaempts, Confederated Tribes of the Umatilla Indian Reservation, Dept. of Natural Resources, 46411 Timine Way, Pendleton, OR 97801 USA, Phone: 541-276-3447, Fax: 541-429-7229, Email: ericquaempts@ctuir.org

FLOODPLAIN RESTORATION USING A RIVERVISION APPROACH IN MEACHAM CREEK, OREGON USA.

James G. Webster*, Scott J. O'Daniel* and *Eric Quaempts*
Confederated Tribes of The Umatilla, Dept. of Natural Resources, Pendleton, OR, USA

Productive fish populations and natural water quality conditions depend on functioning floodplain processes. The Umatilla Rivervision, developed under guidance of the Confederated Tribes of the Umatilla Indian Reservation's (CTUIR) Department of Natural Resources' (DNR) First Foods Concept, defines a functional river as a dynamic environment that incorporates and expresses ecological processes that continue the natural production of First Foods used by the Tribal community. The Rivervision provides direction for restoration by focusing on the five touchstones of hydrology, geomorphology, connectivity, riparian vegetation, and aquatic biota. Operating under this guidance, projects are planned, designed, implemented, and monitored across the usual and accustomed harvesting areas to achieve fish habitat restoration goals. These touchstones help to categorize functions of the riverine ecosystem and relate limiting factors to prescribed treatments.

We present an example application of Rivervision concepts in a stream restoration project on Meacham Creek, a tributary to the Umatilla River watershed in northeast Oregon. Limiting conditions for culturally important fish species, Spring Chinook and Summer Steelhead, in Meacham Creek were identified through an assessment of watershed conditions and identification of suppressed watershed processes. Specific conditions addressed through recent project activities have included floodplain disconnection by existing levees, stream channel and aquatic habitat simplification, and riparian vegetation removal. Restoration actions were designed to address those factors and developed into an implementation plan that is being applied over several phases. As parts of the plan have been completed, monitoring information is showing successful results in achieving intended objectives and improving conditions that support important First Food species.

Contact Information: James Webster, Confederated Tribes of the Umatilla Indian Reservation, Dept. of Natural Resources, 46411 Timine Way, Pendleton, OR 97801 USA, Phone: 541-429-7240, Fax: 541-429-7240, Email: jameswebster@ctuir.org

ALGAE AND NUTRIENT CONTROL IN THE GREAT LAKES – THE NEED FOR INNOVATIVE REGULATORY APPROACHES

Lyman C. Welch
Alliance for the Great Lakes, Chicago, IL USA

Excessive runoff of phosphorous is one of the leading causes of massive and recurring algal blooms in the Great Lakes when the nearshore waters are overloaded with this essential nutrient. Agricultural sources are typically the major source of phosphorus loadings with urban runoff and discharges from waste water treatment plants also contributing to the problem.

The new 2012 Great Lakes Water Quality Agreement provides a framework for coordinating binational research and monitoring priorities on nutrient control, but implementation is left to domestic laws. In the United States, the US EPA has strongly urged states to implement numeric water quality standards for nutrients like phosphorus. Great Lakes states, with the exception of Wisconsin, have failed to adopt enforceable nutrient water quality standards. Even when standards are instituted, states often lack the regulatory tools necessary to ensure phosphorus reductions from nonpoint pollution sources such as agricultural operations.

The lack of specific numeric criteria contributes to government mandated evaluations of waterbodies that are incomplete and/or inaccurate. The 303(d) Impaired Water list is the primary tool states use to identify waters that do not meet water quality standards for their intended uses. Unfortunately, even in states bordering Lake Erie, the official state impaired waters list does not adequately address the serious algae problems fed by excess phosphorus. If this list is used to prioritize and allocate resources for remediation, then this omission has the potential to divert resources that are needed to address the causes of impairment.

Innovative regulatory approaches are now being used in Wisconsin to address nonpoint nutrient pollution. Under Wisconsin's new phosphorus rule, Clean Water Act "point source" permittees such as sewage plants and industrial facilities may choose a compliance strategy that involves restoring water quality through phosphorus reductions by nonpoint sources in the same watershed. By accounting for reductions of phosphorus from nonpoint sources, water quality limits of the point source dischargers may be relaxed. Permittees who choose this option may avoid high-cost technology upgrades that would not improve water quality on any significant scale. By making the point source community a collaborative partner, this new rule can resolve a shortcoming of the Clean Water Act and drive successful watershed restoration projects.

Four key strategies should be implemented to effectively reduce phosphorus in the Great Lakes: (1) require Great Lakes states to adopt numeric nutrient standards; (2) develop and implement protocols for near-shore monitoring of phosphorus and nutrients in the Great Lakes; (3) list Great Lakes nearshore areas on state impaired waters lists for nutrients and algae; and (4) implement innovative policies to address both nonpoint and point sources of pollution.

Contact Information: Lyman C. Welch, Water Quality Program Director, Alliance for the Great Lakes, 17 N. State Street, Suite 1390, Chicago, IL 60602 USA, Phone: 312.445.9739, Email: lwelch@greatlakes.org

PELLETING AND CHEMICAL AMENDING SEED TREATMENTS FOR IMPROVED VERSATILITY AND SUCCESS RATES OF AERIAL SEEDING IN COASTAL RESTORATION AND EROSION CONTROL

***Ida Wenefrida**, Herry Utomo* and *Steve Linscombe*
Rice Research Station, Louisiana State University Agricultural Center, Crowley, LA, USA

Aerial planting using an airplane or airboat can be used for rapid revegetation in coastal restorations and erosion control efforts. To obtain a maximum level of success, aerial planting of smooth cordgrass (*Spartina alterniflora*) seed must be conducted when weather conditions are at the best. Early spring or late fall has the most suitable conditions for direct planting. Even though the best weather combination (which is very rare) may be obtained, the conditions in the coastal regions change rapidly due to tidal movement, wave action, rain, and wind speed and direction. Unlike in an agriculture system where most critical growing conditions can be optimized, there will be little or nothing at all that can be done to improve the conditions during planting. The capability of seed to adapt to these conditions, therefore, needs to be improved against the spikes of adverse micro temperatures, prolonged lack of moisture, prolonged inundation, high wind, wave energy, and other variables. One strategy that can be applied is by improving the physiological and physical properties of the seed to better respond to less optimum growing conditions and a wide range of environmental fluctuations. Seedling synchronization, faster stem elongation, rapid root anchoring, and improved seedling vigor are critical factors to enhance seed versatility and improve the success rates of aerial seeding.

Smooth cordgrass has elongated seed that is chaffy and relatively light and float on the water. De-husked seed (i.e. its chaff or lemma and palea removed) has specific gravity of 1.1, heavier than saline water. The chaff made of dry pericarp has a low specific gravity and therefore makes the smooth cordgrass seed float. The majority of full seeds remain afloat for 4 to 8 hours while a small portion of full seeds remains floating for 18 hours. The floating property could be part of a natural mechanism to spread and colonize new areas. As a planting tool, aerial seeding must be adequately precise in producing vegetation in the target areas. The seed drift can be minimized by coating or pelleting seed. In addition to adding weight, components with specific functions were incorporated into the seed pelleting. Water attracting materials was added to the pellets to absorb moisture. It helped seed that landed on the higher soil elevation with less exposure to water during low tidal cycles to grow. Tackifier was added to help pelleted seed stick to the soil. Incorporation of pesticides into the seed coat was also effective in controlling mold-induced diseases and the pests causing them, promoting better seedling growth and increasing seedling establishment rates. Seed of smooth cordgrass from the aerial seeding has attracted a large number of local birds to feed on it. The seed is not hard coated and will not survive the bird’s digestive process causing a tremendous seed loss. Coating or pelleting reduces its palatability. Non-toxic bird repellents can also be incorporated into the seed to further reduce its palatability.

Contact Information: Ida Wenefrida, Rice Research Station, Louisiana State University Agricultural Center, Crowley, LA, USA. Phone: 337-788-7531, Fax: 337-788-7553, Email: iwenefrida@agcenter.lsu.edu.

US ARMY CORPS OF ENGINEERS PERSPECTIVE AND EVOLVING ROLE IN LOUISIANA COASTAL RESTORATION

Darrel Broussard *Presented by:* ***Mark Wingate***
U.S. Army Corps of Engineers, New Orleans District, New Orleans, LA, USA

Wetland loss in coastal Louisiana has reached catastrophic proportions, with the equivalent of a football field of wetlands being lost every hour. The disappearance of wetlands threatens the productivity of Louisiana's coastal ecosystem, the economic viability of industries, and the safety of residents along Louisiana's "Working Coast," a marine-resource based economy defined by the interactions of numerous stakeholders engaged in consumptive and non-consumptive uses of coastal resources. Louisiana's "Working Coast" is unique in its scope and scale, with extensive infrastructure needs to serve the oil and gas, and commercial and recreational fishing industries, needs which must be balanced and must exist in harmony with coastal restoration.

The US Army Corps of Engineers' (USACE) large-scale Louisiana ecosystem restoration efforts is the LCA program, which Congress authorized in the Water Resources Development Act (WRDA) of 2007 to include 15 near-term coastal Louisiana restoration projects and a science and technology program intended to resolve coastal restoration uncertainties. USACE and the State of Louisiana have advanced many of these efforts over the past recent years. However, the approval of the 2012 State Master Plan, a $50-billion, 50-year plan to substantially increase flood protection for communities and create a sustainable coast has resulted in the realignment of all coastal ecosystem restoration efforts with the State Master Plan. Anticipated funding from a variety of sources, including Clean Water Act fines and the Natural Resource Damage Assessment (NRDA) process in response to the Deepwater Horizon Oil Spill has also influenced evolving roles for the various ecosystem restoration stakeholders. As a result of these developments, the State has selected to suspend numerous design efforts and studies within the LCA program, opting to independently advance some of the efforts outside of the LCA authority.

This presentation will provide the evolving perspectives and roles of USACE and address various topics related to the development and realignment of a portfolio of restoration projects to be implemented in harmony with the Louisiana "Working Coast." The presentation will include USACE's perspective of issues associated with aligning a shared vision of coastal restoration with the approved 2012 Master Plan, Federal authorization and policy issues, funding sources, and balancing the interests of stakeholders and resources of the Mississippi River associated with large scale coastal restoration projects. The past, current and envisioned role of USACE in coastal restoration will be addressed, as will the USACE perspective of collaboration amongst the stakeholders.

<u>Contact Information</u>: Darrel Broussard, New Orleans District, Corps of Engineers, P.O. Box 60267, New Orleans, LA, Phone: 504-862-2702, Fax: 504-862-2572, Email: Darrel.M.Broussard@uasce.army.mil

LARGER-SCALE AND LONGER-TERM PLANNING TO RESTORE WETLAND ECOSYSTEM SERVICES, INCLUDING BIODIVERSITY SUPPORT AND RESILIENCE

Joy B. Zedler
University of Wisconsin, Madison, WI, USA

Where the ultimate goal is restoration of wetland services, biodiversity, and resilience, the project objectives need to extend beyond "reducing stressors" on site. Without attention to the surrounding watershed, the wetland's ecosystem services, biodiversity support, and resilience will depend on circumstances--where the site is located, its access to water supplies, the nearby habitat, its connectivity with other wetlands, and threats from development. If external stressors are addressed, the potential for restoring ecosystem services will be greater. If not, the vegetation might shift toward unwanted weeds. Weedy sites can provide supporting services other than biodiversity support (e.g., abundant productivity and nutrient cycling); regulatory services (erosion control, improve water quality, and store carbon); provide useful materials (biofuels, other fibers, and some foods), and serve culture (create green space). For small-site projects, restoration proponents should modify the topography and condition the soil to support biota, but not invest heavily in planting seeds or introducing wildlife, as the outcome is likely to be aggressive, invasive species, despite such efforts. Very large sites might provide more services at higher levels, while small sites respond to their context more than to the actions of contractors.

In contrast, operating at the watershed scale, restoration proponents can tackle the most important and basic causes of wetland degradation, namely, impaired hydrology, inflowing contaminants (sediments, nutrients, toxic materials), invasive species, and insufficient fire. And because the impacts of both land-use change and climate change cause these same four stressors for wetlands, a watershed approach can establish strategies that anticipate and compensate for increasing frequency and intensity of extreme weather events, while minimizing or slowing the impacts of development. Problems that watershed approaches might have mitigated include widespread eutrophication and "cattailization" from land-use change (Great Lakes coastal wetlands), extensive invasion by reed canary grass (Wisconsin marshes and sedge meadows), and extreme sedimentation caused by the combination of land-use and climate changes (Tijuana Estuary salt marsh).

Large-scale plans that focus on regulatory needs, such as wetlands under the Clean Water Act and rare species under the Endangered Species Act, lag behind the national need to restore ecosystem services for human well-being. Innovative watershed plans can guide restoration work toward the "most-needy" subwatersheds and priority restorable wetlands. The next generation of watershed plans should address all ecosystems (uplands, wetlands and water bodies), aiming to (a) set aside and manage large reserves where landscapes are still largely intact, integrating human activities that can sustain services by providing biodiversity and resilience; (b) characterize restorable watersheds and prioritize restoration efforts; (c) identify urgently-needed services that working wetlands can provide, but where biodiversity support is difficult to achieve.

Contact Information: Joy B. Zedler, Botany Department and Arboretum, University of Wisconsin, Madison, WI 53706, Phone 608-262-8692, Fax 608-265-9272, Email: jbzedler@wisc.edu

Author Index

Bold numbers indicated presenters

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