

Engineering With Nature



Dr. Todd S. Bridges

**Senior Research Scientist, Environmental Science
Engineer Research and Development Center**

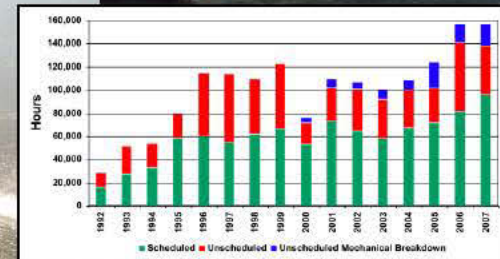
89th CERB Meeting

18-20 September 2012



®

**US Army Corps of Engineers
BUILDING STRONG®**

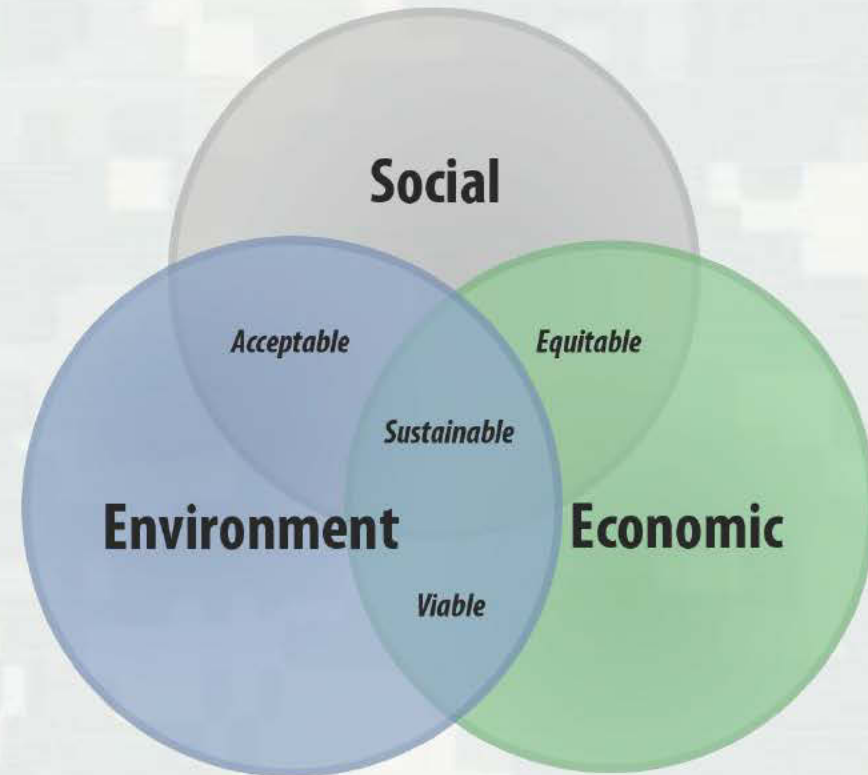


The Challenge:

The Status Quo is Not An Option

The need:

- Efficient, cost effective engineering and operational practices
- More collaboration and cooperation with our partners and stakeholders.
 - ▶ Ports, commercial interests, regulators, NGOs, and others
- Sustainable projects. Triple-win outcomes integrating social, environmental and economic objectives.



Definition

Engineering With Nature is the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental and social benefits through collaborative processes.

Key Ingredients

- Science and engineering that produces operational efficiencies
- Using natural process to maximum benefit
- Broaden and extend the benefits provided by projects
- Science-based collaborative processes to organize and focus interests, stakeholders, and partners



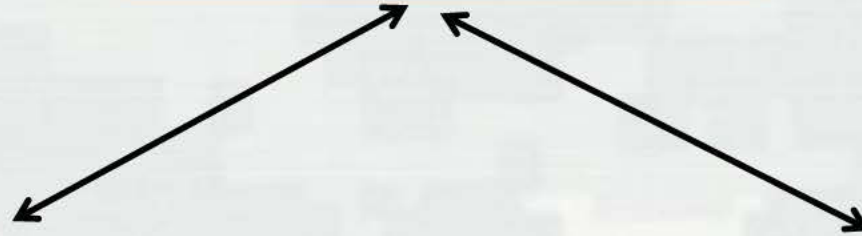
Background

- *Engineering With Nature* initiative was started by USACE Navigation program in 2010. Over that period we have:
 - ▶ Engaged > 200 ind. across USACE Districts (23), Divisions, HQ; other agencies, NGOs, academia, private sector, international collaborators
 - Workshops (9), dialogue sessions, project development teams, etc.
 - ▶ Developed a strategic plan for the initiative
 - ▶ Initiated research to support the intent of EWN
 - ▶ Implementing our communication plan





***Working
with Nature***



***Building
with Nature***



***Engineering
With Nature***



EWN, A Natural Extension of RSM



- EWN- An *ecosystem approach* to infrastructure development and operations
 - ▶ Applied across missions and business lines
 - ▶ Expanding environmental benefits and services provided by infrastructure



Example EWN Solutions



Upper Mississippi River Training Structures: Chevrons



River Bendway Weirs



**Environmentally
Enhanced
Breakwater
Toe Blocks**

Example EWN Solutions

Upper Missouri River Sandbar Habitat

- \$25 Million to construct 650 acres of sandbar
- Buried under 16,000 acres, 2011 flood

July 2009

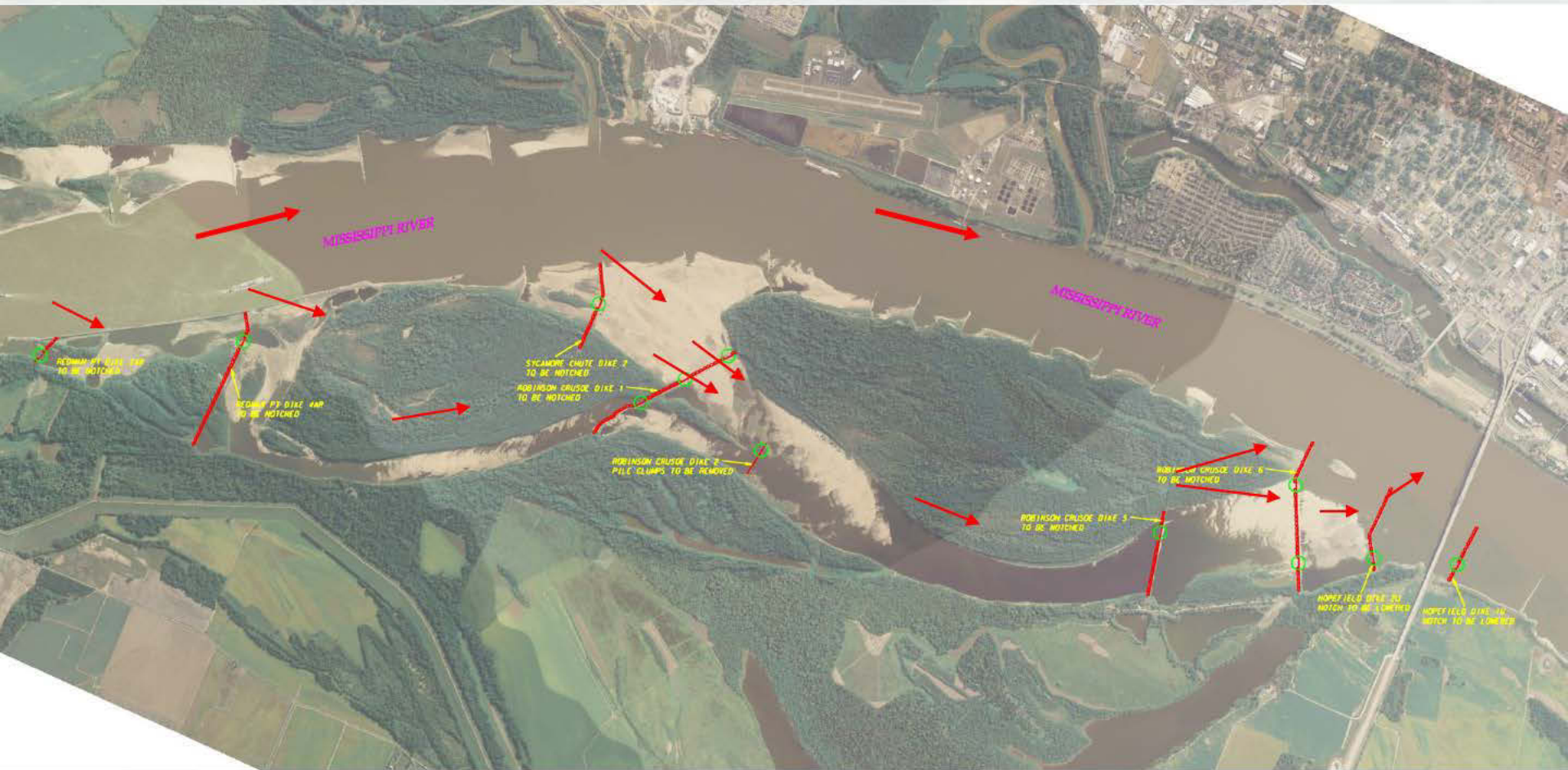


November 2011



Courtesy: G. Pavelka
COE, 2012

Example EWN Solutions

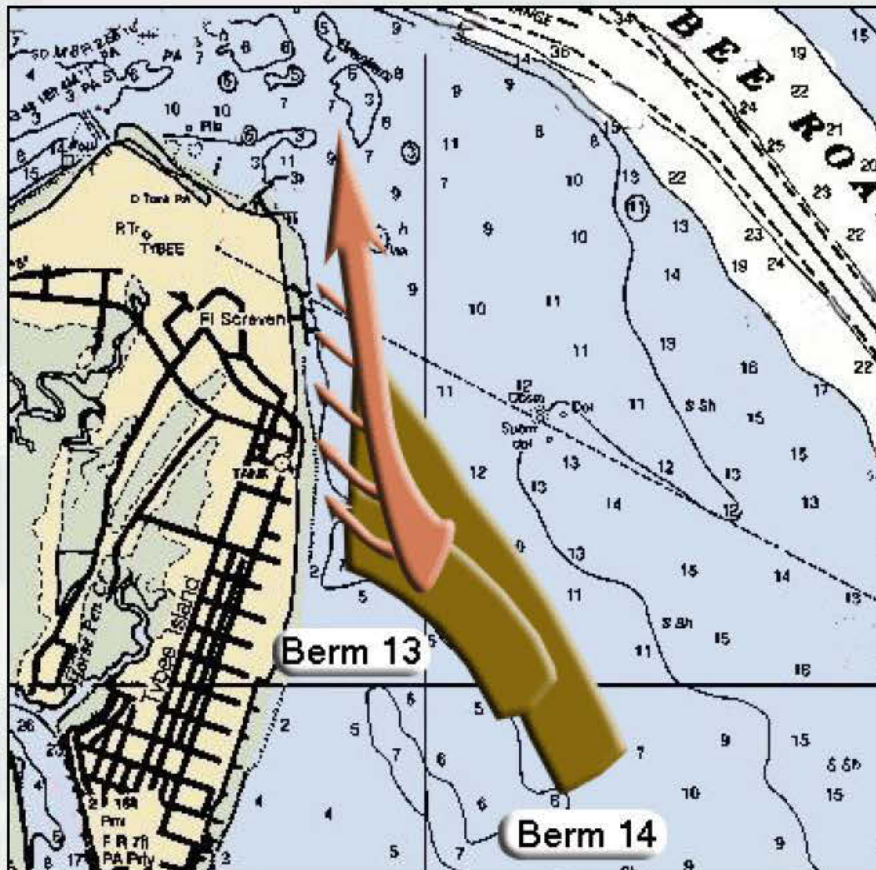


Loosahatchie Bar
Aquatic Habitat Rehabilitation

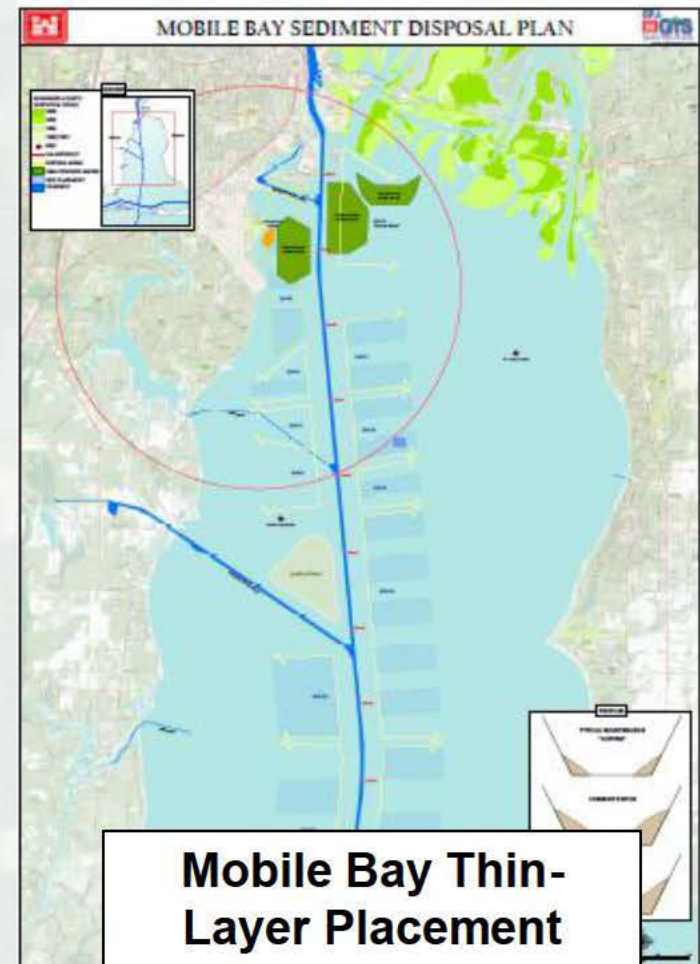


Example EWN Solutions

Strategic Sediment Placement



**North Tybee Island
Savannah, Georgia**



**Mobile Bay Thin-
Layer Placement**

Example EWN Solutions

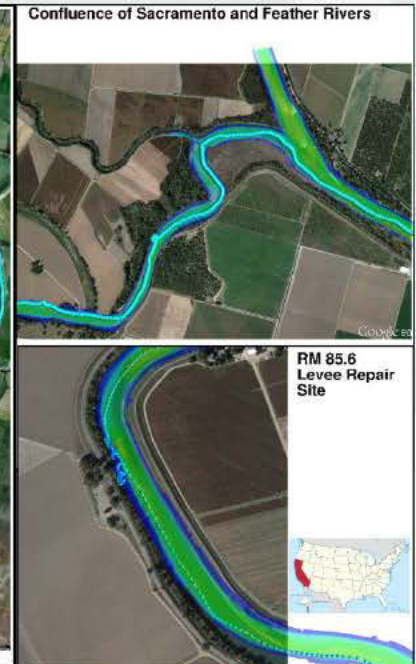
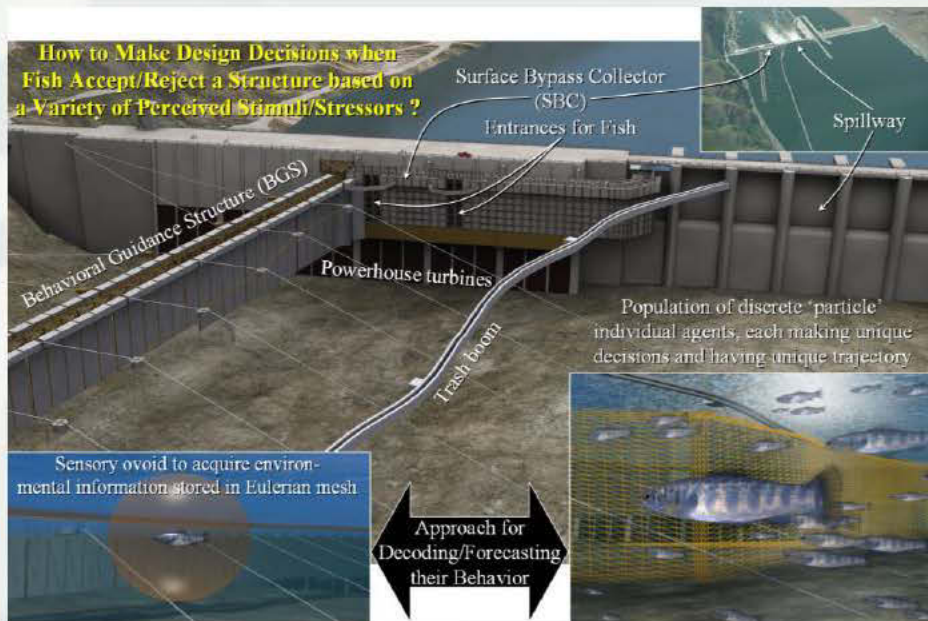
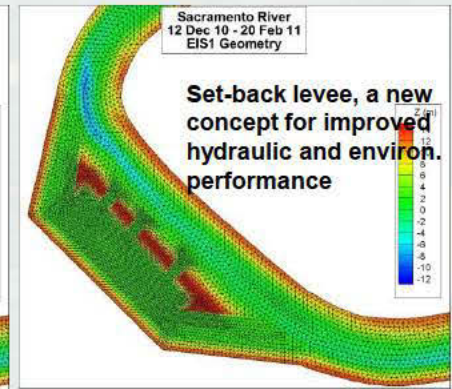
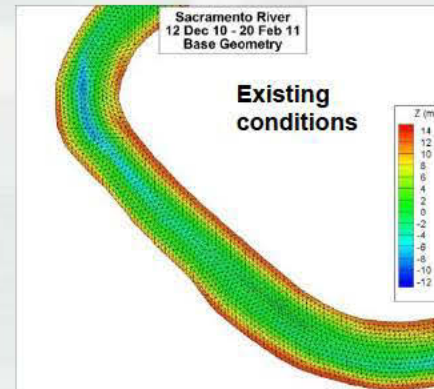
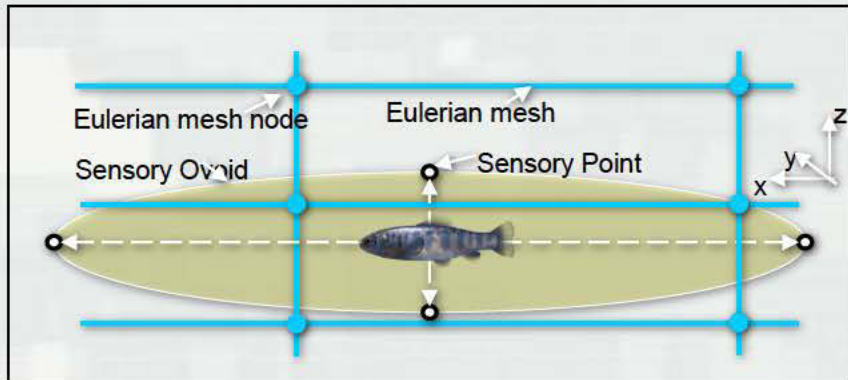


**Long-distance
pumping of
dredged material
for wetlands
creation in coastal
Louisiana, USA**

**• *How to marry LDC
with natural transport
processes to expand
opportunities?***

Example EWN Solutions

Fish Modeling in the Columbia and Sacramento Rivers



EWN for Coastal Resilience

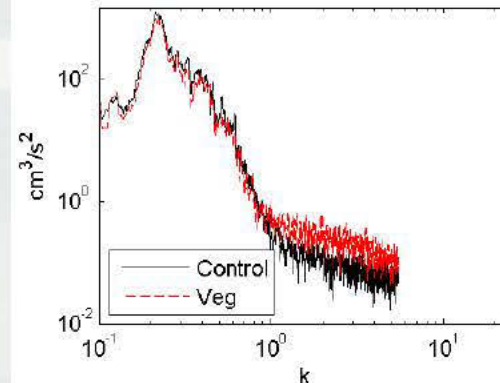
DOER-EMRRP research collaboration to improve the efficiency of engineering and operational practices, expand and extend project benefits, and improve the resilience and sustainability of coastal systems under climate change.

Field Research Activities:

- Wetland primary productivity
- Sediment processes
 - ▶ Cohesive sediment settling
 - ▶ Sediment resuspension
 - ▶ Marsh platform erosion

Laboratory Analyses:

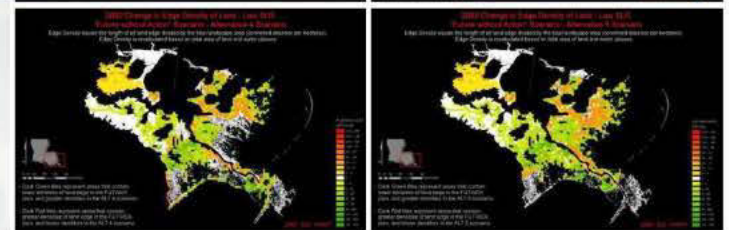
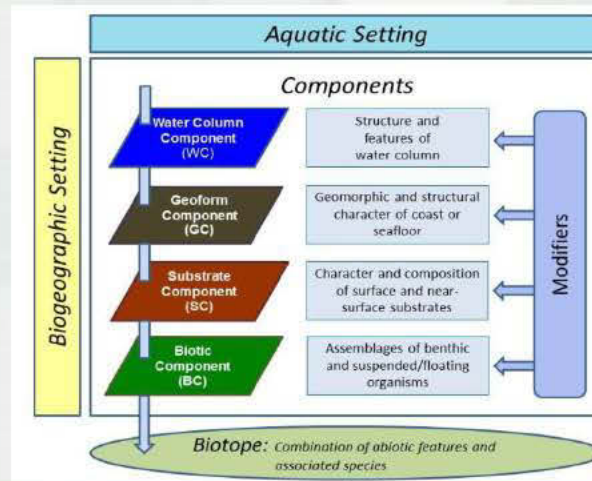
- Transport in vegetation
- Wave energy transformation



EWN for Coastal Resilience

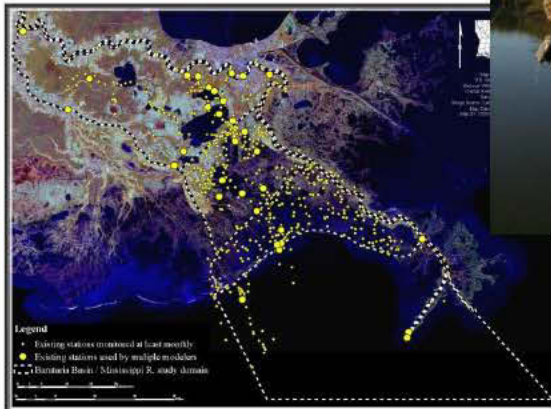
Products

- Classification system
- Conceptual Models
- Web portal
- Enhanced numerical models & tools
 - ▶ PTM/LTFATE
 - ▶ SLAMM
 - ▶ SAND
 - ▶ D2M2



Collaborative Efforts

- Primary productivity and marsh accretion (USGS NWRC)
- Sediment bulk density and sediment transport (NRCS & USFWS)
- SLAMM improvements (Audubon, USFWS, & Maryland)



Example R&D Targets for EWN

- Improved modeling systems that engage users, stakeholders and decision-makers
- Understanding critical, fundamental processes
 - ▶ E.g., sediment transport through wetlands, fish and wildlife responses to engineered features, engineering performance of environmental structures
- Reliable, cost-efficient monitoring technologies for measuring environmental outcomes
- Coastal engineering/infrastructure producing benefits for the environment, and *vice versa*



Engineering With Nature

- Expand the range of benefits provided through water-based infrastructure
 - ▶ “Doing more with less”
- Balancing consideration of environmental risks with **benefits**
- A path to more sustainable projects

