APPLYING ECOSYSTEM SERVICES FOR WATERBORNE TRANSPORT INFRASTRUCTURE PROJECTS

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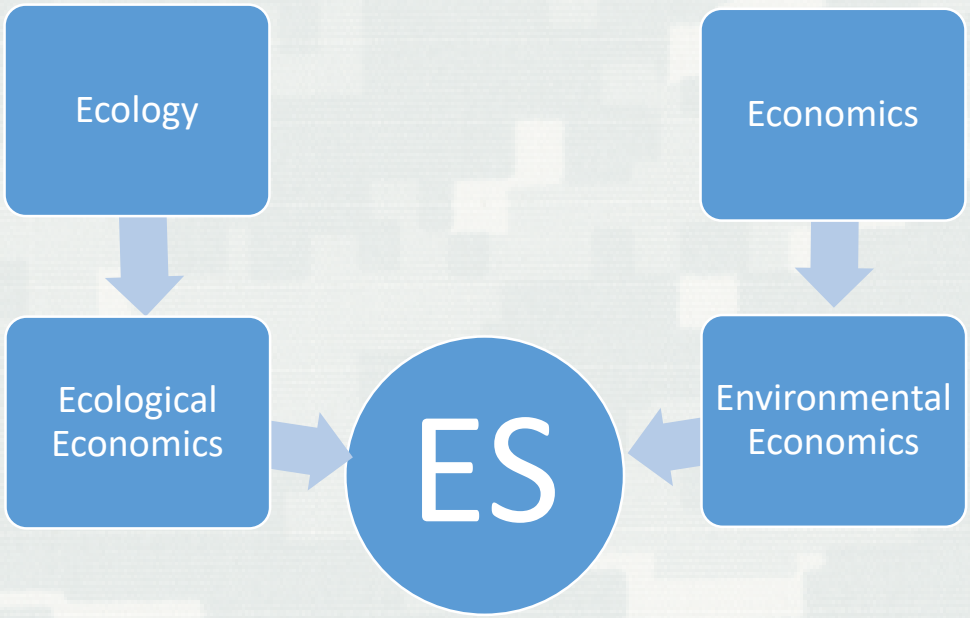
The community of waterborne transport organizations has been a global economic engine with profound impacts on trade and commerce in every country around the world.

Ecosystem Services



We need to integrate the Ecosystems Services concept to the Waterborne Transport Infrastructure (WTI) community in the deployment, planning, designing and/or maintenance of WTI projects.

Target Community

- **Port owners, operators or managers: responsible for adaptations to their Ports and the incorporation of the ES concept.**
- **Public authorities: empowered to encourage and facilitate the incorporation of the ES concept in WTI projects.**
- **Consultants and Contractors: able to incorporate the ES concept during study and design phase as well as during construction of WTI projects.**
- **Financers: understand the need to incorporate the ES concept and the need to invest maybe more on the short run to have benefits on the long run in order to develop adequate packages to finance the implementation of the ES Concept.**
- **NGO's: able to stimulate their external input to enhance and inspire the ES concept within WTI projects.**
- **Academic institutions: stimulate and carry out research and to share the findings and recommendations.**

Key Questions

- What are ES in general, what are the underlying ideas and concepts?
- How can the ES concept be applied in WTI design and maintenance?
- In which contexts can ES concepts be utilized best?
- How do ES concepts relate to other WTI relevant subjects, specifically Working with Nature, Environmental Risk Management, and Climate Change?

What are ES in general, what are the underlying ideas and concepts?

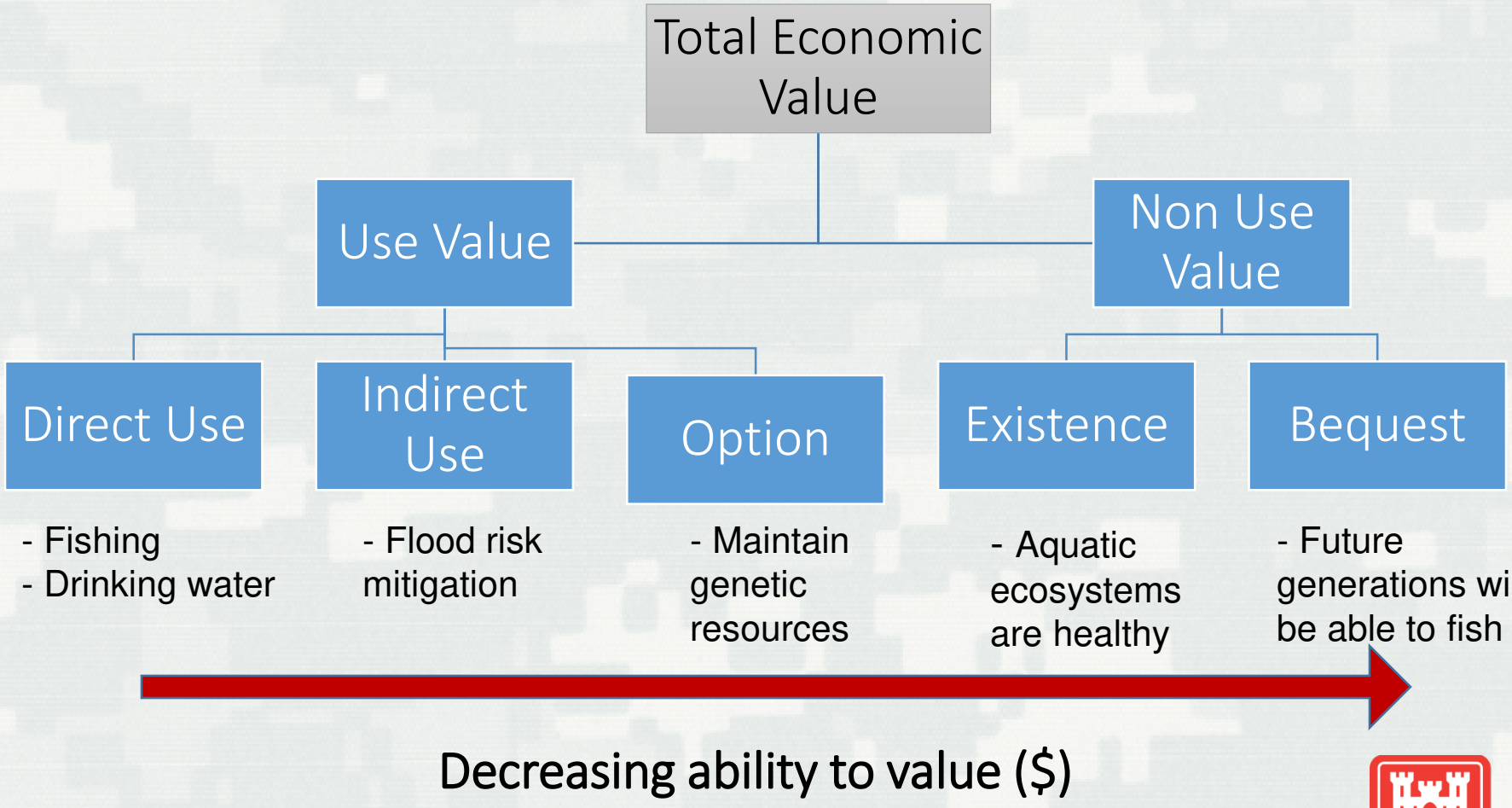
- Millennium Ecosystem Assessment (MA 2005) defines the linkages between well-being and ecosystem services "as the goods and services that people obtain from ecosystems".

- The concept that the sustainability of human well-being and economic development is dependent on the preservation of natural resources is certainly not new (Grove 1995),

- The ES concept is increasingly a component or even an underlying principle of environmental policy, legislation and management internationally.

Total Economic Value

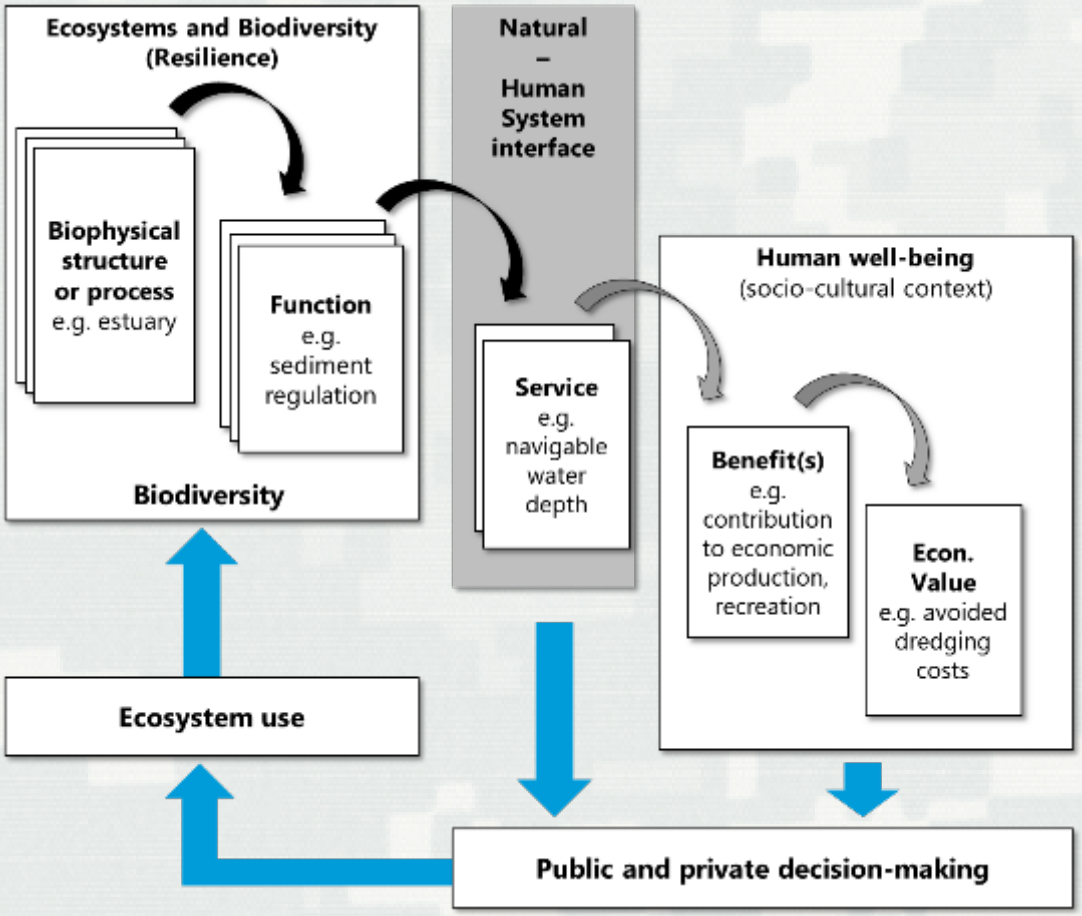
Sum of use and non-use values



Ecosystem Services Can Be Classified In Three Broad Categories

- **Provisioning Service**
  - Commercial Fisheries
  - Wood Logging
- **Cultural Services**
  - Nature For Education And Research
  - Enjoyment Of Natural Landscapes
- **Regulating Services**
  - Carbon Storage
  - Protection Against Erosion

Ecosystem Services Cascade Model



The model illustrates how ES derive from ecosystem structures and functions, are linked to human well-being and how they are used in management of the ecosystems.

(Adapted from MEA 2005).

How can the ES concept be applied in WTI design and maintenance?

- The adoption of ES concepts in the WTI sector encourages better single-issue or sectoral decisions
- It also provides insights into the true costs and benefits of management choices, allowing for joint and cross-sectoral planning
- identifies win/win opportunities and hidden dangers.

How To Approach Ecosystem Services

Short Term Gains

Long Term Vision

Including ES concepts in the planning, design and maintenance of WTI projects has the following potential beneficial consequences:

- there are economic gains for the WTI sector
- it improves the understanding of the societal context in which the WTI sector operates and makes the trade-offs of WTI activities explicit
- it improves integrated management of the wider environment
- it contributes to overall biodiversity, and natural functioning and thereby reduces the negative impact of any design on the surrounding environment.
- it facilitates the consent process and stakeholder dialogue (by e.g. mitigation of negative impacts in EIA)
- it reduces environmental risks
- it reduces societal costs
- it may improve climate change adaptability

In which contexts can ES concepts be utilized best?

- Geographically scalable—to allow application to local projects, with limited spheres of influence, as well as to regional problems that may carry national or trans-national implications

- Technically scalable—to allow for efficient allocation of resources (time, money, etc.) in proportion to the consequences of the decision, or to adapt to the extent and type of data available

- Systematic and transparent—to allow adequate understanding by all stakeholders, and

- Iterative and based on learning—to inform corrective action and adaptive management through careful consideration of monitoring data and other information

Island Protection and Restoration

Pool 8 Islands HREP Phase II,
near Stoddard, Wisconsin

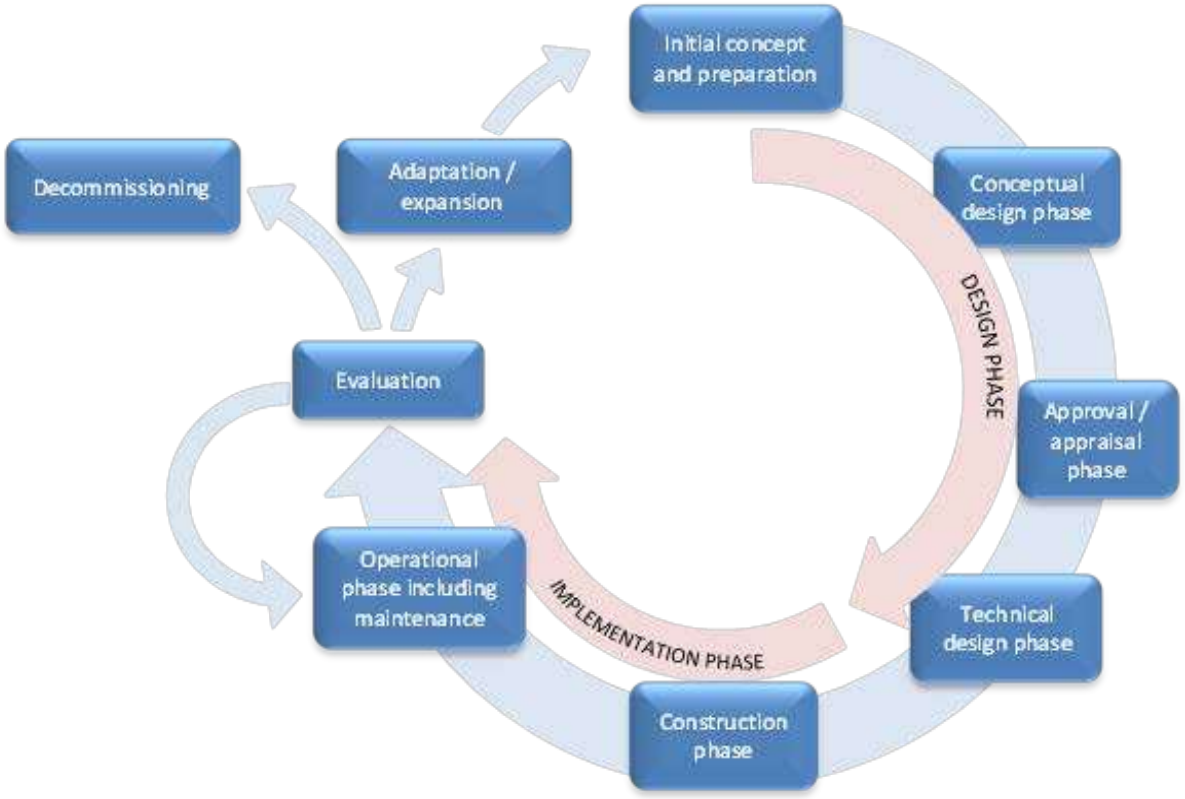
October 1961 August 1994 August 2000

Have We Documented the Ecosystem Services Provided?

ES-based management has a number of other essential components.

- provide appropriate stakeholder involvement (various stakeholder groups should be involved and communicated with)
- consider assessing cross-scale as well as cross-sectoral interactions and influences of mixed-use mosaic land- and waterscapes
- based on a solid understanding of the relationship between management decisions and the ecological processes that contribute to human well-being **(thus data on the wider natural and social environment needs to be taken into account**)
- identify localities and understand social and/or ecological conditions in which ES are generated and consumed, especially in cases where ES flows cross decision-unit boundaries.

Project Development Cycle



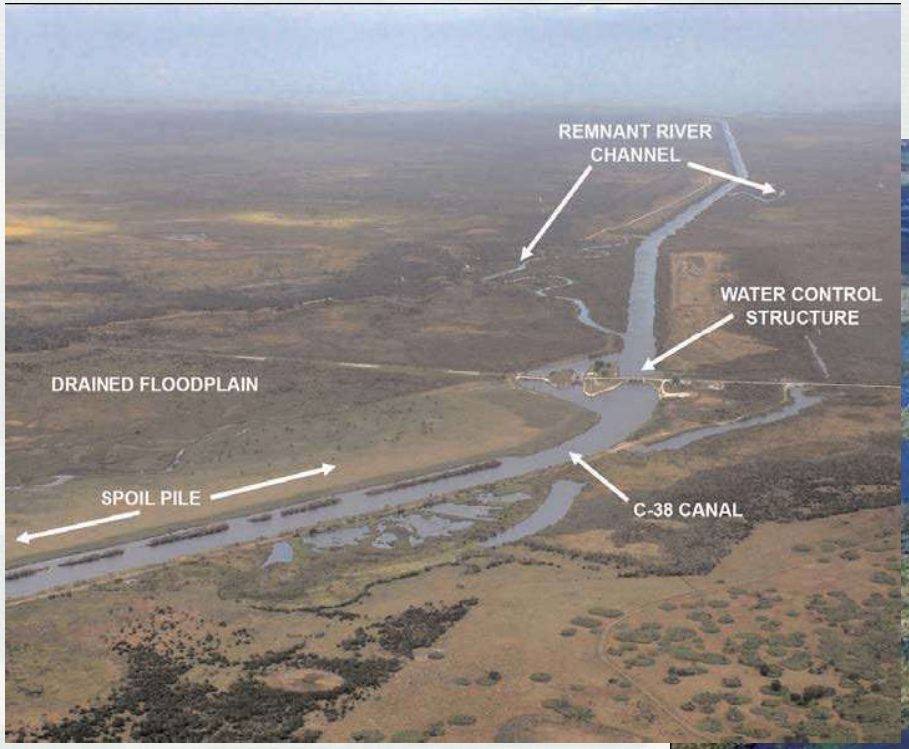
Water Transport Infrastructure (WTI) projects generally follow an iterative cycle. The project cycle includes roughly three different phases, and the application of ES in WTI projects is imperative in all these phases.

Kreetsand Tidal Shallow Water Area

The model results were used to design habitats within the area in a way that improves ecosystem services provisioning while reducing tidal energy.

Remeandering

Kissimmee River, FL

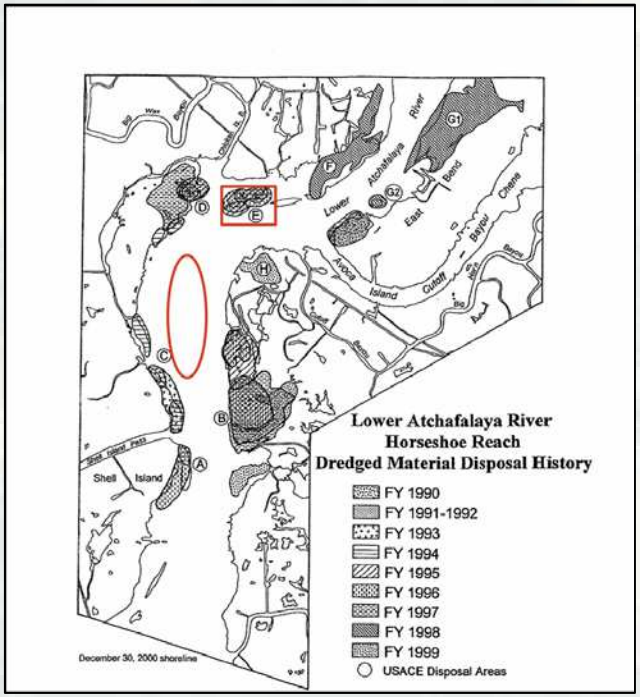


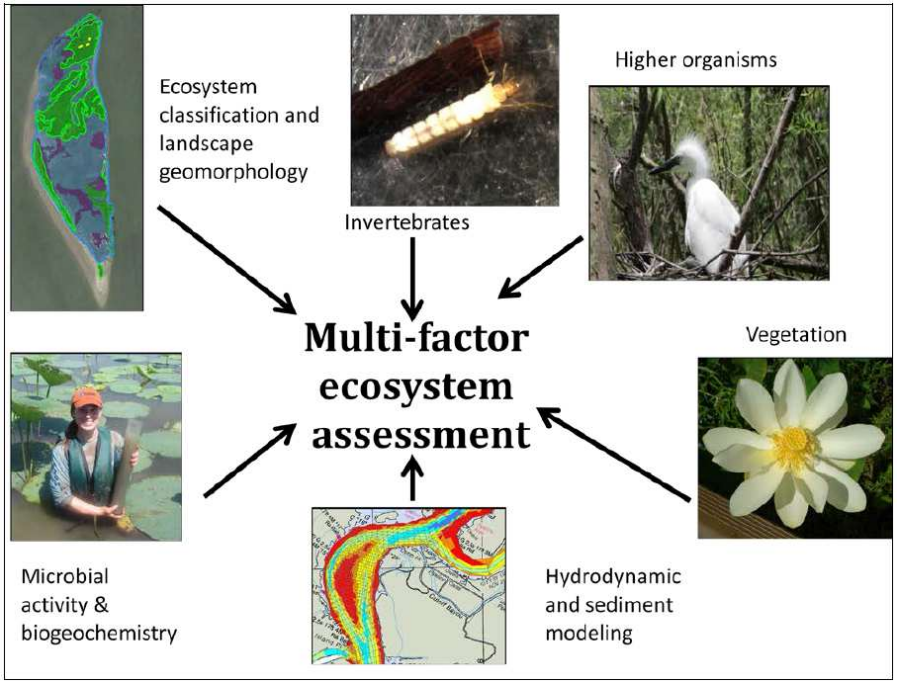
Horseshoe Bend

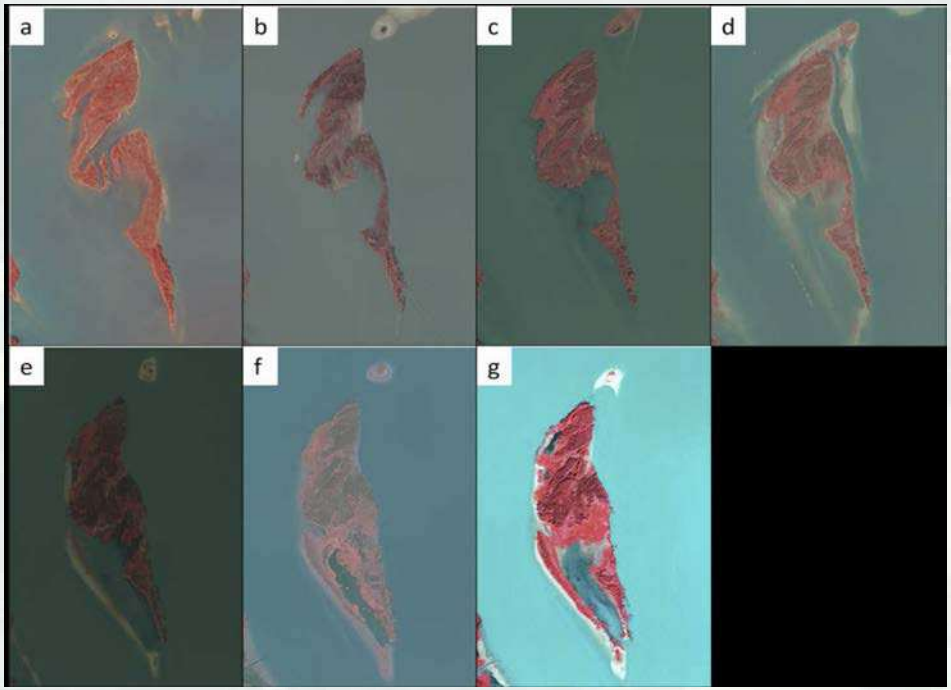
Problem: Limited options for dredged material placement alternatives

Solution: Innovative EWN placement technique created wetland island

Approach: Ecological assessment documented environmental Goods and Services (EGS) benefits







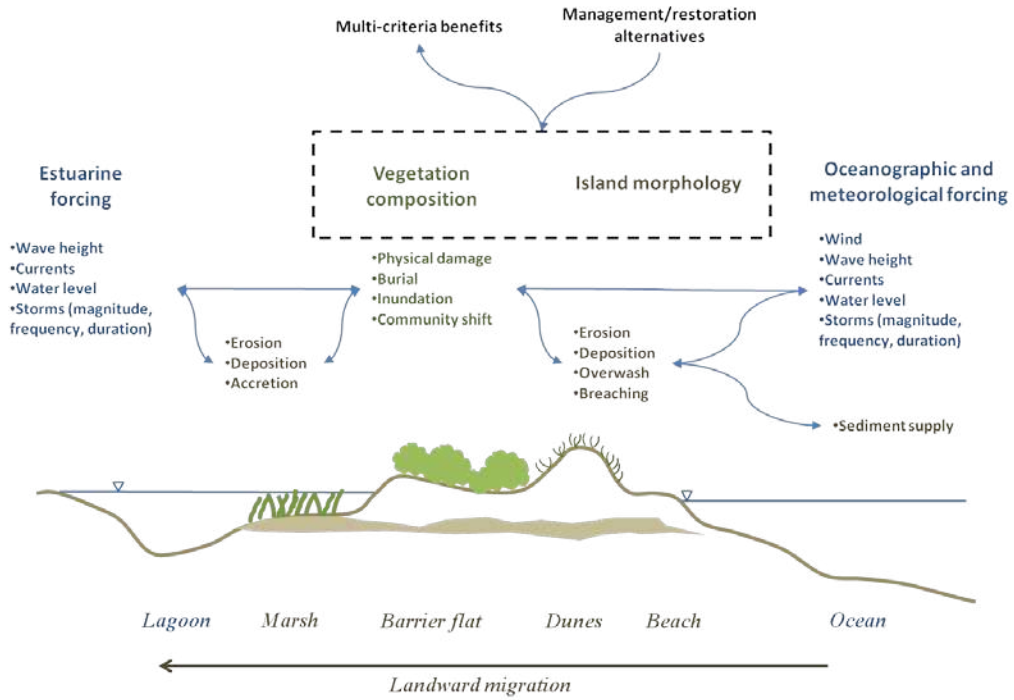
Ecosystem Services Provided By Coastal Dunes

SMART Planning requirements

Efficient
Cost-effective
Quick
Existing data
Flexibility

Coastal Planning Challenges

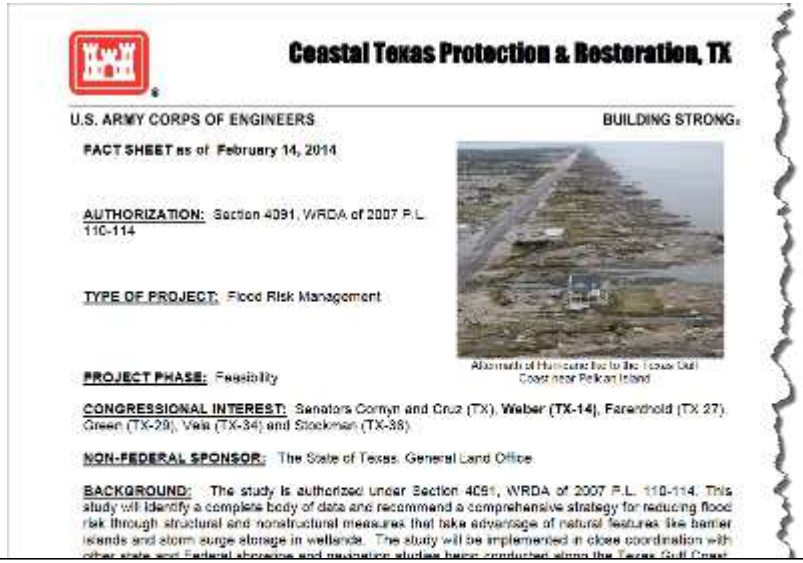
Complex systems
Climate change/SLR
Multiple benefits
Scarce data
Data-hungry models



- Coastal ecosystems are dynamic with multiple drivers and feedbacks
- Dune degradation and community shifts are increasing due to climate change
- Need to understand what actions to take to maintain and increase coastal resilience

Ecosystem Services Provide Coastal Benefits

- Ecosystem restoration and natural and nature-based features
- Comprehensive approach to coastal planning



Coastal Texas Protection & Restoration, TX

U.S. ARMY CORPS OF ENGINEERS — BUILDING STRONG®

FACT SHEET as of February 14, 2014

AUTHORIZATION: Section 4091, WRDA of 2007 P.L. 110-114

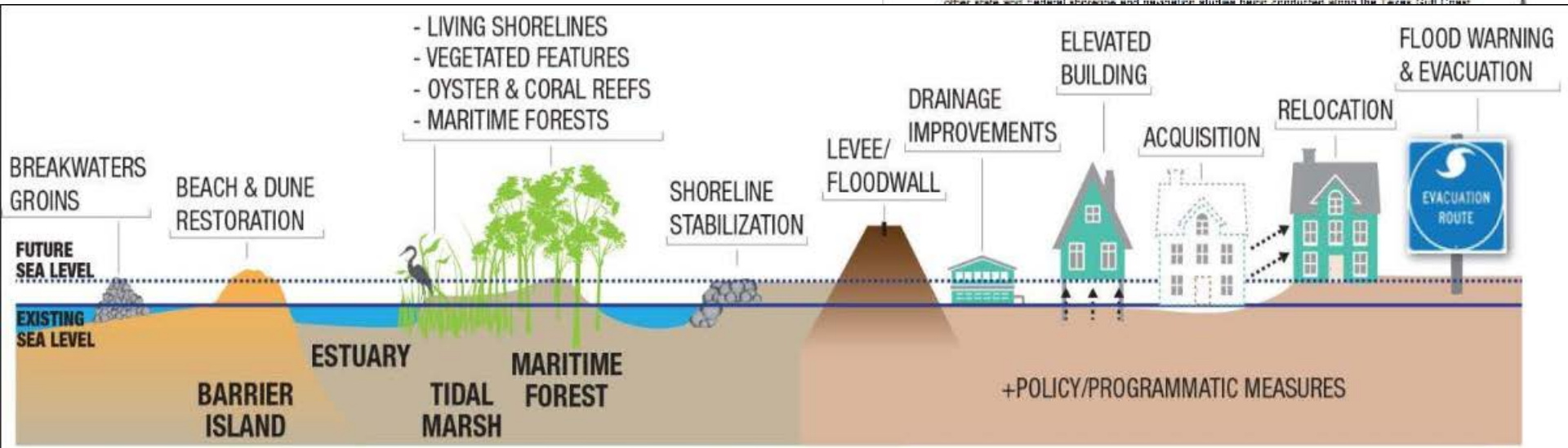
TYPE OF PROJECT: Flood Risk Management

PROJECT PHASE: Feasibility

CONGRESSIONAL INTEREST: Senators Cornyn and Cruz (TX), Weber (TX-14), Farenthold (TX 27), Green (TX-29), Vela (TX-34) and Stockman (TX-36)

NON-FEDERAL SPONSOR: The State of Texas, General Land Office

BACKGROUND: The study is authorized under Section 4091, WRDA of 2007 P.L. 110-114. This study will identify a complete body of data and recommend a comprehensive strategy for reducing flood risk through structural and nonstructural measures that take advantage of natural features like barrier islands and storm surge storage in wetlands. The study will be implemented in close coordination with



Considerations of Ecosystem Services Provided

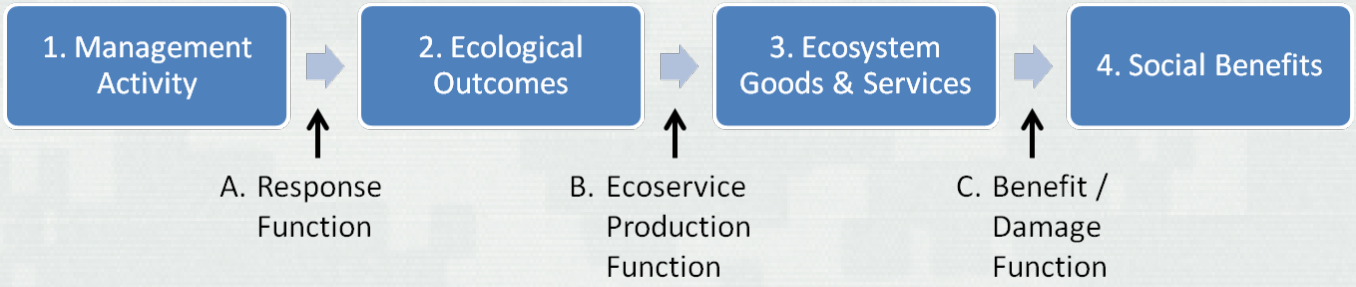
- Alternatives analysis
  - Quantify the impact of future-without-project
  - Choose among restoration actions
  - Calculate environmental benefits
- Restoration site selection
- Adaptive management planning

Tier 1: Spatially-explicit screening-level tool to assess ecosystem vulnerability with minimal pre-existing data → Index-based assessment of vegetation and morphology (integrating existing data and indices) – ArcGIS platform

Tier 2: Use existing storm data to quantitatively assess ecosystem vulnerability to a suite of events of specific magnitude → Quantitative assessment of vegetation and morphology (site specific for "hard" questions) – standalone executable

Framework

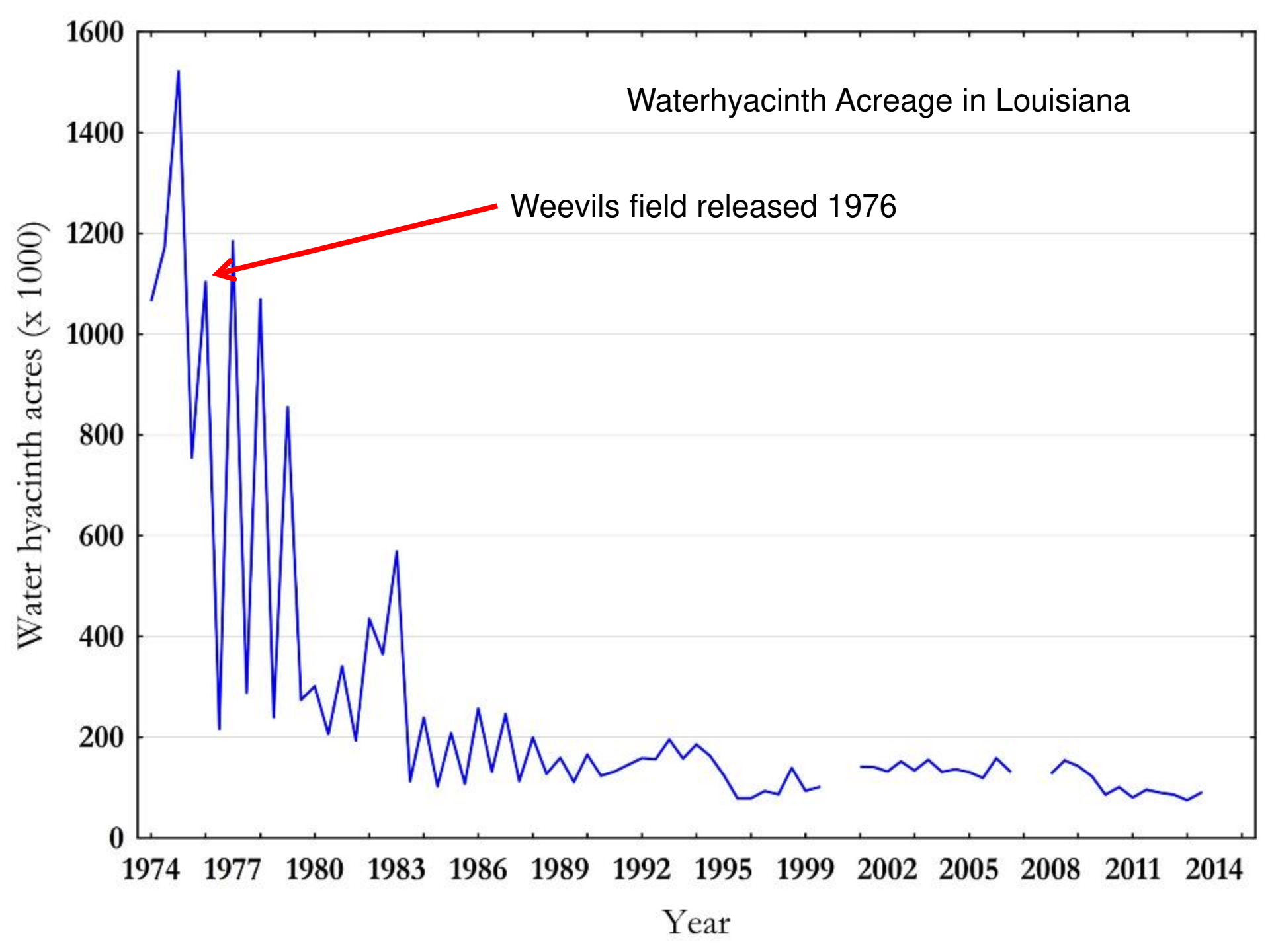
Conceptual Model for developing Quantitative ES Assessment Results



- *Response Function* estimates the expected changes in ecological outcomes when conditions and stressors change.
- The *Ecoservice Production Function* determines whether services are produced..
- The *Benefit/Damage Function* determines the value of the change in services.

DATA

- Being able to obtain the correct Data to document the ES that are being provided is often difficult
- People are unaware of the Data that needs to be collected
- The type of Data required is not always collected
- Many projects were conceived without consideration for ES and making these determinations was an afterthought


Waterhyacinth Acreage in Louisiana
Weevils field released 1976
Water hyacinth acres (x 1000)
1600
1400
1200
1000
800
600
400
200
0
1974
1977
1980
1983
1986
1989
1992
1995
1999
2002
2005
2008
2011
2014
Year

EGS Evaluated

1. Recreational Fishing
2. Recreational Hunting
3. Boat-dependent tourism & recreation (“swamp tour” companies, marinas)
4. Water Supply
5. Flood risk reduction
6. Commercial navigation
7. Commercial fishing
8. Non-use services (existence values for species and ecosystems)

Ecosystem Service Benefits estimated for 1987 & 2010

Impact	Affected Users/Entities	Annual benefit (Millions $2010)	
		1987	2010
Recreational freshwater fishing	583,480 anglers	$413.9	$675.5
Recreational waterfowl hunting	19,400 waterfowl hunters	$5.2	$8.3
Boat-related businesses	400 marinas (South Louisiana only)	$4.6 – $8.0	$5.2 – 9.2
Drinking Water Supply	77 drinking water intakes	$0.06 - $0.2	$0.08 - $0.3
Total		**$424.5**	**$691.2**

Generated A ---- 34:1 Benefit To Cost Ratio

Meeting in
Germany

Meeting in
The Netherlands

Working Group 195

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United Kingdom

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