Proceedings of the Gulf of Mexico Ecosystem Services Workshop

Bay St. Louis, Mississippi, June 16-18, 2010

by

David Yoskowitz
Carlota Santos
Becky Allee
Cristina Carollo
Jim Henderson
Steve Jordan
Jay Ritchie

October, 2010

Suggested Citation:

Yoskowitz, D., C. Santos, B. Allee, C. Carollo, J. Henderson, S. Jordan, J. Ritchie (2010). *Proceedings of the Gulf of Mexico Ecosystem Services Workshop: Bay St. Louis, Mississippi, June 16-18, 2010.* October. 16 pages. Harte Research Institute for Gulf of Mexico Studies. Texas A&M University-Corpus Christi

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NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE

NGI NORTHERN GULF INSTITUTE a NOAA cooperative institute

ABSTRACT

On June 16-18th, 2010, the first Gulf wide Ecosystem Services Workshop was held in Bay St. Louis, MS. There were a total of 31 attendees, representing different areas such as ecology, biology, economics, geology, oceanography, and fisheries. Federal and state agencies, NGOs, the private sector, and academic institutions were represented. The goal of this workshop was to gain consensus on approaches, definition, and identification of ecosystem services in the Gulf of Mexico (GoM) and the steps to be taken toward the initiation of a case study. Some of the outcomes of this workshop were a common definition of ecosystem services in the GoM, an inventory of different ecosystems in the Gulf and the services they provide, and lastly criteria to select a pilot project to implement ecosystem services valuation in one of the U.S. Gulf States. The workshop was supported by NOAA Gulf Coast Services Center and NOAA's Gulf of Mexico Regional Collaboration Team.

Keywords

Ecosystem services, ecosystem services valuation, Gulf of Mexico, CMECS, GOMESC.

I. INTRODUCTION

"*Decisions are incomplete and inefficient if they do not include <u>all</u> benefits and costs*" (Yoskowitz, 2009). So, how do we start including ecosystem services (ES) into decision making in the Gulf of Mexico (GoM)? Environmental decision making should include four elements: socio-cultural, science, policy, and economics. Imagine a table with each leg as one element; without one of the legs, decision making is not effective (Figure 1). What is currently missing to inform environmental decisions is a strong economic analysis of ES provided by our GoM geo-environments. However, there are currently a couple of efforts underway within the Gulf region to support the incorporation of ES valuation within the decision making process.

Figure 1: The four elements in environmental decision-making
Source: Yoskowitz and Santos, Harte Research Institute, Texas A&M University-Corpus Christi

The first of these efforts is the Gulf of Mexico Alliance (GOMA), a regional partnership of the five U.S. Gulf States with the purpose of significantly increasing regional collaboration to enhance the ecological and economic health of the GoM. The Alliance's Action Plan II (APII) addresses four major challenges:

1. Sustaining Gulf Economy;
2. Improving Ecosystem Health;
3. Mitigating the impacts of and adapting to climate change; and
4. Mitigating harmful effects to coastal water quality

Although the APII is a step forward in integrating ES in the decision making process, there needs to be a more structured approach.

The other ongoing effort is the Gulf of Mexico Ecosystem Services Collaboratoy (GOMESC). The GOMESC was formed with the intent to discuss Gulf wide ES issues, local ES issues, and what is needed to integrate ES into the research and policy arenas for the region. The members of the GOMESC met in January 2010 and defined their mission statement and three initial short-term goals.

1. Identify a specific policy case that would have relevance across the Gulf region, focusing on wetland loss in coastal Louisiana-Mississippi.

2. Convene a workshop to gain consensus on approaches, definition, and identification of ES, and the steps to be taken toward initiation of the test case (Ecosystem Services Workshop).

3. Identify the tools and develop the products necessary for the application of ES values to the policy test case (a future workshop focused on non-market valuation methods).

II. ECOSYSTEM SERVICES WORKSHOP

II. a. Ecosystem Services Definition

The first goal of the workshop was for the attendees to agree on a single, rigorous definition of ES applicable to the Gulf coast. The definition had to be comprehensive enough to capture the major values of coastal ecosystems, workable in that ES can be quantified and valued with a reasonable amount of research and data acquisition, scalable from local sites to regional evaluations, and comprehensive to policy-makers and the concerned public, i.e., expressed in terms that reflect intuitive values.

Five existing definitions of ecosystem services were provided to the group and from there the group was asked to agree on a single definition. A common idea was that ES had to be defined within the context of human values.

Ecosystem services were initially defined using the combination of two different definitions as follows:

- Ecosystem services in the Gulf of Mexico are the direct or indirect contributions that ecosystems make to the well-being of human populations. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on Earth (Combination of EPA Science Advisory Board, 2009 and Millennium Ecosystem Assessment, 2003 definitions).

This definition was refined, resulting in the final definition in the context of the Alliance, but generalizable:

Output 1: Ecosystem Services Definition for the Gulf of Mexico

"*The Gulf of Mexico Alliance defines ecosystem services as the contributions from Gulf of Mexico marine and coastal ecosystems that support, sustain, and enrich human life*"

This definition will be presented to the Gulf of Mexico Alliance Management Team for their consideration.

After agreeing on a common definition of ES, the group felt the need to define "ecosystem services valuation". The ability to quantify the services, in monetary and non-monetary measures as appropriate, and to use a comparable measure seemed very important as a means to inform decisions and have a better understanding of changes brought by policies and/or actions.

The word value can have distinct meanings. Oftentimes, economists and ecologists use the word in two different ways when discussing ecosystems and ecosystem services. Ecologists commonly use the word to mean "*that which is desirable or worthy of esteem for its own sake; thing or quality having intrinsic worth*" (Webster's New World Dictionary, Third College Edition) or quantifiable and significant to the functioning of the system. On the other hand, economists typically use the word to mean "*a fair or proper equivalent in money, commodities, etc*" (Webster's New World Dictionary, Third College Edition), where "*equivalent in money*" stands for the amount of money needed to provide the same wellbeing or utility to individuals.

Given the differing backgrounds of the workshop participants, similar discussion about the meaning of value took place when the group was trying to define ecosystem services valuation. "What is value?" was the repeated question. Since the word "valuation" can have a wide range of meanings (monetary or non-monetary, quantitative and qualitative), the group decided to use the word "quantification" instead of valuation. A variety of benefits provided by the environment are hard to put a monetary value on, and one important idea mentioned was not to worry about the currency as much as the ability to transform it into a common unit for comparison purposes.

Ecosystem services quantification was defined by the group as:

Output 2: Ecosystem Services Quantification Definition

"Ecosystem services quantification provides standard metrics for expressing benefits of the services provided by the ecosystem. The metrics might be monetary or non-monetary".

In this case, quantification is including both the ecological functions (science-based) and the valuation of the ES benefits (usually in monetary terms). A clearer way to represent this idea is by differentiating quantification and valuation of services. Therefore, ES analysis is a multidisciplinary process that involves three elements:

1. **Quantification of ES**: This is science-based and involves measuring at the provision of ES and ecological functions. It provides common metrics for expressing benefits of the services provided by the ecosystem.
2. **Valuation of ES**: This entails looking at the benefits derived from ES (based on the quantification done previously) and their value to humans. The benefits may be expressed in monetary or non-monetary (qualitative) metrics.
3. **ES Actions**: This step involves using the information from quantification and valuation to inform policies for the delivery and sustainable use of ES.

II. b. Ecosystem Services Refinement

The second expected outcome of the workshop was the review and refinement of each ES. The group utilized the identified ES developed by Farber et al (2006) as the strawman, in which ecosystem services are divided into four categories: supporting, regulating, provisioning, and cultural.

The group agreed on the following ecosystem services that are most appropriate for the Gulf of Mexico:

Output 3: Ecosystem Services of the Gulf of Mexico

1. Nutrient Balance	11. Medicinal Resources
2. Hydrological Balance	12. Ornamental Resources
3. Climate Balance	13. Science and Education
4. Pollutant Attenuation	14. Biological Interactions
5. Gas Balance	15. Soil and Sediment Balance
6. Water Quality	16. Spiritual and Historic
7. Water Quantity	17. Aesthetics and Existence
8. Air Supply	18. Recreational Opportunities
9. Food	19. Hazard Moderation
10. Raw Materials	

Table 1. Ecosystem Services of the Gulf of Mexico

One of the suggestions when refining the ES list was dropping the word 'regulation' and using 'balance' instead. The group thought that the word 'balance' better represented the services the ecosystem provides in maintaining healthy levels of elements such as nutrients, soil, and sediment. Balance includes retention, provision, and transportation. Regulation could also have a political connotation, so balance seemed a more appropriate word. This list will be utilized by a working group that will identify mechanisms needed to more fully incorporate values for ecosystem services in decision processes.

Supporting Services

One question that arose was if biological interactions should be considered a service or a function that is present in each ecosystem. The ranked results showed biological interaction as one of the top three services in almost every ecosystem which may have been a result of participants assuming biological interactions are embedded in all ecosystems. Biodiversity (e.g., the variety of species, populations, genes, communities) may be considered an indicator of or a factor influencing an ecosystem's health. It can be seen as an important goal or condition of an ecosystem, but maybe not a service. For example, it is important to understand the changes in species abundance to be able to relate biodiversity and ecosystem functioning, as changes in populations can affect the provision of ES [2].

Some participants believed that supporting services should be taken into account (quantified), but not valued. It seems that the supporting services are needed for the ecosystem to be healthy and for all the other services to occur. They are fundamental pieces that can be used to understand both where the other services come from and what the necessary/minimum conditions for those ES to occur are. However, they are not experienced directly by humans and are therefore very difficult to value. Thus, many agreed they should be eliminated from the category list and should be quantified only (see Figure 2).

Regarding hydrological balance (hydrological cycle in Farber et al.), participants expressed that currents should be included. Existing services relating to hydrological factors are predominantly terrestrially biased; we need to translate those services to the marine environment.

Regulating Services

As mentioned previously, in some occasions the word 'regulation' was replaced by 'balance'. Biological Regulation was changed to Biological Interactions, Water Regulation was included in Hydrological Balance, and Waste Regulation was changed to Pollutant Attenuation. Soil Retention was changed to Soil and Sediment Balance, a more complete definition that would include retention, creation, and transport of soil.

Provisioning Services

One of the suggestions on this category was to add air supply, which the group agreed to. Also, Genetic Resource was removed from the list because the group thought it was not significant in

Gulf of Mexico coastal and marine ecosystems. Water Supply was divided into Water Quality and Water Quantity.

Social and Cultural Services

Participants suggested enrichment services, human services, or social and cultural services as names for this category. Aesthetics was defined as the "use of natural ecosystem resources for sensory enjoyment and appreciation; sensory experience of ecosystems; direct or indirect appreciation of ecological systems."

Output 4: Ecosystem Services of the Gulf of Mexico by Service Level

Ecosystem Services of the Gulf of Mexico by Service Level
Level 1: Ecosystem Foundation or Support Services
Nutrient Balance
Hydrological Balance
Biological Interactions
Soil and Sediment Balance
Level 2: Provisioning Services- Goods and Services Produced by (and dependent on) Support Services
Pollutant Attenuation
Air Supply
Water Quantity
Water Quality
Food
Raw Materials
Medicinal Resources
Gas Regulation
Ornamental Resources
Climate Regulation
Level 3: Outcomes and Benefits to Society
Hazard Moderation
Aesthetics and Existence
Spiritual and Historic
Science and Education
Recreational Opportunities

Table 2. Ecosystem Services of the Gulf of Mexico by Service Level

The organization of ecosystem services can also be visualized as a pyramid whereas the foundation represents those services which are necessary to support all other services. Figure 2 and Table 2 demonstrates this concept for the various levels of ES identified for the GoM. The higher the level, the more directly the perceived human benefit and the more monetary valuation depends on human

demand and preferences. Organized this way, Level 1 services represent services as components of nature, that is, as part of nature's structure, function, and dynamics. These services are usually quantified by natural sciences or discipline based protocols. They represent the base of the pyramid because they are a requisite for a healthy ecosystem and they are a keystone for other services to occur. The other two levels represent goods, services, and benefits provided by the structure, function, and dynamics of the ecosystem and they have some component of human or public value. On top of the structure, function, and dynamics of the system, the goods, services, and benefits to humans require the presence of human demand and human preference for value or decision-making, not strictly a discipline-based measurement. The arrow shown on the figure represents the component of human or public value; the higher the level, the greater is the perceived value. Yet, the foundation of the pyramid is as important as the apex.

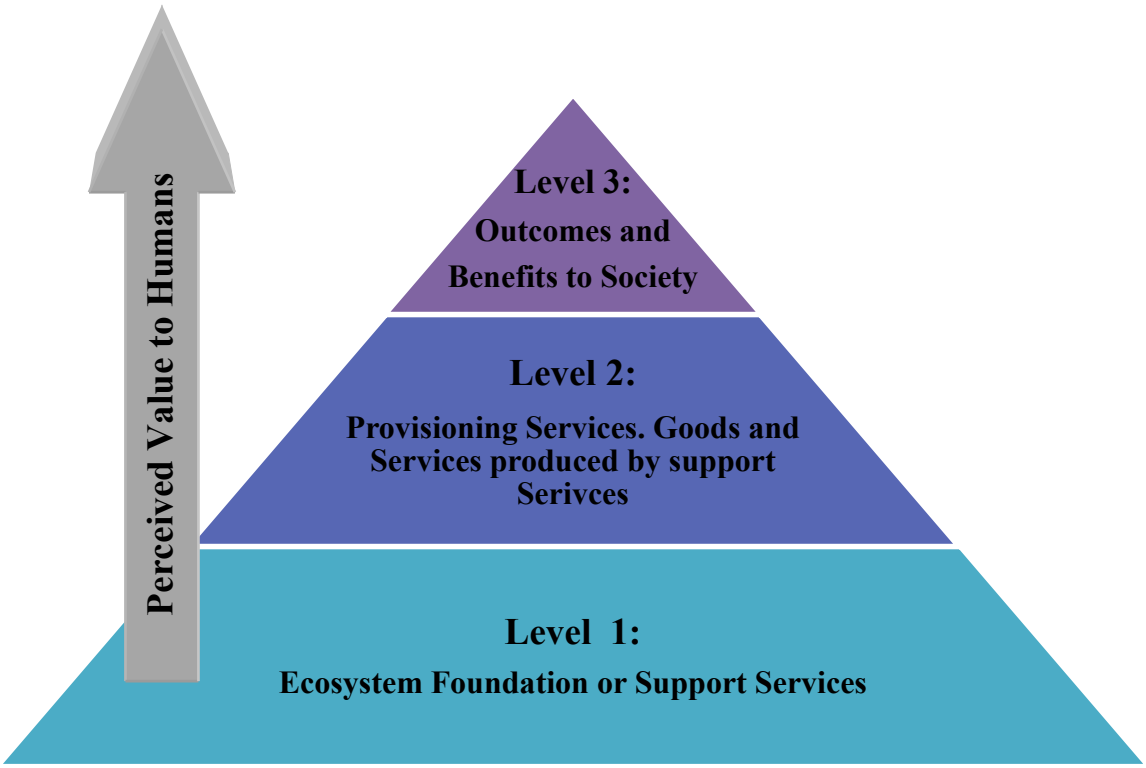

Figure 2: Ecosystem Services Categories and Perceived Impact to Humans.

II. c. Coastal and Marine Ecological Classification Standard (CMECS) and Ecosystem Services

Next, the group identified existing ecosystems in the GoM. The classification of ecosystems was based on the Coastal and Marine Ecological Classification Standards (CMECS), Version 3.1. CMECS, developed by the National Oceanic and Atmospheric Administration (NOAA) and Nature Serve, is intended to provide a national standard for consistent characterizations of coastal and marine ecological types. It provides a framework and consistent terminology intentionally compatible with other existing classification systems. Consistency has been an important issue since data can be classified using different approaches, thus having a standardized classification can improve understanding. CMECS is currently under review by the Federal Geographic Data Committee for consideration of endorsement as a National Standard. Once CMECS has been endorsed, scientists receiving federal support for marine initiatives requiring classification of ecological units will be required to use CMECS as the ecological characterization standard [3]. Consequently, to avoid future conversion, the workshop's organizing committee decided to use CMECS, as well as including specific terrestrial geo-environments. The group identified the following coastal and marine geo-environments of the GoM:

Output 5: Coastal and Marine Geo-Environments of the Gulf of Mexico

1. Oyster Reefs	9. Swamp/Bottomland Hardwoods
2. Coral Reefs	10. Beaches/Dunes
3. Fresh Submerged Aquatic Vegetation (SAV)	11. Forested Coastal Ridge
4. Non-fresh Submerged Aquatic Vegetation (SAV)	12. Intertidal-sand/mud
5. Saline Marsh	13. Subtidal-sand/mud
6. Brackish Marsh	14. Open Water
7. Freshwater Marsh	15. Offshore-shoals and banks
8. Macroalgae	16. Mangroves

Table 3. Coastal and Marine Geo-Environments of the Gulf of Mexico

Once the classification of key coastal and marine geo-environments in the GoM was complete, the workshop attendees were asked to identify and prioritize services provided by those geo-environments. These services are listed in the table below for each geo-environment in priority order. A fourth priority highlighted in red indicates a tie for third.

Output 6: Geo-Environments of the Gulf of Mexico and Associated Ecosystem Services

Geo-Environments of the Gulf of Mexico and Associated Ecosystem Services	
• **Oyster Reef** 1. ***Food*** 2. ***Water Quality*** 3. ***Biological Interactions*** 4. ***Hazard Moderation*** 5. Aesthetics and Existence 6. Nutrient Balance 7. Raw Materials 8. Spiritual and Historic 9. Science and Education 10. Soil and Sediment Balance 11. Recreation 12. Ornamental Resource	• **Coral Reefs** 1. ***Recreational Opportunities*** 2. ***Aesthetics and Existence*** 3. ***Biological Interaction*** 4. Medicinal Resources 5. Food 6. Hazard Moderation 7. Spiritual and Historical 8. Science and Education 9. Ornamental Resources
• **Fresh SAV** 1. ***Biological Interactions*** 2. ***Water Quality*** 3. ***Recreational Opportunities*** 4. ***Nutrient Balance*** 5. Food 6. Air Supply 7. Aesthetics and Existence 8. Hazard Moderation 9. Hydrological Balance 10. Pollutant Attenuation 11. Spiritual and Historic	• **Non-Fresh SAV** 1. ***Food*** 2. ***Biological Interactions*** 3. ***Water Quality*** 4. Soil and Sediment Balance 5. Recreational Opportunities 6. Nutrient Balance 7. Aesthetics and Existence 8. Hazard Moderation
• **Saline Marsh** 1. ***Biological Interactions*** 2. ***Hazard Moderation*** 3. ***Recreational Opportunities*** 4. Food 5. Aesthetics and Existence 6. Nutrient Balance 7. Climate Regulation 8. Gas Regulation 9. Water Quality 10. Water Quantity 11. Soil and Sediment Balance	• **Brackish Marsh** 1. ***Nutrient Balance*** 2. ***Biological Interactions*** 3. ***Soil and Sediment Balance*** 4. Climate Regulation 5. Food 6. Water Quality 7. Hazard Moderation 8. Aesthetics and Existence 9. Recreational Opportunities 10. Hydrological Balance 11. Pollutant Attenuation

• **Freshwater Marsh** 1. ***Nutrient Balance*** 2. ***Biological Interactions*** 3. ***Hazard Moderation*** 4. Food 5. Aesthetics and Existence 6. Recreational Opportunities 7. Spiritual and Historic 8. Hydrological Balance 9. Climate Regulation 10. Pollutant Attenuation 11. Gas Regulation 12. Water Quality 13. Water Quantity	• **Macroalgae** 1. ***Biological Interactions*** 2. ***Nutrient Balance*** 3. ***Food*** 4. Soil and Sediment Balance 5. Recreational Opportunities 6. Aesthetics and Existence 7. Science and Education 8. Raw Materials
• **Swamp/ Bottomland Hardwood** 1. ***Hazard Moderation*** 2. ***Nutrient Balance*** 3. ***Water Quantity*** 4. Spiritual and Historic 5. Raw Materials 6. Recreational Opportunities 7. Food 8. Soil and Sediment Balance 9. Climate Regulation 10. Aesthetics and Existence 11. Water Quality 12. Science and Education	• **Dunes/Beaches** 1. ***Hazard Moderation*** 2. ***Aesthetic and Existence*** 3. ***Soil and Sediment Balance*** 4. Recreational Opportunities 5. Science and Education 6. Biological Interactions 7. Water Quantity

• **Forested Coastal Ridge** 1. ***Recreational Opportunities*** 2. ***Hazard Moderation*** 3. ***Soil and Sediment Balance*** 4. Spiritual and Historic 5. Food 6. Air Supply 7. Water Quantity 8. Biological Interaction 9. Raw Materials 10. Water Quality 11. Aesthetic and Existence 12. Climate Regulation 13. Gas Regulation 14. Hydrological Balance	• **Intertidal- sand/mud** 1. ***Soil and Sediment Balance*** 2. ***Biological Interaction*** 3. ***Recreational Opportunities*** 4. Food 5. Nutrient Balance 6. Gas Regulation 7. Aesthetics and Existence 8. Raw Materials 9. Hazard Moderation
• **Subtidal- sand/mud** 1. ***Biological Interactions*** 2. ***Nutrient Balance*** 3. ***Soil and Sediment Balance*** 4. ***Raw Materials*** 5. Food 6. Aesthetics and Existence 7. Recreational Opportunities	• **Open Water** 1. ***Food*** 2. ***Recreational Opportunities*** 3. ***Climate Regulation*** 4. Hydrological Balance 5. Aesthetics and Existence 6. Gas Regulation 7. Spiritual and Historic 8. Science and Education 9. Raw Materials 10. Biological Interactions 11. Air Supply 12. Nutrient Balance 13. Hazard Moderation

• **Offshore- Shoals and Banks** 1. ***Recreational Opportunities*** 2. ***Food*** 3. ***Biological Interactions*** 4. Aesthetics and Existence 5. Hazard Moderation 6. Spiritual and Historic 7. Soil and Sediment Balance	• **Mangroves** 1. ***Biological Interactions*** 2. ***Hazard Moderation*** 3. ***Soil and Sediment Balance*** 4. Aesthetics and Existence 5. Recreational Opportunities 6. Water Quality 7. Pollutant Attenuation 8. Food

Table 4. Geo-Environments of the Gulf of Mexico and Associated Ecosystem Services

II. d. Restoration Project Characteristics

Next, the group discussed potential restoration projects for which ecosystem services could be assessed and quantified as a demonstration; the main goal of the assessment is to improve the decision-making process by taking into account the value of ES. Some participants expressed that "if you don't put a value on an ecosystem service, then it will probably get an infinity value and for policy makers that is usually zero". Before the projects were presented, a few questions arose:

- Do we need existing (with baseline information) or proposed projects or could we predict the results?
- What is the appropriate scale: do we want a local, regional, or national project?
- Do we try to fill in the gaps in ecosystem services research and focus on certain services or should we focus on a specific ecosystem?

Following this discussion, three strawman projects were presented:

- Port of Gulfport- permit submitted
- Bayou DuPont- constructed
- Large Breton Sound Diversion- still in the concept phase

1. Port of Gulfport
    - Dredging: turning basin 160,000 CY; Berth 16,200,000 CY
    - Filling of approximately 700 acres of open water bottoms
    - Ecosystem Services Issues:
        a) Habitat loss/change
        b) Fill/dredging
        c) ES in economic development context

2. Bayou DuPont
    - Project constructed recently
    - Marsh creation with dredge material
    - Project Area: 471 acres
    - Total estimated cost: $28.3 million
    - Ecosystem Services Issues:
        a) Surge attenuation
        b) Habitat change: open water to marsh
        c) Created vs. Natural Services.
3. Large Breton Diversion
    - Conceptual: can be tailored to explore ES issues
    - Large structure or river realignment: effects on navigation
    - Ecosystem Services Issues:
        a) Effects across entire salinity gradient
        b) System level changes: surge attenuation for high risk/value assets; many habitats altered
        c) Concept could be tailored to explore ES challenges

After a long discussion about the strawman projects presented, the group decided that the focus should be on selecting project criteria rather than choosing one of the projects. A demonstration project could have the following characteristics:

Output 7: Demonstration Project Characteristics

- Be small enough to allow for fast results;
- Be transferable to a larger spatial scale and be policy/regionally relevant;
- Be at a planning stage;
- Allow for a pre/post evaluation;
- Have a short-term or short-time frame;
- Allow for beneficial use of dredge material;
- Have a sea level rise component;
- Potentially be located in Louisiana and/or Mississippi (per Council on Environmental Quality LA/MS Gulf Coast Ecosystem Restoration working group's Roadmap interest) but not limited to that region.

The next step will be to identify a project or set of projects that meet these criteria.

III. WHAT'S NEXT?

This workshop successfully accomplished the goals set by the GOMESC and the workshop participants. Specific outputs generated are: A definition for ecosystem services for the GoM; a definition of valuation/quantification; a list of ecosystem services appropriate for the Gulf; identified coastal and marine geo-environments; geo-environments with associated ecosystem services; ecosystem services by service level; and, restoration demonstration project characteristics.

Two immediate needs were identified as follow up to this workshop. One, organize a working group to review possible restoration projects within the characteristics outlined by the workshop. This step becomes relevant in light of the BP oil spill and the anticipated restoration efforts. Two, there is a need for an inventory of ES quantification/valuation approaches appropriate to the Gulf of Mexico. A follow up workshop will focus on existing methods to measure ecosystem services value and how to operationalize them into the decision making process. The approaches chosen for assessing ecosystem services are intended to make "decision making" more complete and efficient.

Ecosystem services are evolving in the Gulf and individual institutions, researchers, NGOs, private sector firms, and agencies is where the work will go on. The Collaboratory can continue to play an important role by acting as a 'sounding board' or science advisory committee for GoM projects. The GOMA will continue to provide an opportunity to move the practice of ES into policy and action. Additional parties, not yet identified, will also play an important role.

Workshop Participant List

Ann Weaver (Moderator)	NOAA – Coastal Services Center
Anthony Dvarskas	NOAA - Office of Response and Restoration
Becky Allee	NOAA- Gulf Coast Services Center
Carlota Santos	Texas A&M-Corpus Christi - Harte Research Institute
Carol Richards	Louisiana Office of Coastal Protection and Restoration
Cristina Carollo	Florida Institute of Oceanography
Daniel R. Petrolia	Mississippi State University
David Yoskowitz	Texas A&M-Corpus Christi - Harte Research Institute
Denise Reed	University of New Orleans – Pontchartrain Institute
Diane Altsman	EPA – Gulf of Mexico Program
George Ramseur	Mississippi Department of Marine Resources
Henry Norris	Florida Fish and Wildlife Conservation Commission
Jay Ritchie	Northern Gulf Institute
Jim Henderson	U.S. Army Corps of Engineers
Kent Thornton	FTN Associates Ltd.
Kim Caviness	Mississippi Department of Environmental Quality
Mary Ruckelshaus	NOAA – Northwest Fisheries Science Center
Mike Smith	Gulf of Mexico Foundation
Michael Stovall	University of Alabama
Paul Montagna	Texas A&M-Corpus Christi - Harte Research Institute
Peter Wiley	NOAA – National Ocean Service
Rex H. Caffey	LSU - Center for Natural Resource Economics and Policy
Rusty Swafford	NOAA – National Marine Fisheries Service
Sharon Hayes	Council on Environmental Quality
Stephen Sempier	Mississippi-Alabama Sea Grant
Steve Jordan	EPA – Gulf Ecology Division
Syed Khalil	Louisiana Office of Coastal Protection and Restoration
Thomas Calnan	Texas General Land Office
Tom Doyle	U.S. Geological Survey
Wade Cooper	Florida Fish and Wildlife Conservation Commission
William Schubert	Texas Parks and Wildlife

Workshop Organizing Committee:

Becky Allee, Cristina Carollo, Steve Jordan, Denise Reed, Jay Ritchie, Carlota Santos, David Yoskowitz.

References

[1] S. Farber et al., "Linking Ecology and Economics for Ecosystem Management," *BioScience*, vol. 56, no. 2, p. 121, 2006.

[2] L. Braat, P. T. Brink, and et al, *The cost of policy inaction. The case of not meeting the 2010 biodiversity target*. Wageningen, Brussels: A report for the European Commission, DG Environment, 2008, p. 187.

[3] Federal Geographic Data Committee, 'draft Coastal and Marine Ecological Classification Standard', http://www.fgdc.gov/standards/projects/FGDC-standards-projects/cmecs-folder/cmecs-index-page.