A green chalkboard with two pieces of pink chalk and some faint white chalk markings. The chalkboard is the background for the text. The text is centered and reads:

Ecosystem Services and Corresponding Valuation Methodologies for the Galveston Bay Estuary System

By Elizabeth Shelton



Facts about Galveston Bay

Measurements

- The combined area of Galveston Bay is 600 square miles and the average depth is 12 feet
- The average volume of Galveston Bay is 2.2 million acre-feet
- There are 4 major sub-bays: 1) Galveston Bay, 2) Trinity Bay, 3) West Bay, and 4) East Bay

Population

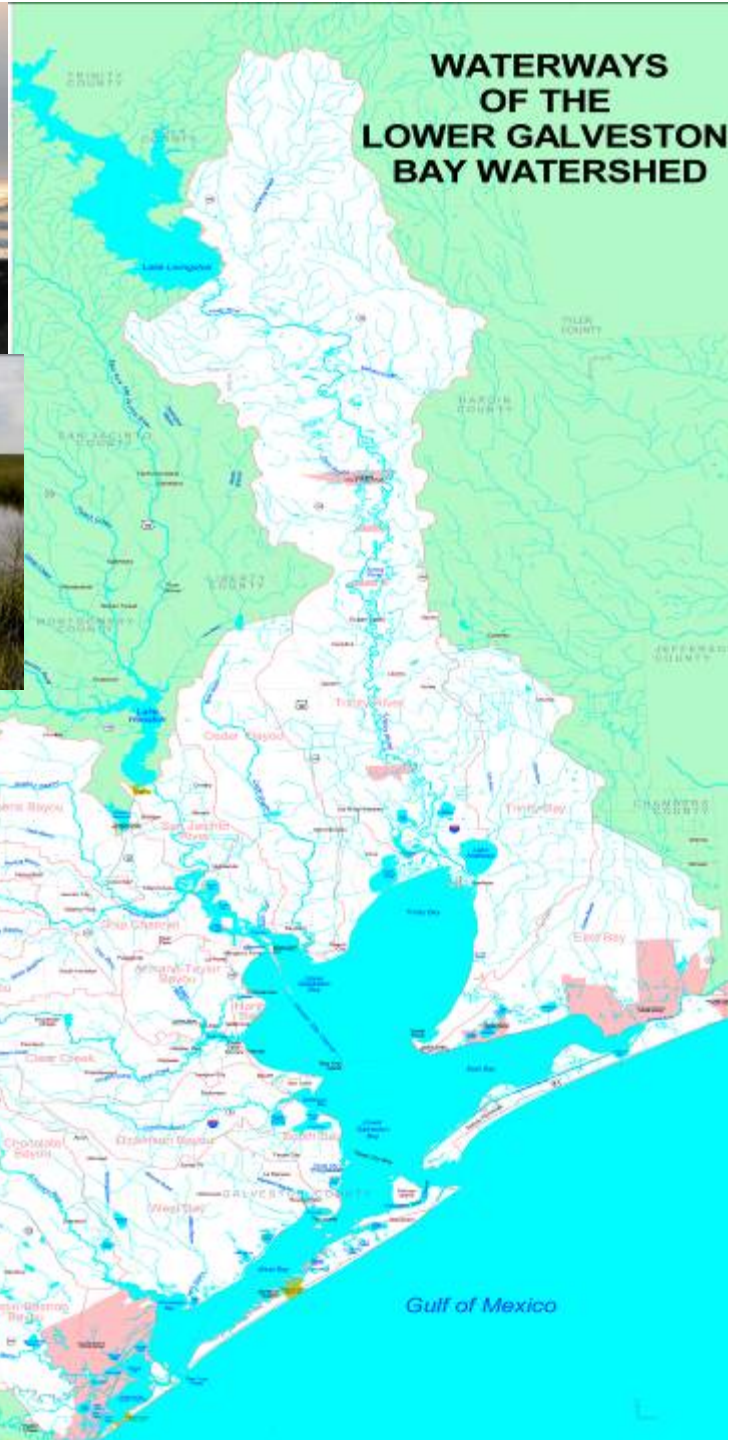
- 4 million people live in the five counties surrounding Galveston Bay
- 3.4 million reside in Harris County alone making Houston the 4th largest metropolitan area in the U.S
- These numbers equate to 546.5 persons per square mile in the five county region

Economics

- ½ of state expenditures for recreational fishing occur within Galveston Bay
- 98,000 recreational boats are registered in the five counties surrounding Galveston Bay
- This system also supports 1/3 of the state's commercial fishing income
- Over \$7.5 billion in travel and payroll dollars (1996) were generated into the Texas economy by travel related activities in the Galveston Bay watershed area

Water Usage

- Over 1.4 billion gallons of freshwater are used each day in the 5 bordering counties of Galveston Bay
- The Bay's watershed receives 60% of Texas' wastewater discharge





Background and Outline of Research Project

- Research project is a collaborative effort to determine the market and nonmarket values of ecosystem services within the Galveston Bay Estuary System
- Collaborative partners are: Texas A&M University at Galveston's Center for Texas Beaches and Shores, Dr. Jae-Young Ko, Dr. William Merrell, Houston Advanced Research Center, and the Galveston Bay Estuary Program
- I would like to acknowledge the research assistance of Nicole Ekstrom, master student in Marine Resource Management at TAMUG, the project development and guidance of Dr. Jae-Young Ko, and the valuable input from Dr. William Merrell

Tasks outlined in proposal

- Literature search
- Hosting two workshops of experts to review work performed
- Catalogue ecological services
- Identify applicable valuation methodologies
- Replacement Cost Analysis
 - Literature search, data collection, presentation of the costs of projects to replace ecosystem services
- Market Value Analysis
 - Literature search, data collection, analyze data for trends of human use/impact



My Contributions

- Library database and internet searching for appropriate peer reviewed articles, agency reports, and websites
- Review and summary of collected citations
- Development of a Draft annotated bibliography
- Assistance with creation and critique of presentation to experts at workshop



Remaining Tasks of Proposal

- Replacement cost literature search and data collection
- Listing costs of projects that will replace lost ecosystem services
- Market value literature search and data collection
- Analyze data for human impacts and trends



Research Importance and Challenges

Improve environmental policy and management decisions

- Protect natural environments which tend to be public goods – nonrival and nonexcludable
- Emphasize the importance of ecosystem services, which may have been taken for granted
- Provide better communication of information to diverse stakeholders

Incomplete knowledge

- Some ecosystems are better understood than others
- Some type of values (i.e. nonuse value) are more difficult to estimate than others



Definitions of terms

Ecosystem structure

- The physical and biological composition of the ecosystem (i.e. marsh plants)

Ecosystem function

- A process resulting from the interactions of the structures in an ecosystems (i.e. primary production)

Ecosystem service

- Products of a functioning ecosystem (i.e. water purification from marsh plants)

“Services consist of flows of materials, energy, and information from natural capital stocks which combine with manufactured and human capital services to provide human welfare.” (Costanza, et al. 1997)

Ecosystem values

- Defined in terms of a function or service contributing to the goals embodied in the object.

“Economists’ objective is human welfare (anthropocentric), ecologists objective is ecosystem sustainability or diversity (biocentric).” (Lazo 2002)

“Dollars are simply used to measure the rate of tradeoff between goods and services that generate utility. Different uses of ecological services generate utility differently, necessitating different measurement approaches.” (Lazo 2002)

Conceptual differences in valuation methodologies

Approach	Anthropocentric	Biocentric
Discipline	Neo-Classical Economics	Systems ecology, Physics
Value	Utility, exchange	Accumulated energy, matter
Major concepts	Willingness-to-pay	Energy-return-on-investment,
Principles	Substitution, market	Thermodynamics, holistic
View on technology	Positive	Neutral
View on society	Bargaining process	Web of energy, resource flow
Growth factor	Human capital, technology	Natural capital



Anthropocentric Valuation methods

Revealed-preference approaches

Travel cost

- measured costs people incur to enjoy (i.e. national park)

Market value

- direct measurement of willingness to pay (i.e. recreational fishing)

Hedonic method

- measured by what people will be willing to pay for the service through purchases in related markets (i.e. higher housing prices in open space)

Production approach

- measured from the impacts of those services on economic output (i.e. increased shrimp yields from increased area of wetlands)



Anthropocentric Valuation methods

Stated-preference approaches

Contingent valuation

- people are directly asked their willingness to pay (i.e. willingness to pay for cleaner air)

Conjoint analysis

- people are asked to choose or rank different service scenarios or ecological conditions that differ in the mix of those conditions (i.e. choosing between wetlands scenarios with different levels of flood protection and fishery yields)



Anthropocentric Valuation methods

Cost-based approaches

Replacement cost

- the loss of a natural system service is evaluated in terms of what it would cost to replace that service (i. e. restoration cost for the value of lost wetlands)

Avoided cost

- a service is valued on the basis of costs avoided (i.e. natural wetlands utilization for improving water quality)

Non-monetizing valuation

Individual index-based method

- ranking choice models, expert opinions

Group-based method

- voting mechanisms, focus group, citizen juries



Biocentric Valuation Methods

Embodied energy

- consider energies directly and indirectly used for producing goods and services; discounting is not allowed

Emergy method

- Converts all diverse energy flows inside an ecosystem into solar-energy based values; adjusts energy quality for the diverse energy types



Original list of ecosystem services for Galveston Bay

- Commercial fishing
- Recreational fishing
- Recreational boating
- Land-based recreations (i.e. swimming, hiking, picnicking, camping, etc)
- Wetlands as storm buffers
- Primary production



Original list with applicable valuation methods

Commercial fishing

- Market analysis

Recreational fishing

- Benefit transfer and Production function

Recreational boating

- Benefit transfer and Contingent valuation

Land-based recreations (i.e. swimming, hiking, picnicking, camping, etc)

- Benefit transfer

Wetlands as storm buffers

- Avoided cost

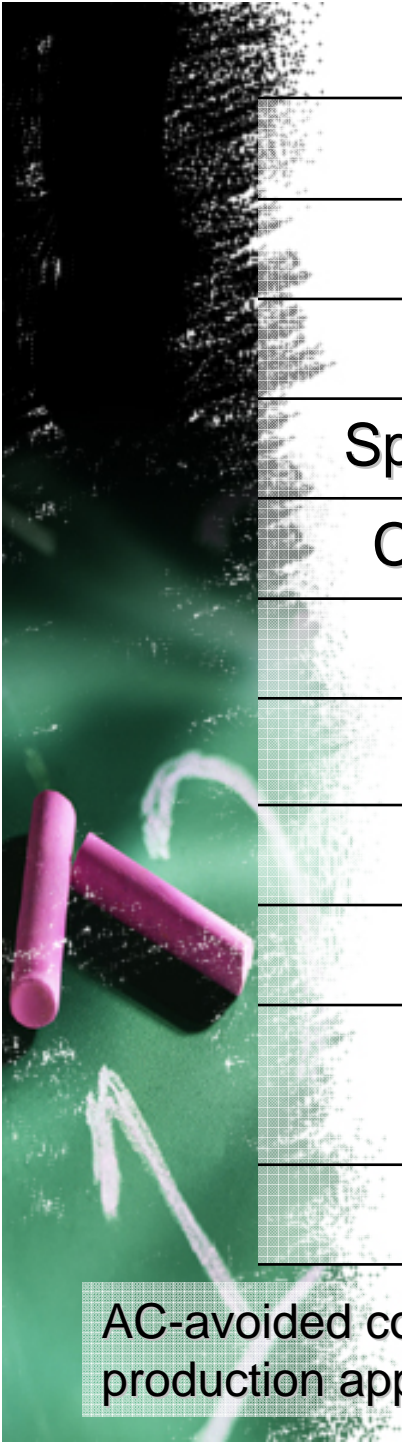
Primary production

- Embodied energy

Combined list collected from first workshop

Ecosystem service	Valuation methods
Storm water abatement	A/RC, H
Water quality	A/RC, CV, H
Erosion control	A/RC, H
Flood & Storm protection	A/RC
Subsidence abatement	A/RC
Cultural & Historical Activities	CV, M, TC
Gas regulation	CV
Nutrient regulation	A/RC, CV

AC-avoided cost; CV-contingent valuation; H-hedonic pricing; M-market pricing; P-production approach; RC-replacement cost; TC-travel cost



Ecosystem service	Valuation methods
Open space	CV, H
Fish & wildlife habitat	P, E, CV
Spawning & nursery habitat	CV, E, P, Ranking
Commercial transportation	M
Commercial fishing	M, P, E
Recreational fishing	M, TC, E, Ranking
Recreational activities	TC, CV, Ranking
Ecotourism	TC, CV, Ranking
Scientific & Educational Activities	CV, P, M
Aesthetics	H, CV, TC, Ranking

AC-avoided cost; CV-contingent valuation; H-hedonic pricing; M-market pricing; P-production approach; RC-replacement cost; TC-travel cost



Conclusion

- Goods and services provided by this estuary system need to be identified so that they can be used as indicators of human impacts and the bay's health
- Economic values and the associated methodologies are tools that are developing to assist society in balancing current human demands with those of the future

Any Questions?



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