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# Gulf of Mexico Ecosystem Service Valuation Database (GecoServ): Gathering ecosystem services valuation studies to promote their inclusion in the decision-making process

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## ABSTRACT

The main goals of the Gulf of Mexico Ecosystem Service Valuation Database (GecoServ), an inventory of ecosystem services (ES) valuation studies applicable to the Gulf of Mexico, are to allow for the distribution and sharing of information about said studies and to identify current gaps in the ES valuation literature.

The utility of GecoServ (<http://www.gecoserv.org>) lies in that it fills a void left by non-ES specific environmental databases, highlights the lack of studies for some ecosystems and associated services, and provides background information for future ES valuation studies.

GecoServ functions as a uniquely centralized source of information for both researchers and natural resource managers. Researchers can find information for different study sites to be used in value transfer methods. For managers, instead, GecoServ is a tool that provides them with ES values to inform their decision-making process.

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## 1. Introduction

Ecosystem services (ES) can be defined as the contributions given by the environment that support, sustain, and enrich human life [1]. They are typically divided into four categories: *supportive* (e.g. pollination and seed dispersal), *regulating* (e.g. disturbance regulation), *provisioning* (e.g. food), and *cultural services* (e.g. recreation and esthetics) [2].

Regardless of the importance of ES in sustaining and enriching human life, it is still surprisingly rare to see them used to inform the decision-making process. Sharing information about ES values might facilitate this practice.

Conducting a primary study is considered the best method to value ES. However, this often proves to be very time-consuming and expensive. Management decisions are usually made in a relatively short amount of time, so conducting a primary study before each decision can be very challenging. A solution to this problem is to perform value transfer (VT), sometimes referred to as benefit transfer. VT is a common technique that uses existing data or information in a different setting other than that for which it was collected [3–5]. The goal of VT is to estimate the value of ES at a specific site (policy site), given the value provided by another study at another site (study site) [3,6,7].

To conduct VT, it is critical to have access to primary studies valuing ES. Databases that provide such information can be an important resource for researchers, scientists, and decision makers. However, current environmental valuation databases (a review is shown in Table 1) focus on general environmental valuation and not specifically on ES monetary values. Some of the common environmental assets being valued in such databases are air quality, water quality, plants, animals, beach, boating, and fisheries.

Since existing environmental databases are geographically limited in scope and non-ES specific, there is a lack of a single access point providing ES monetary values. This translates into the need for a Web site where decision makers and researchers alike could easily search for studies based on specific ecosystems and/or ecosystem services. The response to this need is the Gulf of Mexico Ecosystem Service Valuation Database, known as GecoServ, a newly published, online, comprehensive database and the object of this paper. The next section describes the efforts carried out at the Harte Research Institute to design and develop the database; Section 3 describes GecoServ's applications.

## 2. Methodology

Initially, GecoServ was meant to be populated with Gulf of Mexico specific studies. However, they were (and still are) not abundant. Since VT allows using primary studies from other, even

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**Table 1**  
Existing environmental valuation databases.

Database	Description
Environmental valuation reference inventory (EVRI) <a href="http://www.environment.nsw.gov.au/publications/evri.htm">http://www.environment.nsw.gov.au/publications/evri.htm</a>	Focuses on environmental assets, which are divided by the authors in eight categories: air, land, man-made structure, water, plants, animals, micro-organisms, and human. Access is free for all residents of member countries, such as Australia, Canada, France, New Zealand, UK, and USA.
Envalue <a href="http://www.environment.nsw.gov.au/envalueapp/">http://www.environment.nsw.gov.au/envalueapp/</a>	A searchable environmental valuation database from the New South Wales Government, Australia, focuses on topics such as air quality, water quality, noise, and radiation.
ValueBase <sup>SWE</sup> <a href="http://www.beijer.kva.se/valuebase.htm">http://www.beijer.kva.se/valuebase.htm</a>	A valuation database for environmental change in Sweden funded by the Swedish Environmental Protection Agency. Users can download a copy of the database as an excel file or as a pdf report.
The National Ocean Economics Program Database (NOEP) <a href="http://www.oceaneconomics.org/nonmarket/NMsearch.asp">http://www.oceaneconomics.org/nonmarket/NMsearch.asp</a>	Provides non-market research papers based on ocean and coastal resources. Available assets include beach, boating, climate, coastal farmland, coastal wetlands, ecosystems, estuary, fishery, freshwater, land, mangroves, marine protected areas, ocean information, etc. Users can download some of the articles cataloged in the database; however, the results are very descriptive and are not focused on the monetary value of ES.
Conservation International <a href="http://www.consvalmap.org/">http://www.consvalmap.org/</a>	Visual database where users can select among ecosystem valuation studies, livelihood support, payment for ecosystem service project or agreement, and socio-cultural and spiritual use and value. A short description of each study is provided and although the site might be visually appealing, it is hard to compare studies since the results are not uniform. Additionally, due to the lack of funding the site is currently outdated.
New Zealand Non-Market Valuation Database <a href="http://www2.lincoln.ac.nz/nonmarketvaluation/">http://www2.lincoln.ac.nz/nonmarketvaluation/</a>	Identifies non-market valuation studies undertaken in New Zealand. This database includes monetary values for some ES such as recreation and esthetics, but one limitation is that it focuses only on New Zealand.

distant, study sites, the geographic criterion was expanded to include ES studies worldwide. Ecosystems (habitats or geo-environments) relevant to the Gulf of Mexico were identified: freshwater and saltwater wetlands, beach, dunes, coral reefs, oyster reefs, seagrass, and open/marine water, and a search for studies quantifying the ES provided by these ecosystems began. During the discovery phase, two selection criteria were followed: (1) a study had to provide a monetary value for an ecosystem service and (2) the study had to focus on one of the identified ecosystems.

A list of twenty two ES was created; this list is a combination of Farber et al.'s [2] and de Groot et al.'s work [8]. The services selected for this project are listed in Table 2.

ES studies were collected and key information was extracted and stored in the working database. It took two years to find all the relevant studies to populate the database; in the six months prior to its release the Web interface was designed and developed

**Table 2**  
Selected ecosystem services.

Gas regulation	Habitat/refugia
Climate regulation	Genetic resources
Disturbance regulation	Esthetics
Water regulation	Recreation
Water supply	Cultural/spiritual/historic
Erosion/soil retention	Science/education
Soil formation	Food
Nutrient cycling/regulation	Raw materials
Waste treatment/regulation	Medicine resources
Pollination/seed dispersal	Ornamental resources
Biological control/regulation	Net primary production

in house. GecoServ was recently published online and is now available to the public at <http://www.GecoServ.org>.

The database can be queried by selecting a combination of ecosystems and ecosystem services. The fields shown in the results page are (Fig. 1): ecosystem type, ES valued, adjusted monetary value in 2008 US dollars, units used (e.g. US\$ 2008/ha/year), country, state if within the United States, valuation method, and short citation of the article (by clicking on the 'References' tab, users can have access to the full bibliography). All values were standardized to 2008 US dollars for comparison purposes. If the original value was in a foreign currency, it was converted to US dollars using exchange rates for the original year and then using the consumer price index (CPI) it was converted to year 2008 [9,10].

One of the challenges of this project was that only a few of the collected studies included the information necessary to meet the database requirements; oftentimes some of the required information was not readily available, in a different format, or missing. It was then the researchers' task to address and solve these issues so to arrange the data into predefined GecoServ's fields. The year in which the original value was presented, for example, was frequently not provided. In that case, the study publication date was used as the currency year.

### 3. GecoServ's applications

GecoServ's main goals are to allow for the distribution and sharing of information about ES valuation studies and to identify current gaps in the ES valuation literature.

Unfortunately, there is a lack of studies on ES for specific habitats of interest to the Gulf of Mexico. Given the manner in which data availability is presented online a de facto gap analysis is performed. Fig. 2 shows that valuation studies are available for the majority of the ecosystem services provided by freshwater and saltwater wetlands; in contrast, seagrass, oyster reef, and marine/open water lack data for several ES. Considering ES types, studies are available for disturbance regulation, esthetics, recreation, and food for several of the ecosystems considered; instead, there are no accessible valuation studies for climate regulation, water regulation, water supply, and net primary production other than for freshwater and saltwater wetlands. By performing similar gap analysis, researchers can identify areas in which new primary studies are lacking, which can possibly justify the need for funding. Further research would allow investigating the reason why some services or ecosystems are studied more often than others.

There are two main additional uses of the database:

1. Facilitate the application of value transfer (VT);
2. help managers include ES in the decision-making process.

To perform VT, available ES valuation studies are of critical importance. Access to the primary information necessary to carry

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