

GULF RESEARCH PROGRAM

Project Title: The effect of the Deepwater Horizon oil spill on human wellbeing in the Gulf of Mexico

Award Amount: \$118,000

Awardee: Louisiana State University

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I. ORIGINAL PROJECT SUMMARY (from proposal)

Understanding of the linkages between offshore environmental impacts and human well-being following the Deepwater Horizon (DWH) blowout is minimal. In response to the RFA topic area "Linking Ecosystem Services Related to and Influenced by Oil and Gas Production to Human Wellbeing" it is proposed to begin making this connection by (1) building a model that incorporates provisioning, recreational, and cultural ecosystem services into a trophic flow ecological modeling framework, (2) gathering and inputting biomass data pre- and post-DWH event into the model, and (3) running simulations with the model to test how ecosystem services have been changed and to test the resilience and potential recovery of offshore environments. The trophic flow framework is an Ecopath with Ecosim model that will be developed by expanding on the existing Northern Gulf of Mexico Ecospace model (Suprenand et al. in press). Ecosystem services will be accounted for by employing the methods of Plummer et al. (2013) to apply an ecosystem service category to each of the biomass groups within the model. For example marine mammal and bird biomass can be used to evaluate wildlife watching, which is a cultural service.

In accordance with goals of the Gulf Research Program, the results of this project would begin to provide a framework for predicting effects on human well-being of any oil and gas production in other areas of the world. This information would prove useful particularly in the Atlantic Ocean where the Obama administration has moved to open an area from Virginia to Georgia for offshore drilling exploration. Future work could expand the model to include additional components of the ecosystem, such as, other ecosystem services and biogeochemical processes.

II. PROJECT RESULTS

Accomplishments

It's always important in environmental assessment to be able to understand how a disturbance event has an effect on people. The only way to do that is to translate biophysical impacts to ecosystem service impacts. This approach was taken in to determine how the Deepwater Horizon (DWH) blowout affected ecosystem services in the Gulf of Mexico. An Ecopath with Ecosim model was developed for the Northern Gulf of Mexico that incorporated three ecosystem services that benefit people: commercial fisheries, recreational fisheries, and carbon sequestration. The model results predicted an overall decrease in all three services investigated. Changes in commercial fisheries and carbon sequestration were valued by linking the ecological model outputs to monetary valuation models. The change in commercial fishery yield resulted in monetary changes ranging from \$65 to -\$5,091,109 in one year depending on the species. Investigation of carbon sequestration predicted up to an \$876,583 loss in the ability of the Northern Gulf of Mexico offshore environment to sequester carbon.

Initial Outcomes

This project has provided the first estimates of ecosystem services in offshore environments and evaluated their changes as a result of the DWH blowout. By fostering a collaboration between scientists and students in the biophysical and economic disciplines, improvements have been made as to how we value offshore ecosystem services. Using this approach it was possible to identify the possible impact of the DWH blowout on offshore services and provide a magnitude of impact in a way that is understandable to decision makers. This project has provided the first estimates of ecosystem services in an offshore environment and evaluated their changes as a result of DWH accident.

Future work will require improving model structure, expanding the model to fill data gaps, and linking the model to economic analysis. These activities are very labor intensive and will require much more effort over the years. There is a whole movement into thinking about benefit relevant indicators (BRIs) that more explicitly links bio-physical structure, function, and processes to human well-being. Additional work would look at those connections, of which many BRIs could be bio-physical, because of the inherent difficulty in monetizing ecosystem services. In addition, we need to continue to develop the biophysical science behind ecosystem services whether it be monetized or non-monetized.

On the economic side only four ecosystem services were investigated in the current project. Those represented in the model are considered low hanging fruit. Further works needs to be done in order to determine evaluation and valuation techniques for the remaining services. For example, waste regulation is an important offshore service that was not considered and often utilized in our society. In the past the deep ocean was often used for waste disposal and continues to be. It is of particular interest as a way of storing excess CO₂. Of the services explored in the current model improvements can be made to the associated economic models. For example, a collaboration with NOAA to use their NMFS economic impact model would lead to a more detailed and accurate calculation of ecosystem services values not only for commercial fisheries but recreational as well. In addition, management actions were not adequately addressed in the model. For example, fisheries closures because of the DWH blowout were not account for in the current model. Fisheries closures would affect both the biophysical and economic model.

Unexpected Results

We did expect to see a loss of ecosystem services in the deep sea as a result of the oil spill, however we had no idea of the relative size of the impact, and that was quantified.

Project Relevance

Researchers, community leaders, state government officials, federal government officials, and the private sector would be interested in the results of this project.

The scientific community will be interested because of the new approach and valuations made. Community leaders and private industry will be interested because we estimated direct effects on human well-being. State and Federal scientists and regulators will be interested because we propose a new method for assessing direct biological and economic impacts of an oil spill for components that have non-market values; but more importantly the approach is transferable to any kind of human or natural disturbance in the environment.

Education and Training

Number of students, postdoctoral scholars, or educational components involved in the project:

- Undergraduate students: 1
- Graduate students: 4
- Postdoctoral scholars: 0
- Other educational components: 2 (research associates)

III. DATA AND INFORMATION PRODUCTS

This project produced data and information products of the following types:

- Data
- Scholarly publications, reports or monographs, workshop summary or conference proceedings

DATA

See attached Data Report.