Gulf of Mexico Restoration Decision Support project

In response to the Deepwater Horizon oil spill in April 2010, The Nature Conservancy in collaboration with multiple partners including NOAA, the University of Southern Mississippi, Stanford University, and ESRI, has developed an online web mapping application and robust Gulf of Mexico spatial database to help facilitate restoration and recovery decisions. Primarily targeted to help our state programs and the state agencies and partners they work with, the Gulf Restoration Decision Support project is being advanced to inform the identification of oyster reef restoration projects with maximum ecological, social and economic benefits. The Oyster Restoration Dashboard allows users to explore this database to identify potential restoration investments within each of the Gulf states of Florida, Alabama, Mississippi, Louisiana and Texas.

The Oyster Restoration Dashboard is organized by state and permits users to easily visualize locations most appropriate for oyster restoration investment using a suite of ecological, social and economic criteria. The suitability criteria vary somewhat between states due to differences in data availability, however all states include basic ecological measures such as depth, salinity and historic oyster distribution.

How the Oyster Restoration Dashboard works

The aim of the Oyster Restoration Dashboard is to help with scenario planning at a state scale. When a user interacts with the Oyster Restoration Dashboard for a particular state they have the ability to assign a number of weights to the various criteria or individual parameters. These weights are assigned through the interface by sliding a bar to select a value between 0 and 10. When the user assigns a weight in this manner the predefined values for each parameter are then multiplied by the weight assigned to it. The pre-defined values for each parameter can be found in the Map Layers panel, under each state in the category called Oyster Restoration Dashboard Data. The user-defined weighted parameters are combined to produce an overall score of restoration suitability in the following equation:

$$\text{Score} = \sum_{i=1}^{n} \text{weight}_i * \text{paramater value}_i$$

Where *n* in the above equation is the number of parameters.

Sliding the bar to 0 eliminates the parameter from being included in the suitability analysis. A user assigning a weight of 1 will cause the original parameter value to carry through into the score sum equation. The score is what is displayed to the user on the map, however the raw score cannot be displayed directly because the cartography depends on the scores always maintaining a constant range.

In this case the values are rescaled to a range of 0 – 100. Values in the range from 0 – 20 are assigned "Low", 40 – 60 "Medium", 80 – 100 "High" and then assigned a color for display as referenced in the Legend. Values from 20 – 40 are assigned a color between the Low and Medium classes, and values from 60 – 80 a color between the Medium and High classes. The "others" class has no meaning here as no regions will ever fall into this range.

When the user exports a scenario, the weights displayed on the web mapping application will be captured in the attribute table of the dataset. The values that are present in the table include fields for each parameter ("Score") as well as a rescaled (0-100) overall score value ("Dash_Score").

Suitability parameters included in the Florida Oyster Restoration Dashboard:

Ecological

Salinity- Optimal salinity zones (generally 5-25ppt) were scored as most suitable for oyster restoration while areas of extreme low and high salinities were scored as least suitable. For the panhandle region, polygons representing optimal salinities between 5-25 ppt were scored 1 with remaining areas scored 0. For the peninsula region, the salinity range was adjusted to better reflect the relationship between measured salinities and oyster distribution. Polygons representing salinities over 5ppt were scored 1 with remaining areas scored 0. The scored polygons were converted to a 1km, 1km grid. Original data source: Salinity Zones in Estuaries along the Gulf of Mexico- NOAA/NCDDC (polygon), Resolution: 1:24,000.

Depth- Oysters are able to thrive at a variety of depths, however, for the objectives of this project, the depth of placement was restricted to a maximum of 9 feet. All areas 9ft deep or less were scored 1 with remaining areas scored 0. The scored raster was resampled to a 1km, 1km grid. Original data source: Florida bathymetry generated by Duke University Marine Geospatial Ecology Laboratory, Resolution: 30m grid cell.

Historic Reefs- Oysters are likely to be successful in areas where they historically have been productive. However, it is important to note that conditions may have changed in the given time span such that restoration may not be suitable in all of the areas identified by this layer. To identify areas where oysters have been or are currently found, multiple current and historic oyster reef data sets were collated and merged. Areas with reef were scored 1 and all remaining areas were scored a 0. The scored polygons were converted to a 1km, 1km grid. Original data source: Florida Fish and Wildlife Conservation Commission-Fish and Wildlife Research Institute, General chart of the coast-Gulf Coast-USFC (1882) (polygon), Resolution: varies from 1:24,000 to 1:200,000.

Social and Economic

Shoreline Erosion- Oyster reefs can be placed adjacent to eroding shorelines to help attenuate waves and stabilize shorelines. To identify portions of the shoreline that are currently vulnerable to erosion, we used a portion of the USGS Coastal Vulnerability Index. We extracted shoreline erosion rates for

Florida and reclassified the values into quartiles with scores of .25, .5, .75, and 1. A score of 1 indicates areas with the highest erosion rates and a score of .25 indicates areas of low erosion or accretion. The scores were then allocated to the nearshore areas (within 2km of shore) adjacent to the shoreline. All remaining areas were scored 0. Scored polygons were converted to a 1km, 1km grid. Original data source: USGS Coastal Vulnerability Index (Used erosion raw values, polyline), Resolution: 3 arc-minute grid cell.

Natural Resource Job Dependence- Oyster restoration projects can provide social and economic benefits to those communities whose livelihoods depend most upon the health of coastal natural resources. To identify coastal communities with high levels of natural resource job dependence, we used census data to map the percentage of the workforce employed in agriculture, forestry, and fishing per census block group. Nearshore areas (within 2km of shore) adjacent to block groups with high concentrations of workers employed in natural resource dependent sectors were scored 1 while areas adjacent to medium concentrations received a score of 0.5. All remaining areas were scored 0. Scored polygons were converted to a 1km, 1km grid. Original data source: 2000 US Census (polygon), Resolution: 1:100,000.

Project Permit Feasibility- Permitting for oyster restoration is typically viewed as more feasible outside of Florida Aquatic Preserves. Nearshore areas (within 2km of shore) outside of aquatic preserves were scored 1 and areas within Florida Aquatic Preserves received a score of 0. Scored polygons were converted to a 1km, 1km grid. Original data source: Florida Fish and Wildlife Conservation Commission-Fish and Wildlife Research Institute (polygon), Resolution: 1:24,000.