# INTEGRATING REMOTELY SENSED DATA IN THE VULNERABILITY ASSESSMENT OF COASTAL RESOURCES IN THE PHILIPPINES

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**ABSTRACT:** Remotely sensed data was used as inputs to a GIS-based vulnerability assessment from climate change of coastal resources of selected sites in the Philippines. Maps of mangroves, seagrass and coral areas obtained from LiDAR surveys and satellite images served as the smallest unit of analysis. Sensitivity and Adaptive Capacity criteria were identified from existing coastal vulnerability assessment studies including topography, human activity, i.e. urban development and fisheries, and resource extent. These criteria were then translated into spatial layers using the extracted land and benthic cover maps from LiDAR and satellite data with GIS tools. Additional measurements derived from resource maps, including coastline length and grade, canopy height, and vegetation density, among others, can aid in providing general sensitivity and adaptive capacity ratings for the study areas. These layers and ratings may then be used as components in the computation of potential impact and vulnerability scores for each resource type. The study presented a method for integrating remotely sensed data to vulnerability assessment tools that can be implemented in a GIS platform.

## INTRODUCTION

Existing Coastal Vulnerability Assessment tools in the Philippines has identified the importance of spatial data to further the analysis of vulnerability of coastal resources. One source of spatial data that can be used is remote sensing technologies such as satellite image maps and LiDAR surveys. These technologies may be used to map out the coastal resources and generate land cover and benthic habitat maps to be used as inputs to VA studies. Furthermore, data may be derived from these maps that may serve as criteria values for the Vulnerability components Exposure, Sensitivity and Adaptive Capacity. This enables an object-based approach to the evaluation of Potential Impact and overall Vulnerability of coastal resources to Climate Change hazards.

The study demonstrates a method of generating vulnerability component layers using GIS tools that may be later integrated with a GIS-based framework for evaluating the Potential Impact, Adaptive Capacity and overall Vulnerability of coastal resources.

## MATERIALS AND METHODS

### Study Site

Bolinao, Pangasinan is a coastal municipality found in the northwestern part of the Luzon Island. It has seagrass meadows and coral reefs that are at risk from the pollution brought about by extensive aquaculture practices in the area. The proximity to urban areas and fish structures may increase the impact of climate change to the seagrass and coral areas in the municipality.

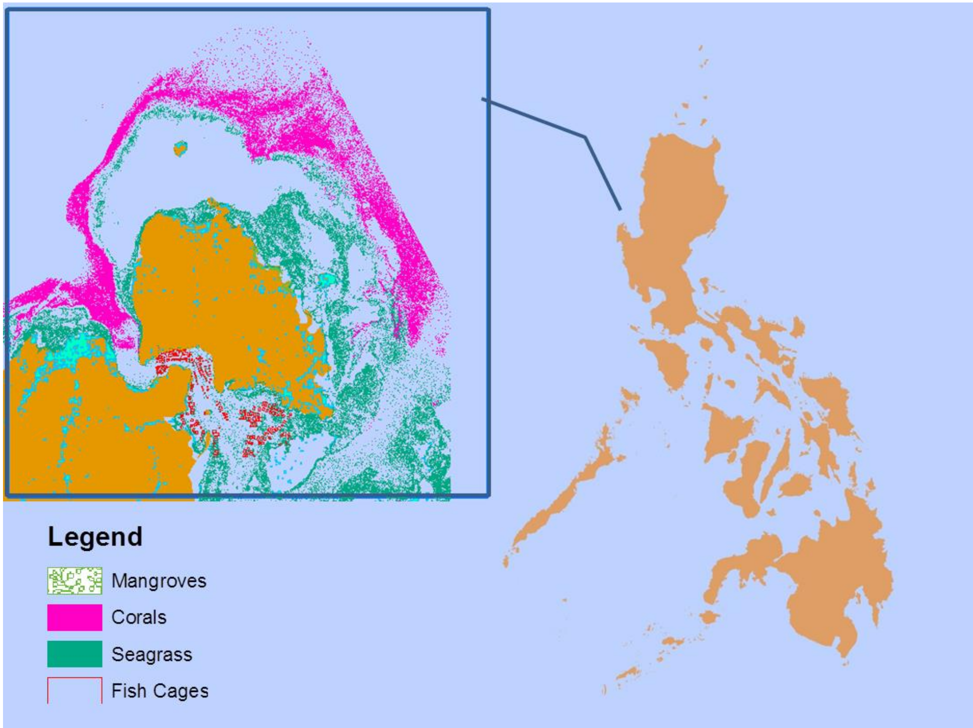


Figure 1: Bolinao, Pangasinan

**Data**

Land Cover and Coastal Resource maps were extracted from high resolution Satellite images, characterizing the urban and benthic cover for the municipality. For this study, the seagrass habitats are the resource considered for Sensitivity evaluation and serve as the basic units of analysis.

**Sensitivity Layers and Scoring**

Proximity layers were derived from urban and fish structures maps using GIS tools. These layers were then reclassified to a numerical rating scale for the sensitivity of seagrasses to the presence of these anthropogenic activities. The scoring is based on case studies done on different coastal municipalities in the Philippines, measuring the range of distances of seagrass meadows to anthropogenic activities and normalizing based on a 1-5 (Low to High) rating scale.

| **SENSITIVITY CRITERIA** | | **Very High (5)** | **High (4)** | **Medium (3)** | **Low (2)** | **Very Low (1)** |
|---|---|---|---|---|---|---|
| **GIS derived Criteria** | **Proximity to Coastal Development** | <300m to nearest built-up region | 301m to 600m to nearest built-up region | 601m to 900m to nearest built-up region | 901m to 1200m to nearest built-up region | >1200m to nearest built-up region |
| | **Proximity to Aquaculture** | <300m to nearest built-up region | 301m to 600m to nearest built-up region | 601m to 900m to nearest built-up region | 901m to 1200m to nearest built-up region | >1200m to nearest built-up region |

Table 1: Seagrass sensitivity scoring to the presence of anthropogenic activities

Overlay analysis is later done to join the sensitivity scores to each seagrass feature to examine the variability of sensitivity over the resource area.

**RESULTS**

The GIS tools used were able to generate surfaces of distances to urban and fish structures. Areas nearer to urban and fish structures indicate a higher sensitivity to anthropogenic activity for seagrasses. Rescaling and overlay analysis show a variation of sensitivity values over the seagrass areas.

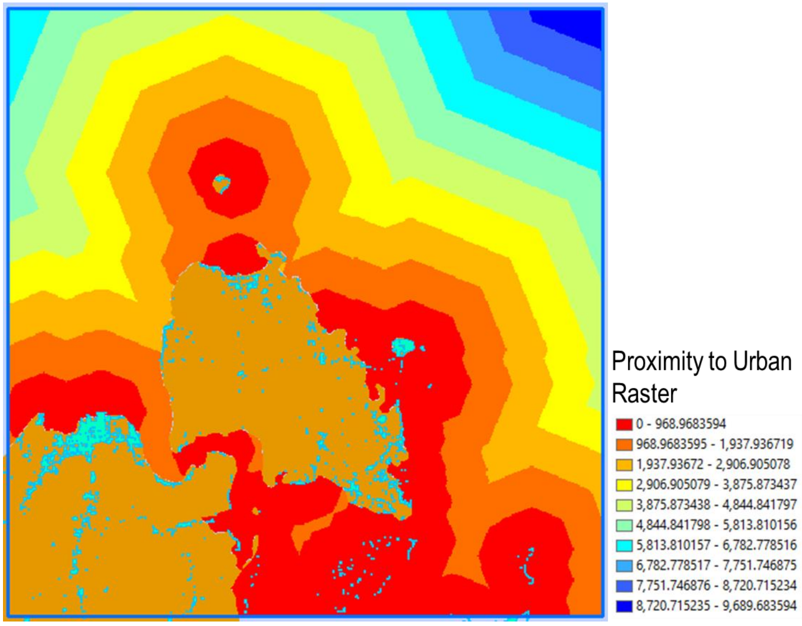


Figure 2: Distance to Urban Raster

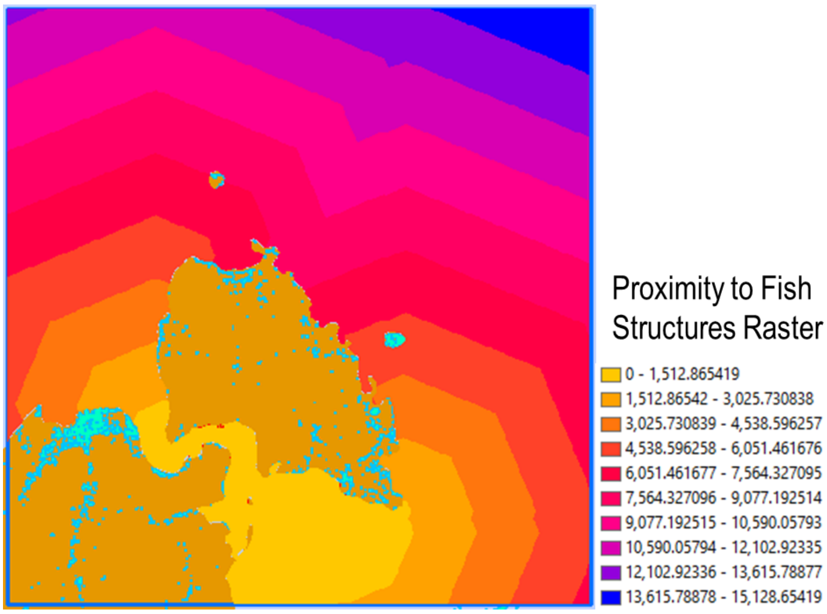


Figure 3: Distance to Fish Structure Raster

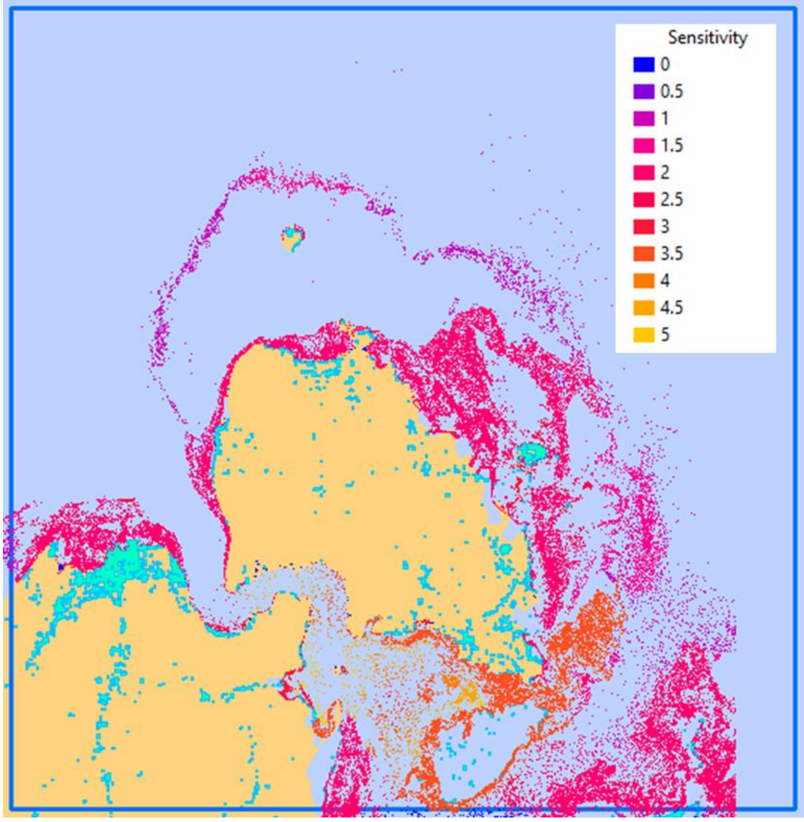

Figure 4: Sensitivity Layer for Seagrass

## CONCLUSION

The study was able to generate an object-based sensitivity layer for seagrasses that identifies the variation of scores over the total seagrass area. This enables a spatial analysis of Sensitivity and overall Vulnerability of seagrass and other coastal resources with a feature-level resolution. Similar layers may be generated from this method and integrated to a GIS-based Vulnerability Assessment framework. This, in turn, can identify the critical areas that may need special recommendations or intervention in the study area.

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