Costal Resource Vulnerability in Masbate City

"Vulnerability Assessment of Coastal Resources in Masbate City using LiDAR Remote Sensing and GIS"

The presentation for the next 9.6 minutes

- Background
- Concepts and Methodology
- Results of the study

The Study Site: Masbate City

- Seagrass and Mangrove areas are present throughout the City's coastline, depended upon by local fishermen to sustain an ideal ecosystem for marine life.
- There are nine (9) coastal barangays in Masbate City that are adjacent to or interacting with coastal resources such as sea-grass, corals, and mangroves.
- The Buntod Reef Marine Sanctuary was subject to illegal activities such as sand quarrying and dynamite fishing before it was declared a protected area. It was only in 2001 when the area was declared a marine sanctuary.

Our Objectives

- Gather socio-economic and political data from the coastal communities and the Local Government Unit;
- Use LiDAR data and GIS derived data to conduct an object based vulnerability assessment of coastal resources;
- Assign Vulnerability ratings to high value coastal resources in Masbate City, using both the socio-economic and political data and the LiDAR and GIS based data, in an integrated methodology for assessing coastal resource vulnerability.

Vulnerability Assessment

- Our study follows the concept of Vulnerability as conceptualized by the Marine Science Institute, as the functions of Exposure, Sensitivity, and Adaptive Capacity.
- The guidebook entitled: *"Vulnerability Assessment Tools for Coastal Ecosystems"* provides three tools with related yet unique approaches to measuring a coastal area's vulnerability to the effects of climate change.
- This study integrates and uses all three of the assessment tools in qualifying and quantifying the Exposure, Sensitivity, and Adaptive Capacity of the areas, using pre-defined criteria.

Methodology

- Using the three tools for assessing vulnerability, an integrated methodology was developed by the UP-Diliman Phil-LiDAR 2, combining the different criteria for measuring *Sensitivity* and *Adaptive Capacity.*

- Generally there are two kinds of data used in this study:
  - Qualitative data: obtained through Focus Group Discussions, Key Informant Interviews, and Participatory Mapping; and
  - Quantitative data: the GIS derived data, classified resource maps using LiDAR, and scores for the sensitivity and adaptive capacity criteria.

Vulnerability Assessment Framework

Assessment was done by analysing the coastal area's physical environment condition and the system's exposure to climate change effects, and its response to exposure factors – the potential impacts to the coastal resources;

Then the potential impact to the environment is assessed with the natural and human system's ability to mitigate the potential damages to the resources.

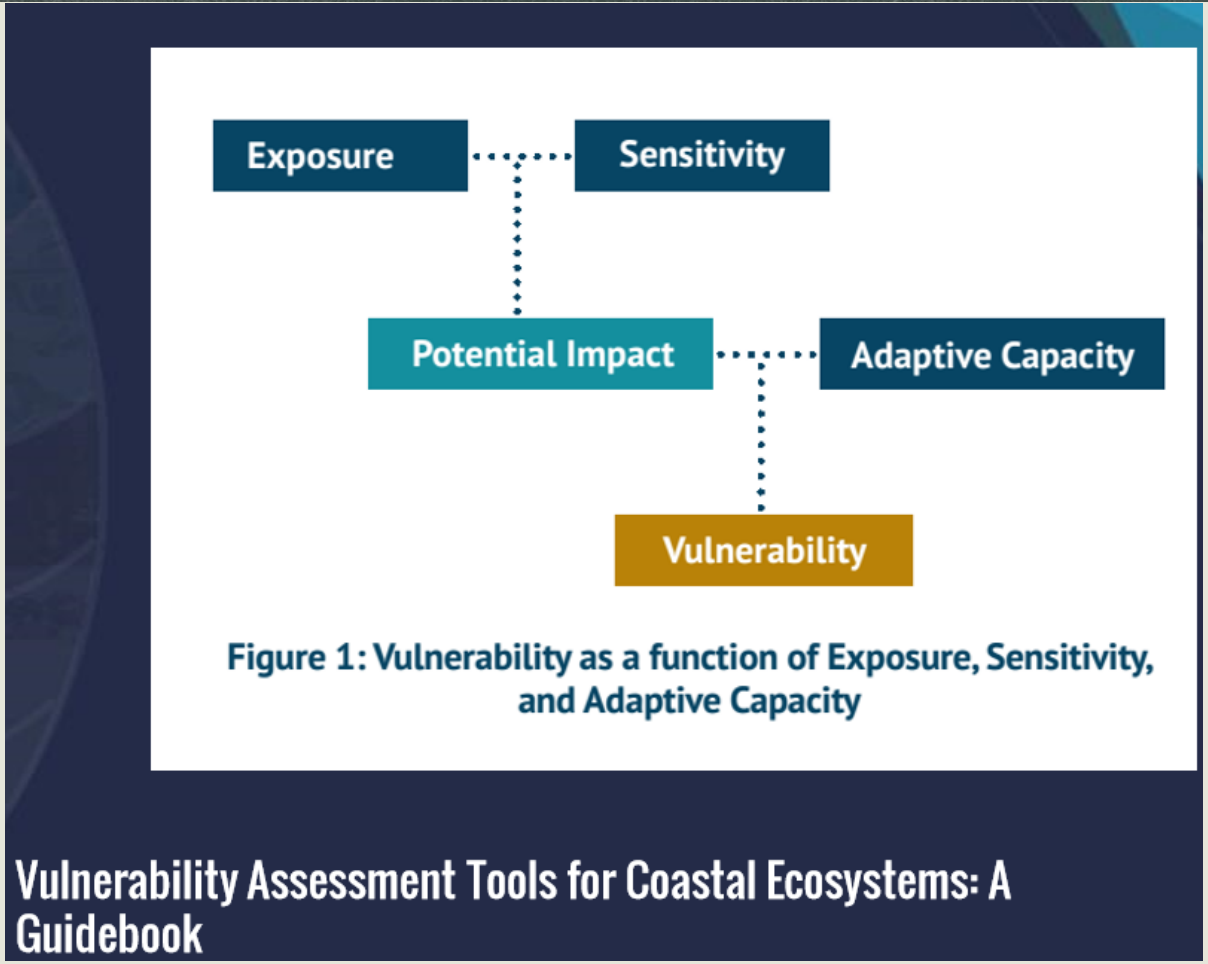


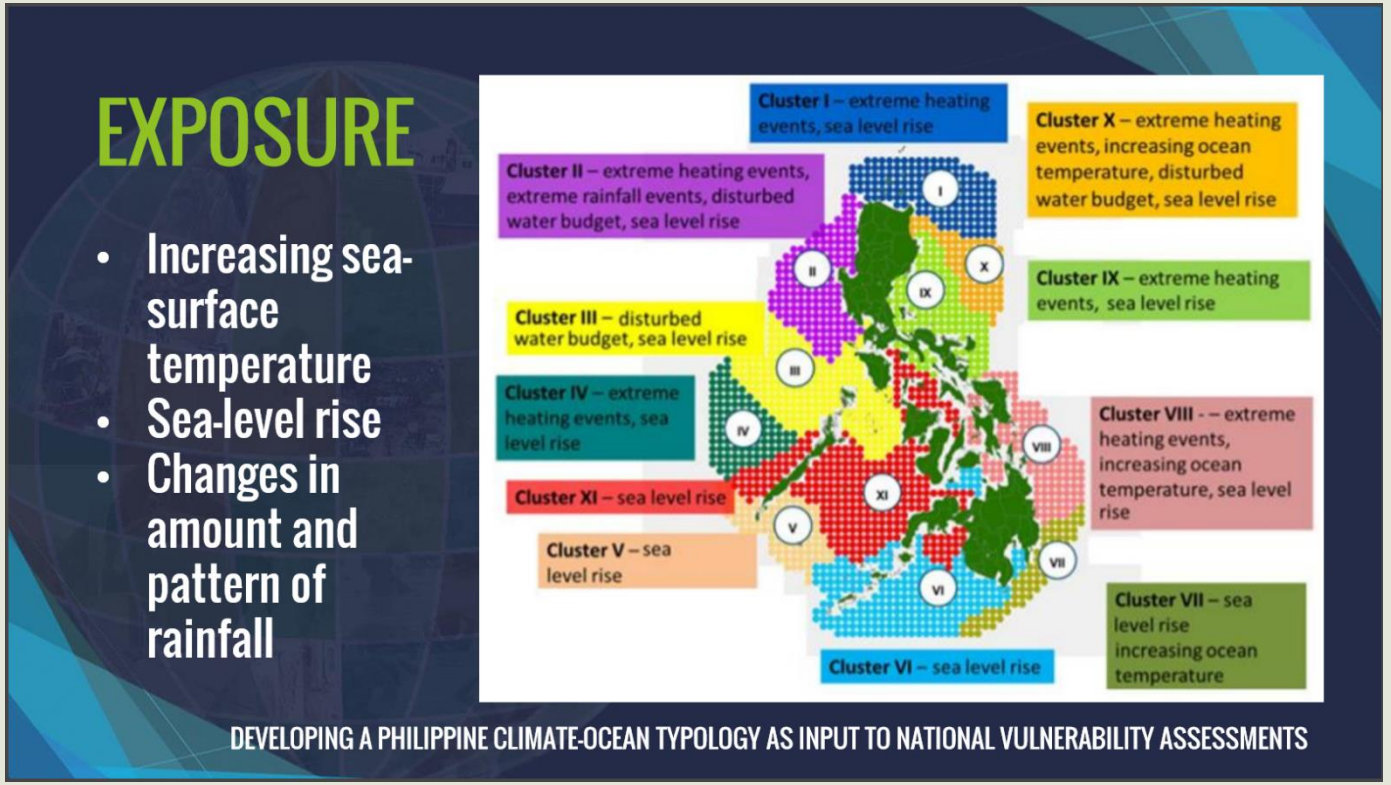
Figure 1: Vulnerability as a function of Exposure, Sensitivity, and Adaptive Capacity

Vulnerability Assessment Tools for Coastal Ecosystems: A Guidebook

VA Concept: Exposure

Exposure quantifies the intensity or severity of physical environment conditions driving changes in the present state of the biophysical system.

We based the study's exposure values on this regionally-applicable guide, which divides the country into regions according to the type and severity of exposure



VA Concept: Sensitivity

The Sensitivity Criteria are grouped into three areas, each containing specific criteria used to determine the *Sensitivity Scores:*

-Water Quality

-Anthropogenic Disturbances

-Habitat Characteristics

Criteria Scoring

CIVAT Rescaling Guide for assigning ratings to Sensitivity & Adaptive Capacity Scores

CIVAT Rescaling Guide

If the no. of criteria = 2	
Maximum score	(2 x 5) = 10
Minimum score	(2 x 1) = 2
Total range	[max - min] = 8
Intervals	8 ÷ 3 = 2.7 or 3
Interval	8/3
	2.7

Rating	Range
Low	2-4
Medium	5-7
High	8-10

If the no. of criteria = 3	
Maximum score	(3 x 5) = 15
Minimum score	(3 x 1) = 3
Total range	[max - min] = 12
Intervals	12 ÷ 3 = 4
Interval	12/3
	4.0

Rating	Range
Low	3-7
Medium	8-11
High	12-15

If the no. of criteria = 4	
Maximum score	(4 x 5) = 20
Minimum score	(4 x 1) = 4
Total range	[max - min] = 16
Intervals	16 ÷ 3 = 5.3 or 5
Interval	16/3
	5.1

Rating	Range
Low	4-9
Medium	10-15
High	16-20

If the no. of criteria = 5	
Maximum score	(5 x 5) = 25
Minimum score	(5 x 1) = 5
Total range	[max - min] = 20
Intervals	20 ÷ 3 = 6.7 or 7
Interval	20/3
	6.7

Rating	Range
Low	5-11
Medium	12-18
High	19-25

If the no. of criteria = 6	
Maximum score	(6 x 5) = 30
Minimum score	(6 x 1) = 6
Total range	[max - min] = 24
Intervals	24 ÷ 3 = 8
Interval	24/3
	8.0

Rating	Range
Low	6-14
Medium	15-22
High	23-30

If the no. of criteria = 7	
Maximum score	(7 x 5) = 35
Minimum score	(7 x 1) = 7
Total range	[max - min] = 28
Intervals	28 ÷ 3 = 9.3 or 9
Interval	28/3
	9.3

Rating	Range
Low	7-16
Medium	17-26
High	27-35

Sensitivity and Adaptive Capacity Rating Matrix; the interactions between the S and AC criteria

Intrinsic Properties and Governance	Anthropogenic Characteristics: H	M	L	Habitat Characteristics
H	HHH	HMH	HLH	H
H	HHM	HMM	HLM	M
H	HHL	HML	HLL	L
M	MHH	MMH	MLH	H
M	MHM	MMM	MLM	M
M	MHL	MML	MLL	L
L	LHH	LMH	LLH	H
L	LHM	LMM	LLM	M
L	LHL	LML	LLL	L

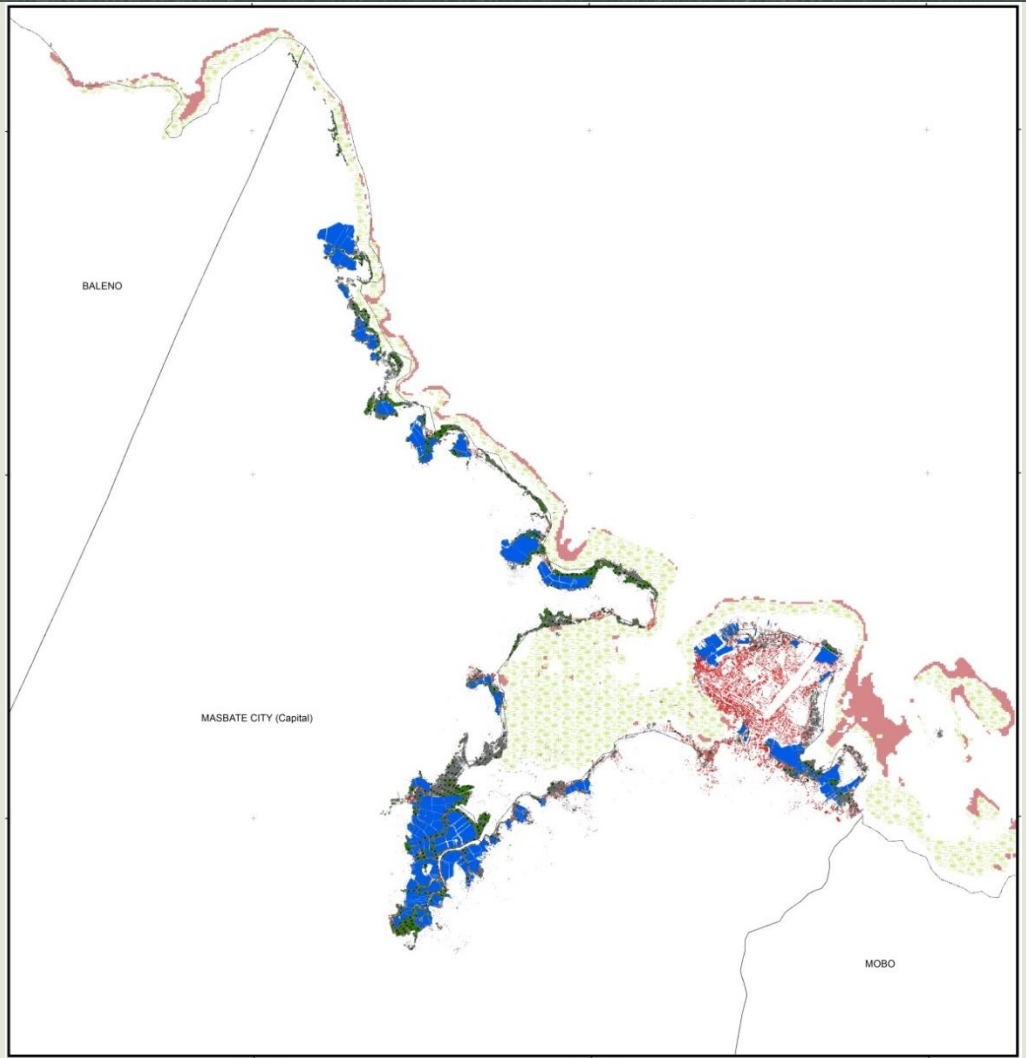
GIS Data Integration

Data Integration of the Sensitivity and Adaptive Capacity criteria was done using ArcGIS in order to produce the rating for the Potential Impact based on Exposure and the different Sensitivity Criteria.

The Vulnerability of the resource using the computed Potential Impact and Adaptive Capacity Criteria.

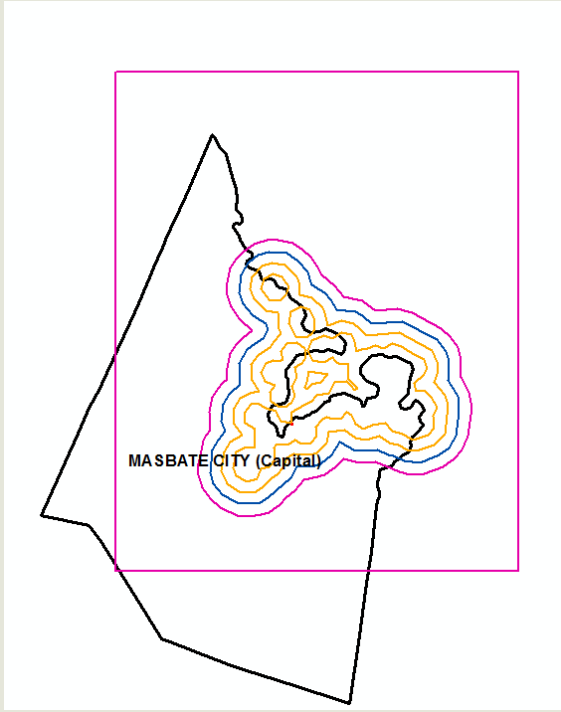
The input for the data integration was the Coastal Land Cover shapefile of the target resources which contains the joined attributes from the different sensitivity layers.

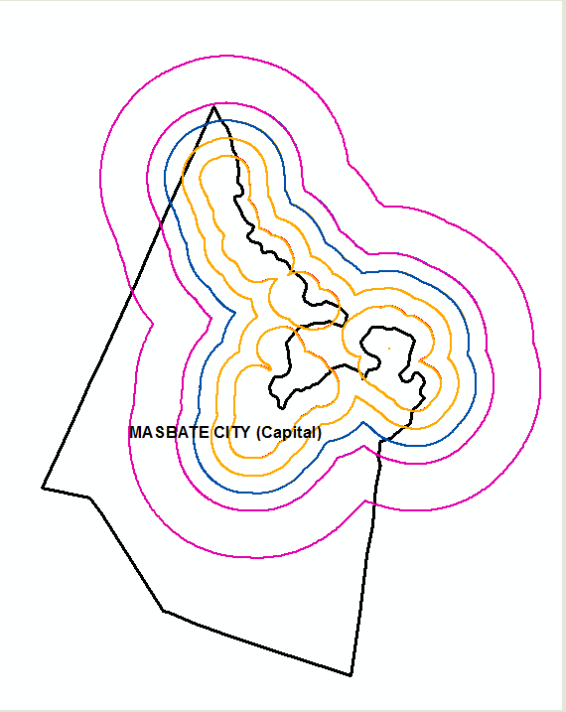
(the land cover map was classified using OBIA using LiDAR)



GIS Data Integration

Included in the Sensitivity Layer, as additional input to the computation of *Sensitivity*, are multiple ring buffers of Aquaculture objects, and the Urban Area, also included is the Bathymetric data collected by our field researchers





Cross-tabulation was then performed to compute for the potential impact and vulnerability rating. Computing for the potential impact required the use of the codeblock in the field calculator with VB Script syntax.

This allowed the use of if-else statements to determine the potential impact score of the cross-tabulated exposure and sensitivity.

The same method is done for computing the vulnerability but with a different syntax since vulnerability is a cross-tabulation of potential impact and adaptive capacity.

Script to calculate overall Vulnerability Assessment (VA)

```
Dim X
If ([V_IC] = "L" and [V_AA] = "L" and [V_HC] = "L") THEN
X = "L"
ELSEIF ([V_IC] = "L" and [V_AA] = "L" and [V_HC] = "M") THEN
X = "L"
ELSEIF ([V_IC] = "L" and [V_AA] = "L" and [V_HC] = "H") THEN
X = "L"
ELSEIF ([V_IC] = "L" and [V_AA] = "M" and [V_HC] = "L") THEN
X = "L"
ELSEIF ([V_IC] = "L" and [V_AA] = "H" and [V_HC] = "L") THEN
X = "L"
ELSEIF ([V_IC] = "L" and [V_AA] = "M" and [V_HC] = "M") THEN
X = "L"
ELSEIF ([V_IC] = "L" and [V_AA] = "M" and [V_HC] = "H") THEN
X = "M"
ELSEIF ([V_IC] = "L" and [V_AA] = "H" and [V_HC] = "M") THEN
X = "M"
ELSEIF ([V_IC] = "L" and [V_AA] = "H" and [V_HC] = "H") THEN
X = "H"
ELSEIF ([V_IC] = "M" and [V_AA] = "M" and [V_HC] = "M") THEN
X = "M"
ELSEIF ([V_IC] = "M" and [V_AA] = "M" and [V_HC] = "L") THEN
X = "L"
ELSEIF ([V_IC] = "M" and [V_AA] = "M" and [V_HC] = "H") THEN
X = "H"
ELSEIF ([V_IC] = "M" and [V_AA] = "L" and [V_HC] = "L") THEN
X = "L"
ELSEIF ([V_IC] = "M" and [V_AA] = "L" and [V_HC] = "M") THEN
X = "L"
ELSEIF ([V_IC] = "M" and [V_AA] = "L" and [V_HC] = "H") THEN
X = "M"
ELSEIF ([V_IC] = "M" and [V_AA] = "H" and [V_HC] = "M") THEN
X = "H"
ELSEIF ([V_IC] = "M" and [V_AA] = "H" and [V_HC] = "L") THEN
X = "M"
ELSEIF ([V_IC] = "M" and [V_AA] = "H" and [V_HC] = "H") THEN
X = "H"
ELSEIF ([V_IC] = "H" and [V_AA] = "H" and [V_HC] = "H") THEN
X = "H"
ELSEIF ([V_IC] = "H" and [V_AA] = "H" and [V_HC] = "M") THEN
X = "H"
ELSEIF ([V_IC] = "H" and [V_AA] = "H" and [V_HC] = "L") THEN
X = "H"
ELSEIF ([V_IC] = "H" and [V_AA] = "M" and [V_HC] = "H") THEN
X = "H"
ELSEIF ([V_IC] = "H" and [V_AA] = "M" and [V_HC] = "M") THEN
X = "H"
ELSEIF ([V_IC] = "H" and [V_AA] = "M" and [V_HC] = "L") THEN
X = "M"
ELSEIF ([V_IC] = "H" and [V_AA] = "L" and [V_HC] = "H") THEN
X = "H"
ELSEIF ([V_IC] = "H" and [V_AA] = "L" and [V_HC] = "M") THEN
X = "M"
ELSEIF ([V_IC] = "H" and [V_AA] = "L" and [V_HC] = "L") THEN
X = "L"
END IF
```

Findings

Findings

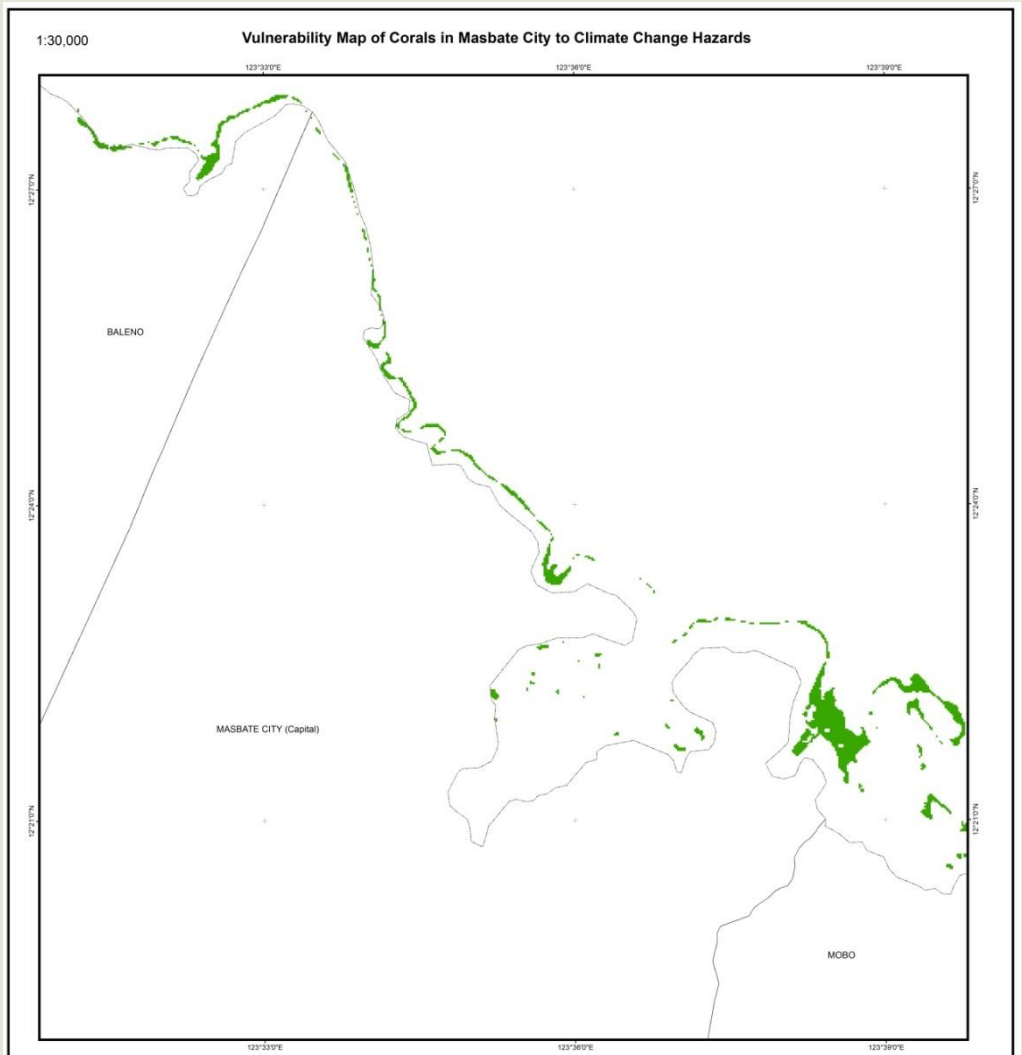
None of the coastal barangays included in this vulnerability assessment study received a “High Vulnerability Rating”; most of the coastal resources for each barangay received only “Low” and “Medium” vulnerability ratings.

Coastal resources on Masbate City have are less likely to experience severe impact from climate change

Findings: Corals

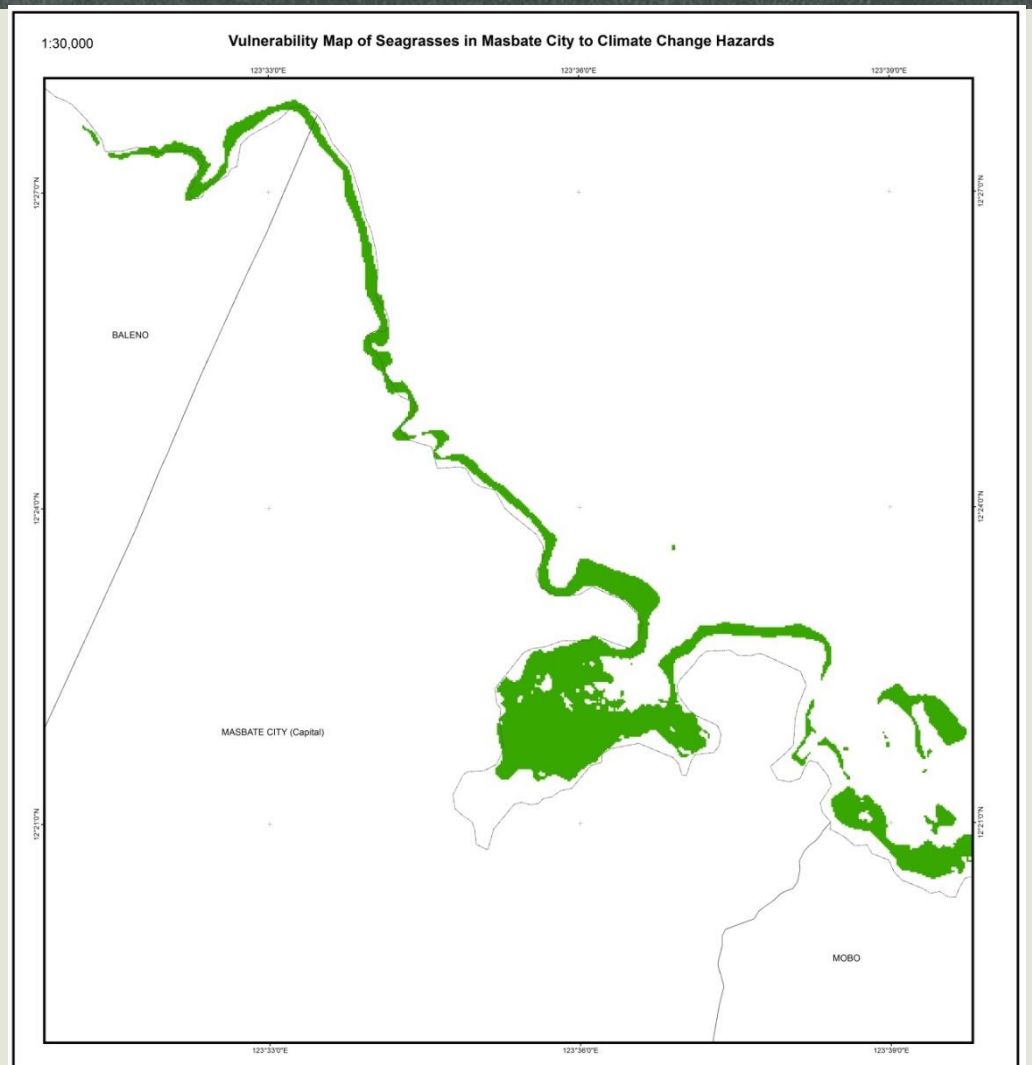
Corals in Masbate City were given a **low** vulnerability assessment rating. The resource's Sensitivity in terms of Water Quality, and Habitat Characteristics, are both low; while the sensitivity to Anthropogenic Disturbances is medium.

Meanwhile the Adaptive Capacity in the areas of Governance, Anthropogenic Characteristics, and Habitat Characteristics, were all given a high rating.



Findings: Seagrass

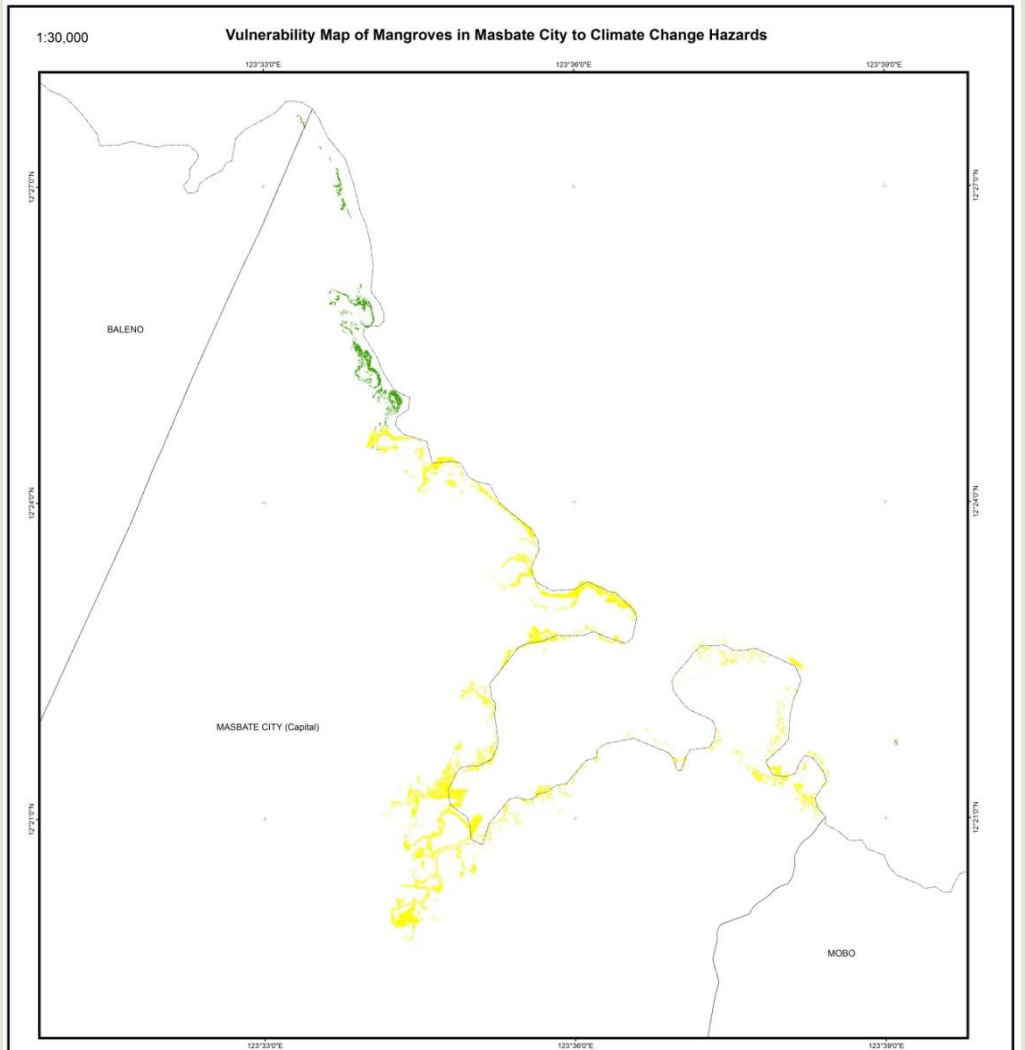
Despite having Medium Sensitivity ratings, Seagrass areas in the city are given a **low** vulnerability rating. This is mainly sue to the high Adaptive Capacity scores; coastal communities are generally aware of the resource's importance and are inclined to protect them.



Findings: Mangroves

For Mangrove areas, the final vulnerability assessment is **medium** for a majority of the area, and about 12% of the total area of mangrove areas has a **low** vulnerability rating.

Initially, the entire mangrove area had a low vulnerability, but due to its proximity to aquaculture objects and built-areas, ma majority of the mangroves were given a final vulnerability of medium.



Conclusions

- The low and medium vulnerability assessments given to the three coastal resources, despite these resources' medium Exposure to Climate Change, and the generally Medium and High sensitivity ratings - can be attributed to two factors:
  - first is the raised awareness of the importance of coastal resources in communities settled in these barangays;
  - and second, is the attention given by the Local Government Unit and other government institutions to the maintenance and protection of their coastal areas.
- These factors contributed to the generally high Adaptive Capacity scores given to each barangay.

Conclusions

- The high Adaptive Capacity scores given to the different criteria, is attributed to the combination of the following strategies in coastal resource management:
  - Existence and proper implementation of ESWM and CRM ordinances;
  - High level of awareness and information dissemination to coastal communities;
  - Creation of a Marine Sanctuary for coral reefs; and
  - Regular coastal-clean-up activities initiated by the barangays

Thank you!

Acknowledgements:
Phil LiDAR 2 Program-UPD COASTMap
AdNU Phil-LiDAR 2 Researchers
Kevin Peñaserada, Jovin Renales, Jan Merel Brazal (photos)