Vulnerability of Mangrove Resources to Climate Change: Coastal Resource Assessment Using LiDAR Data

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ISU Phil-LiDAR 2 Project,

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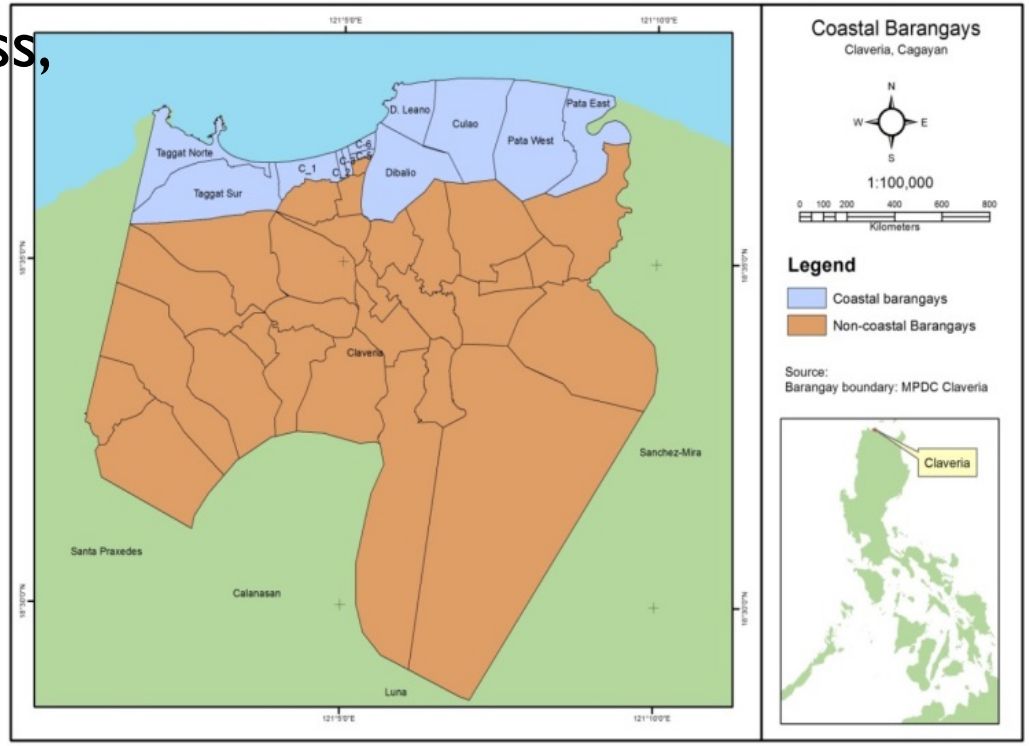
INTRODUCTION

Study Area (Claveria, Cagayan)

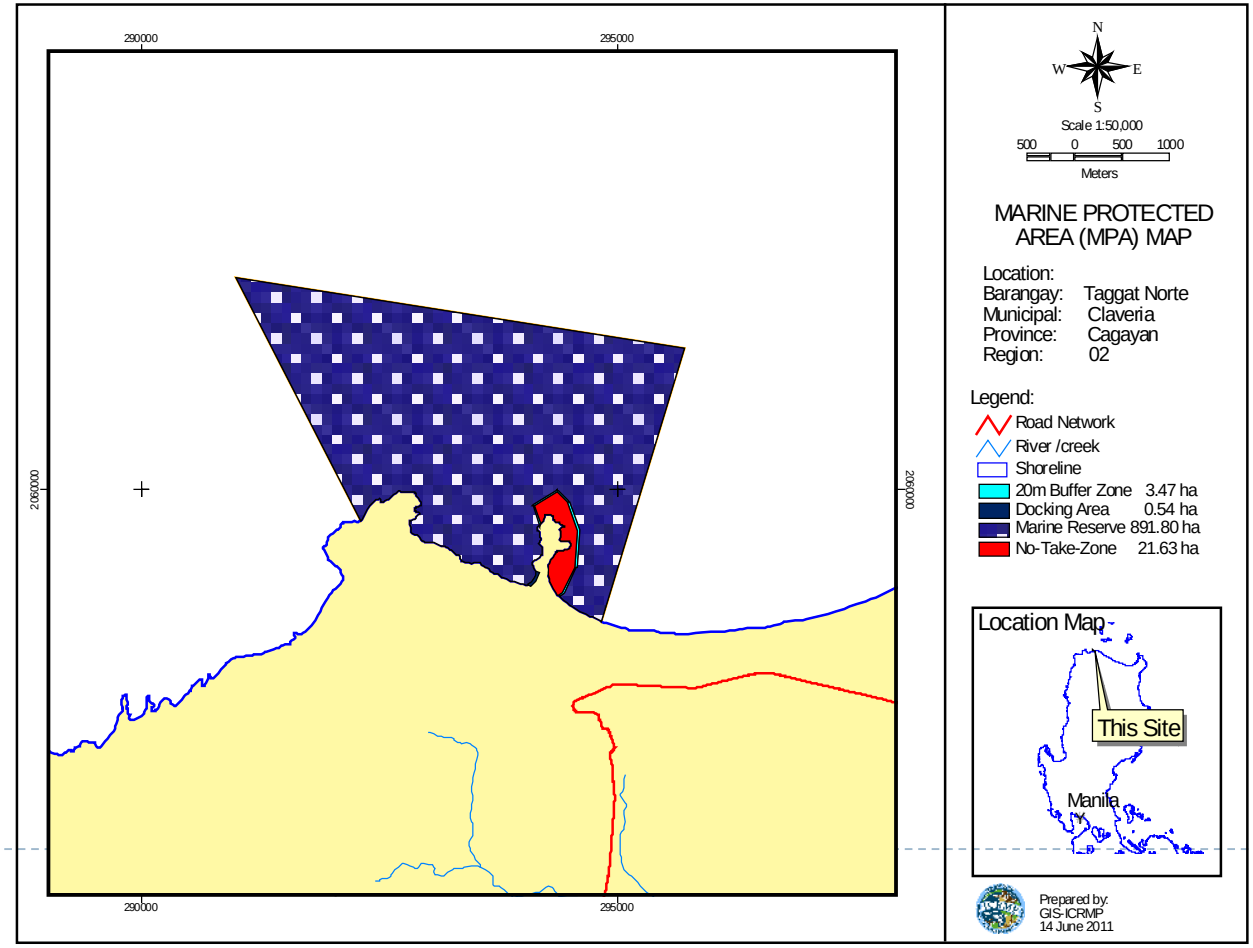
- 3rd class municipality
- 12 coastal Barangays
- With complete coastal resources (corals, seagrass, mangroves and aquaculture
- A tourist destination "Tourist Haven of Northern Philippines" (Taggat Lagoon, Lakay-lakay, Baket-baket)



INTRODUCTION

Study Area (Claveria, Cagayan)

- Existing MPA (Taggat Norte Marine Protected Area)



OBJECTIVES

- To assess the vulnerability of coastal resources to climate change
- To help communities, local governments and stakeholders in the identification and prioritization of appropriate adaptive responses to climate change.
- To recommend policies for adoption and promotion of coastal resource conservation

METHODOLOGY

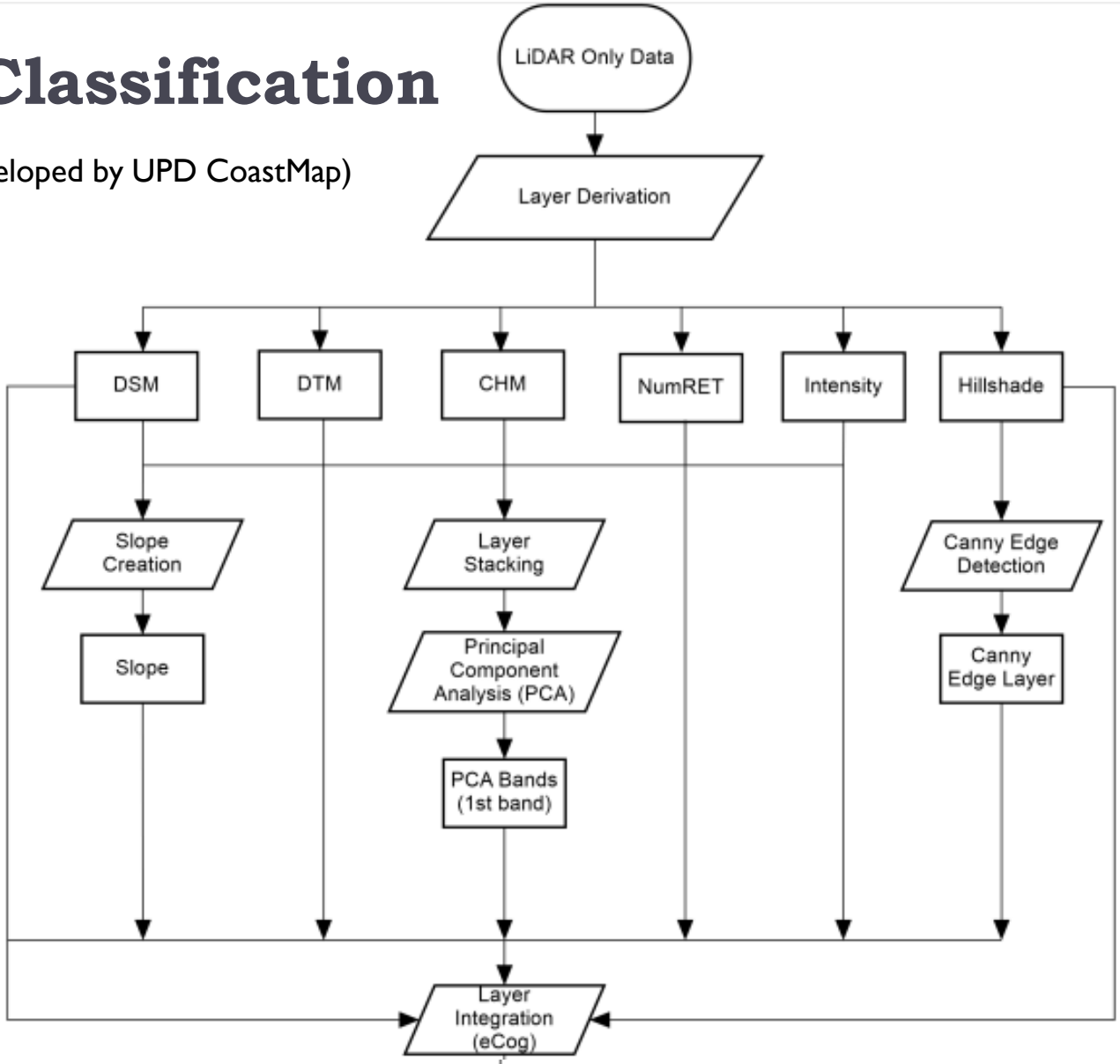
- Complete the rating scores and calculate the values of VA indicators such
  - exposure,
  - sensitivity,
  - adaptive capacity.
- Potential Impact-generate the vulnerability map on coastal resources in Claveria
- LiDAR data derivatives and products used for VA
  - coastal resources,
  - coastal resources maps.
  - resources assessment,
  - secondary data such as typology, landuse/landcover maps, and
  - social data (from interview and FGD).

Data Gathering & Design

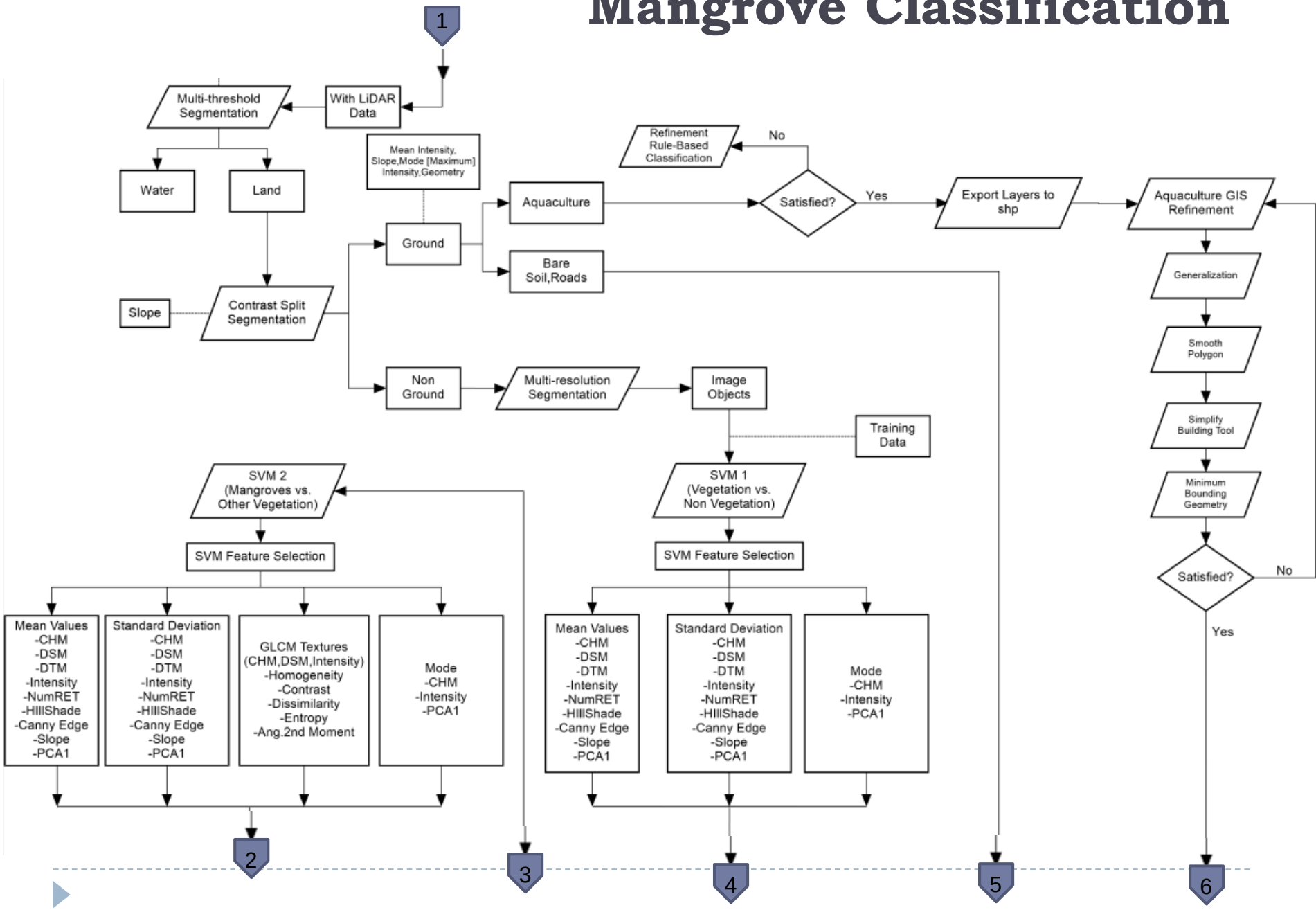
- Coastal Resources- extracted from LiDAR data
- Focus Group Discussion (FGD) and Key Informant Interviews
  - 6 coastal barangays covered
- Secondary Data
- Other data used
  - MPA maps
  - Results of resource assessment
  - Exposure map

Mangrove Classification

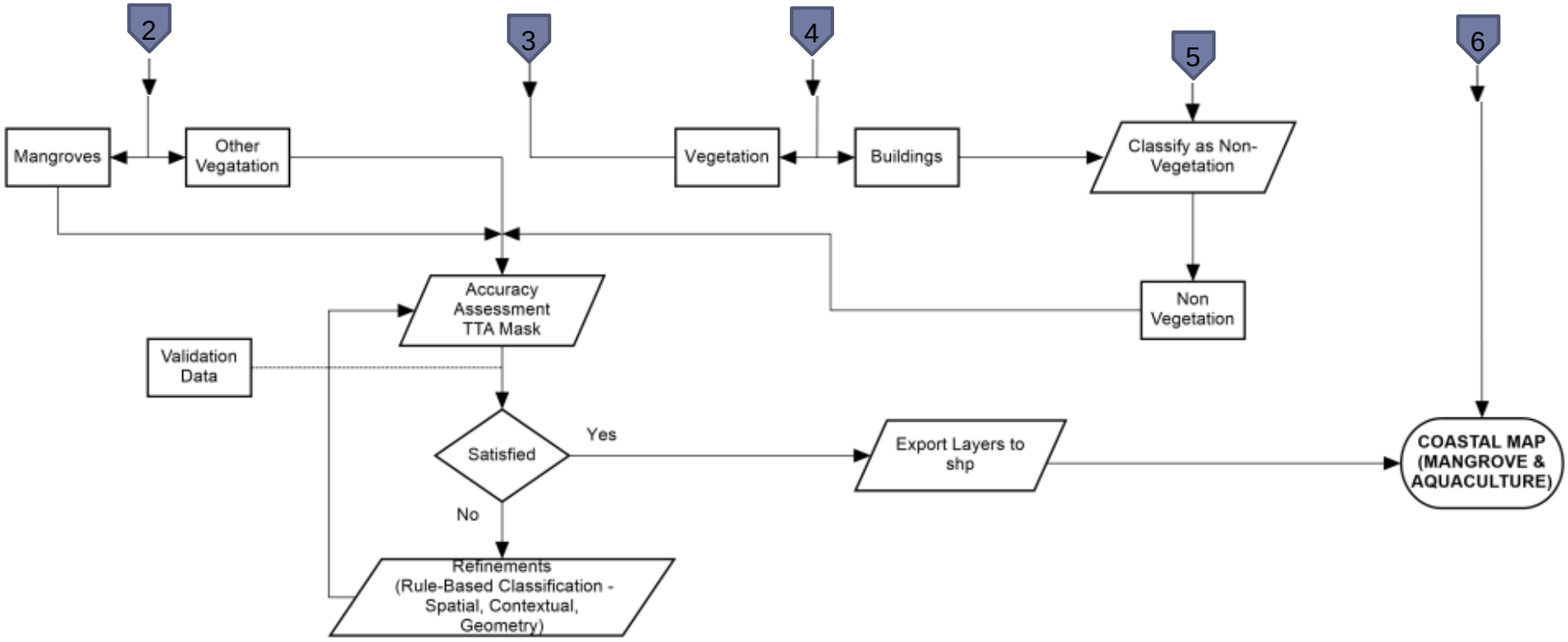
- General Workflow (Developed by UPD CoastMap)



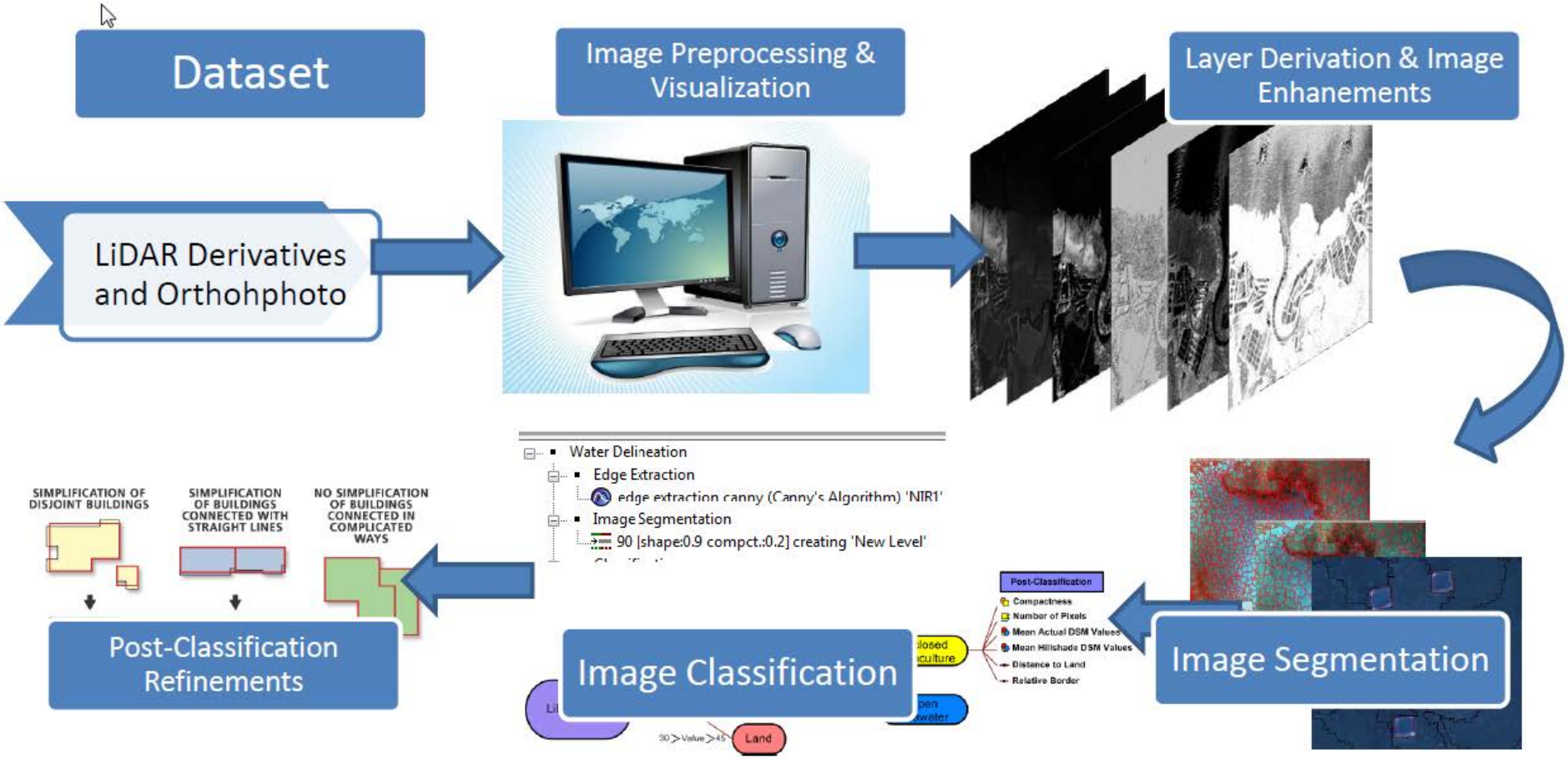
Mangrove Classification



Mangrove Classification

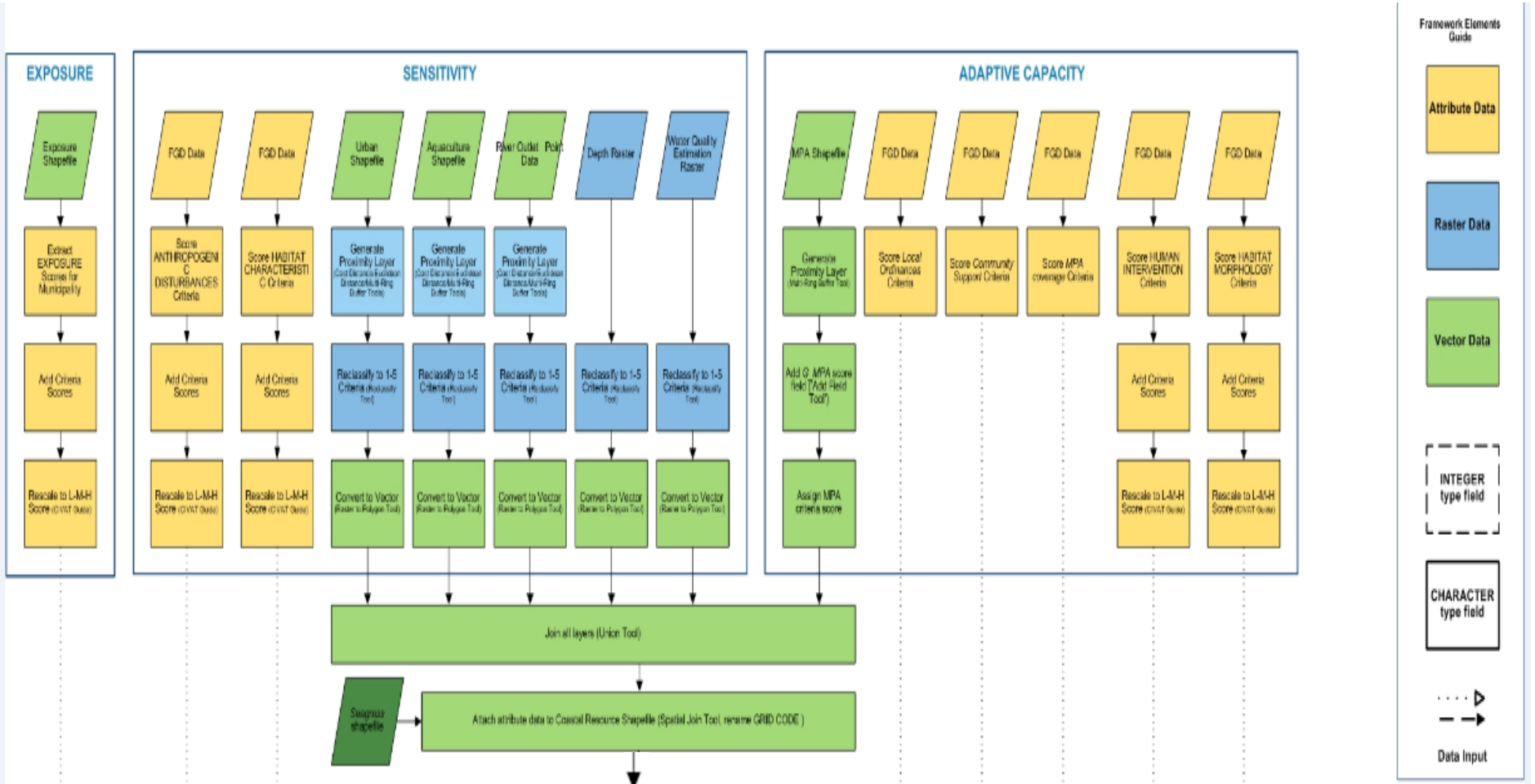


Mangrove Classification

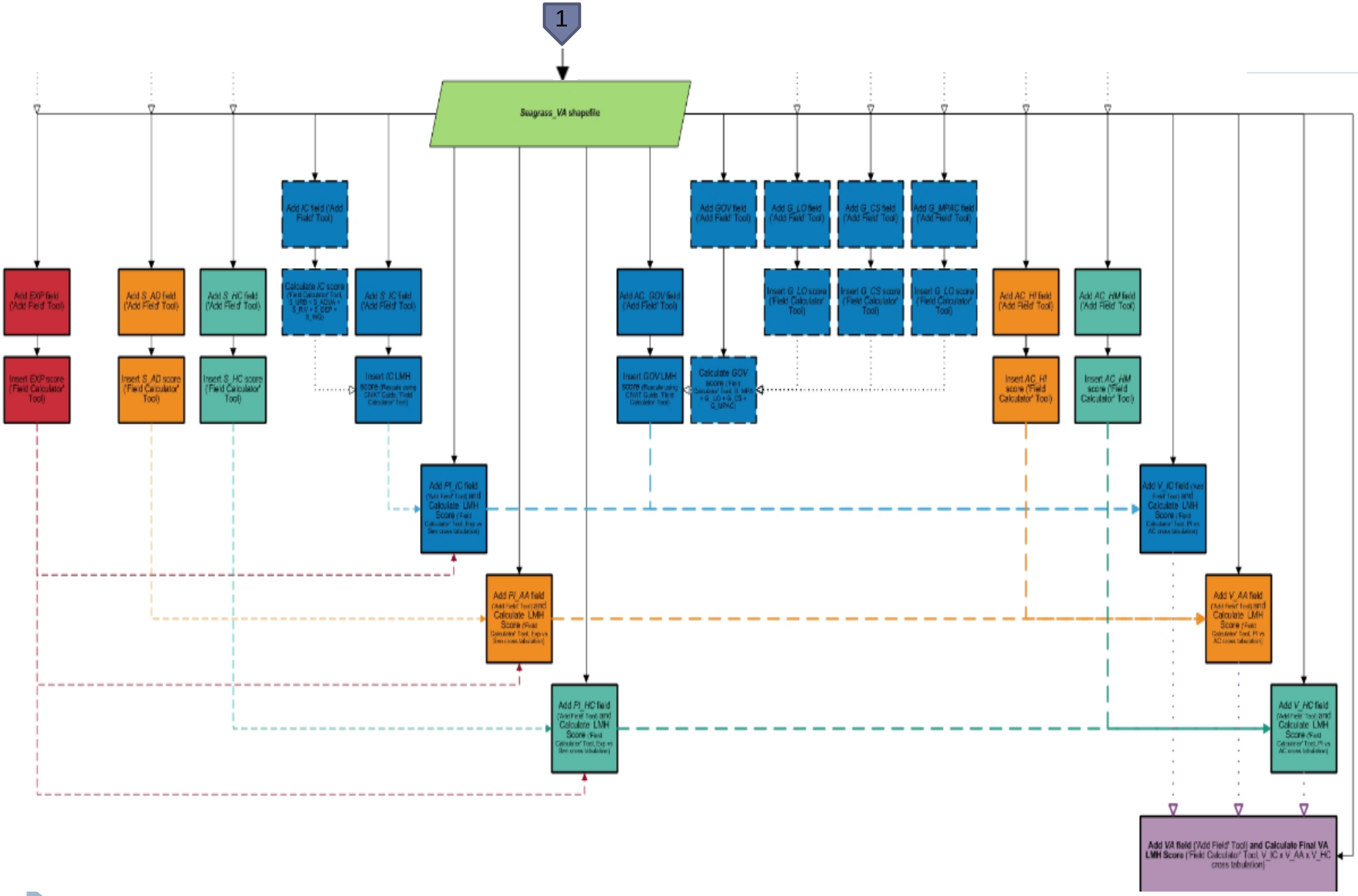


GIS Data Integration

- The VA for mangrove was done following the workflow.



GIS Data Integration



Working Framework (Sensitivity Matrix)

SENSITIVITY CRITERIA		Very High (5)	High (4)	Medium (3)	Low (2)	Very Low (1)
GIS derived criteria	Proximity to Coastal Development	<500m to nearest built-up region	501m to 1000m to nearest built-up region	1001m to 1500m to nearest built-up region	1501m to 2000m to nearest built-up region	>2000m to nearest built-up region
	Proximity to Aquaculture	<750m to nearest aquaculture	751m to 1500m to nearest aquaculture	1501m to 2250m to nearest aquaculture	2251m to 3000m to nearest aquaculture	>3000m to nearest aquaculture
Habitat Characteristics	Age of the mangrove stand	<5 years	5 to 10 years	10 to 15 years	15 to 20 years	more than 20 years
	How much of the natural forest are left?	<20% of natural mangroves are left	20-40% of natural mangroves are left	40-60% of natural mangroves are left	60-80% of natural mangroves are left	<80% of natural mangroves are left
	What kind of mangrove forest is left?	scrub-fringing type *	riverine-fringing type *		riverine-basin-fringing type *	
	What kind of species are present?	All species are slow growing	presence of 1-2 fast growing species	presence of 3-4 fast growing species	presence of 5-6 fast growing species	All species present is fast growing

Working Framework (Adaptive Capacity Matrix)

ADAPTIVE CAPACITY		Very High (5)	High (4)	Medium (3)	Low (2)	Very Low (1)
Governance	**Local Ordinances**	There are laws and ordinances and properly enforced	No written laws and ordinances but protection is strictly observed	Laws and ordinances exist but not well enforced	Laws and ordinances exist but not well enforced	Laws and ordinances are absent
	Community Support and Local Knowledge (on ordinances)	Community widely accept and aid in the impelementation		Community knows about the ordinances but leaves it to the officials to do		Community does not know such ordinances exist
	MPA level	4	3	2	1	0 to no MPA
	MPA coverage (extent of focus)	all habitats are represented in MPAs	Only 2 habitats are represented in MPA	Only 1 habitat is included	No habitats are included	No habitats are included
Human Intervention	**Habitat restoration efforts**	More than 90% of the degraded habitats have been rehabilitated	Between 70 to 90% of the degraded habitats	Between 50 to 70% of the degraded habitats	Less than 50% of the degraded habitats	No rehabilitation efforts being done
	Awareness of coastal resources	Knows all coastal resources very well	Knows all coastal resources but not very well	Knows atleast 2 coastal resources very well	Knows atleast 2 coastal resources but not very well	Not familiar
	Awareness of importance of each coastal resource	Knows the importance of all coastal resources	Knows the importance of all coastal resources but not very well	Knows the importance of atleast 2 coastal resource very well	Knows the importance of at least 2 coastal resources but not very well	does not know the importance of the coastal resources
Habitat Morphology	**Presence of refuge site (buffer zone)**	80 to 100% of buffer	60 to 80% of buffer	40 to 60% of the buffer	20 to 40% of the buffer	0 to 20% of the buffer
	Presence of Adjacent Habitat	2 adjacent habitats, 2 good condition	2 adj habitat, atleast 1 good condition	1 adj habitat, good condition	1 adj habitat not good condition	no adj habitat

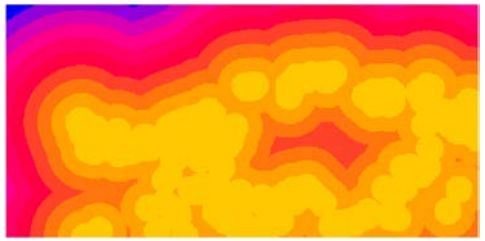
Scoring Criteria per barangay

SENSITIVITY CRITERIA		Pata east	Culao	Taggat Norte	Centro 6	Centro 5	D' Leano	Score
Habitat Characteristics	Age of the mangrove stand	4	5	5	5	5	5	
	How much of the natural forest are left?	5	5	5	5	5	5	
	What kinds of species are present?	2	5	5	5	5	5	
Average for habitat characteristics								14.33
ADAPTIVE CAPACITY								
Governance	Local Ordinances	5	5	5	5	5	5	
	Community Support and Local Knowledge (on ordinances)	1	1	5	5	5	5	
	MPA level	0	0	5	0	0	0	
	MPA coverage (extent of focus)	1	1	5	1	1	1	
Average for Governance								11.17
Human Intervention	Habitat restoration efforts	2	1	1	1	1	1	
	Awareness of coastal resources	4	5	5	4	4	4	
	Awareness of importance of each coastal resource	4	4	5	4	4	4	
Average for Human Intervention								9.67
Habitat Morphology	Presence of refuge site (buffer zone)	5	1	1	1	1	1	
	Presence of Adjacent Habitat	4	3	3	3	1	1	
Average for Habitat Morphology								6.5

GIS Data Integration

Intrinsic Characteristics (Derived GIS criteria)

MANGROVES	Very Low (5)	Low (4)	Medium (3)	High	Very High
Proximity to Coastal Dev	>2000	1501 to 2000	1001 to 1500	501 to 1000	<500
Proximity to Aquaculture	>3000	2251 to 3000	1501 to 2250	751 to 1500	<750

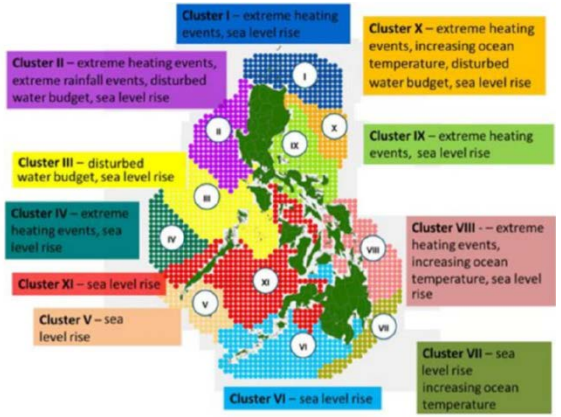


The Exposure Score and the CIVAT LMH Rating

Exposure Type	Increased Ocean Temperature	Extreme Heating Events	Extreme Rainfall	Disturbed Water Budget	Sea-level Rise	Score	LMH Rate
I	3	5	2	3	4	17	M

Sensitivity & Adaptive Capacity Score

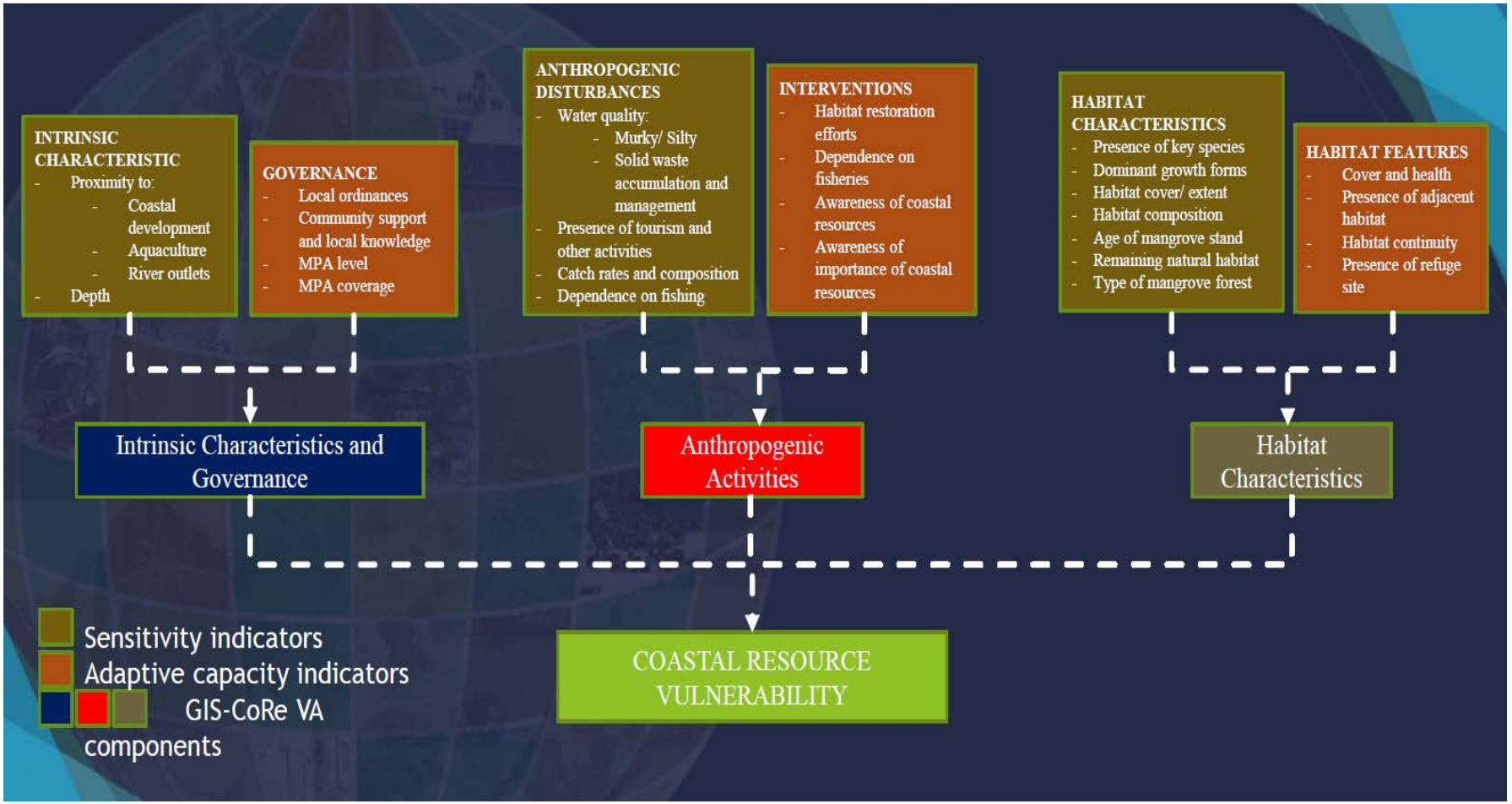
CRITERIA		
SENSITIVITY		
Habitat Characteristic	14.33	H
ADAPTIVE CAPACITY		
Governance	11.17	M
Human Intervention	9.67	M
Habitat Morphology	6.5	M



RESULTS AND DISCUSSION

Vulnerability Assessment

- The procedure of vulnerability assessment



Qualitative Scoring

Exposure	Sensitivity			
	L	M	H
L	L	L	M
M	L	M	H
H	M	H	H

= Potential Impact

Cross-table for Potential Impact (Exposure x Sensitivity)

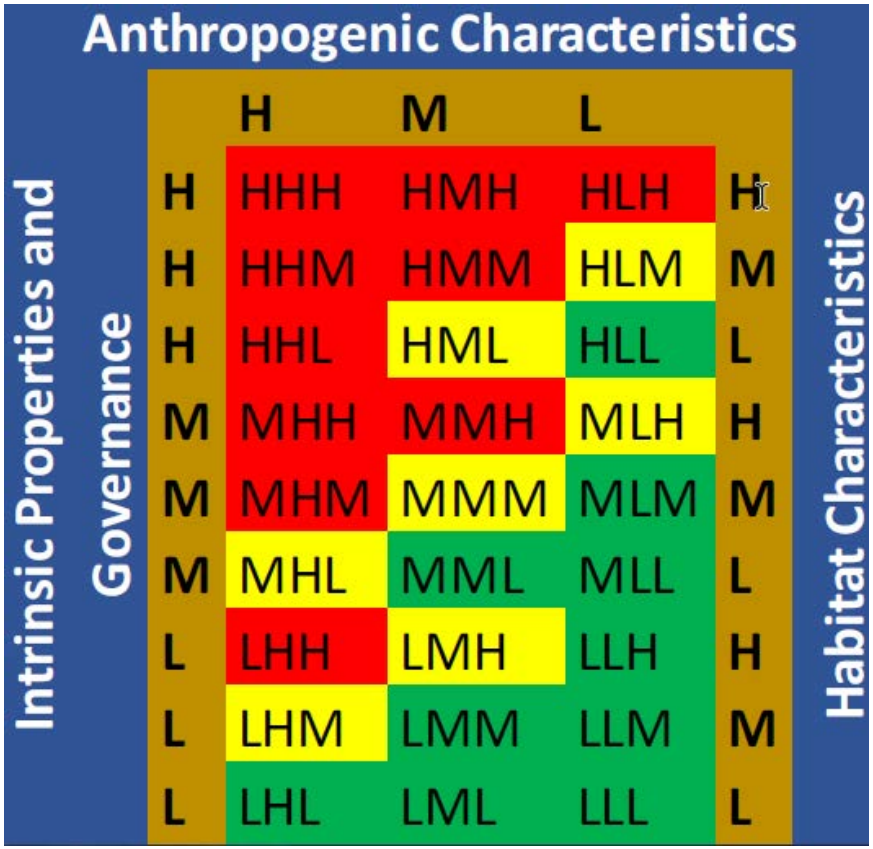
Potential Impact	Adaptive Capacity			
	L	M	H
L	M	L	L
M	H	M	L
H	H	H	M

= Vulnerability

Cross-table for Vulnerability (Potential Impact x Adaptive Capacity)

Scoring Matrix

- The vulnerability of each resource was determined by the result of the 3 aspects (Intrinsic Characteristics and Governance, Anthropogenic Activities, and Habitat Characteristics).
- The result defined using the cross tabulation method
- The color red is High (H) with a score of 5, yellow is Medium (M) with scores of 3-4 and the color green is Low with scores of 1-2.



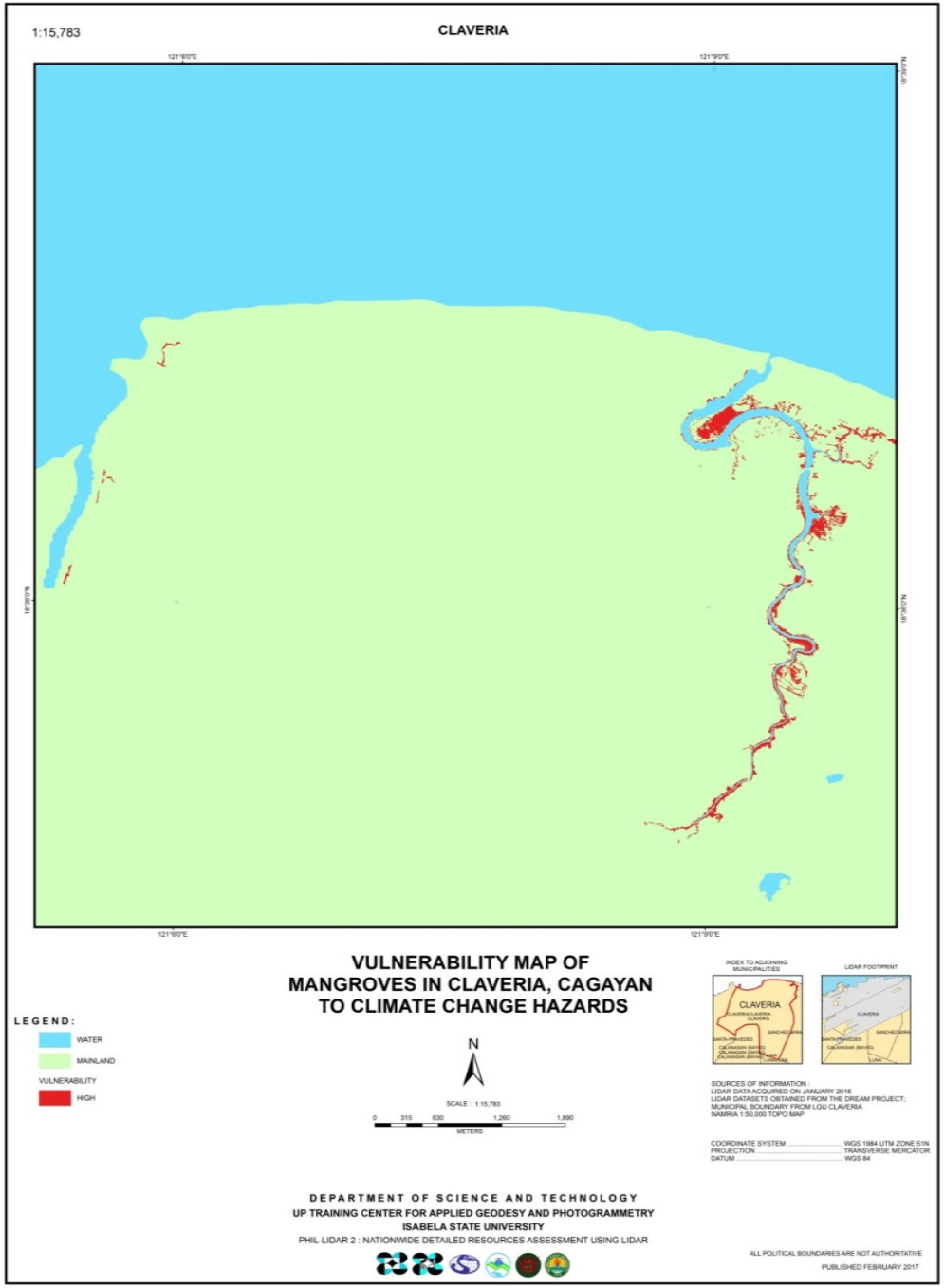
Cross-table for Final Vulnerability

Vulnerability Assessment Ratings

Exposure	Sensitivity			Adaptive Capacity			Potential Impact			Vulnerability			Final VA
	AD	HC	IC	GOV	HI	HM	IC	AA	HC	IC	AA	HC	
M		H	M	M	M	M	M		H	M	M	H	H
M		H	H	M	M	M	M		H	H	M	H	H

- The over-all VA score of mangroves to climate change hazard in Claveria is categorized as **High**.
  - High in sensitivity of intrinsic and habitat characteristic to the exposure is high.
  - High adaptive capacity to potential impact in the habitat characteristic
  - No potential impact on the anthropogenic activities
  - Medium to High vulnerability to the potential impact ,
  - Final vulnerability is HIGH

VULNERABILITY MAP



CONCLUSION and RECOMMENDATIONS

- The vulnerability of mangrove is very high because of its sensitivity to coastal development, the presence of aquaculture in adjacent areas and the potential impact on habitat characteristic.
- The presence of different mangrove species in Claveria is an indication that the area had a diverse ecosystem.

- It is recommended that the remaining mangroves areas should be protected and conserved.
- The LGU must strengthen its programs on mangrove rehabilitation and conservation in the municipality.
- The *Rhizophora mucronata species or* Bakawang babae is suitable in Claveria.
- *Kandelia candel*a species supposedly found only in Baler and Casiguran, Aurora was discovered during the field validation in Claveria. The species should be propagated for planting in the municipality's coastal areas.

Thank you very much!!!