Local Community Knowledge
in Blue Carbon Ecosystem Mapping

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Participatory Mapping: Definition & Significance

Participatory Mapping - a process of using local perceptions and knowledge to build maps of a shared geographical location

- Identify the resources present
- Determine new resources to develop and enhance for future projects in the community
- Determine if existing resources are being managed effectively
- Recognize vulnerable areas of natural resources and environmental problems and develop plans of mitigation and conservation

International Partnership for Blue Carbon. “What Is Blue Carbon and Why Is It Important?” ENV001_Fact_sheet_V05, Nov. 2016,.org/wp-content/uploads/

Participatory Mapping: Advantages & Disadvantages

Engages the locals within the community in creating maps

Powerful tool that creates opportunities for stakeholders' participation and capture relevant information

Major issue: validity and reliability (participant expertise and familiarity over his environment)

Objective: To evaluate how "relative proximity" to landmarks affects the accuracy and agreement of blue carbon ecosystem status obtained from participatory mapping

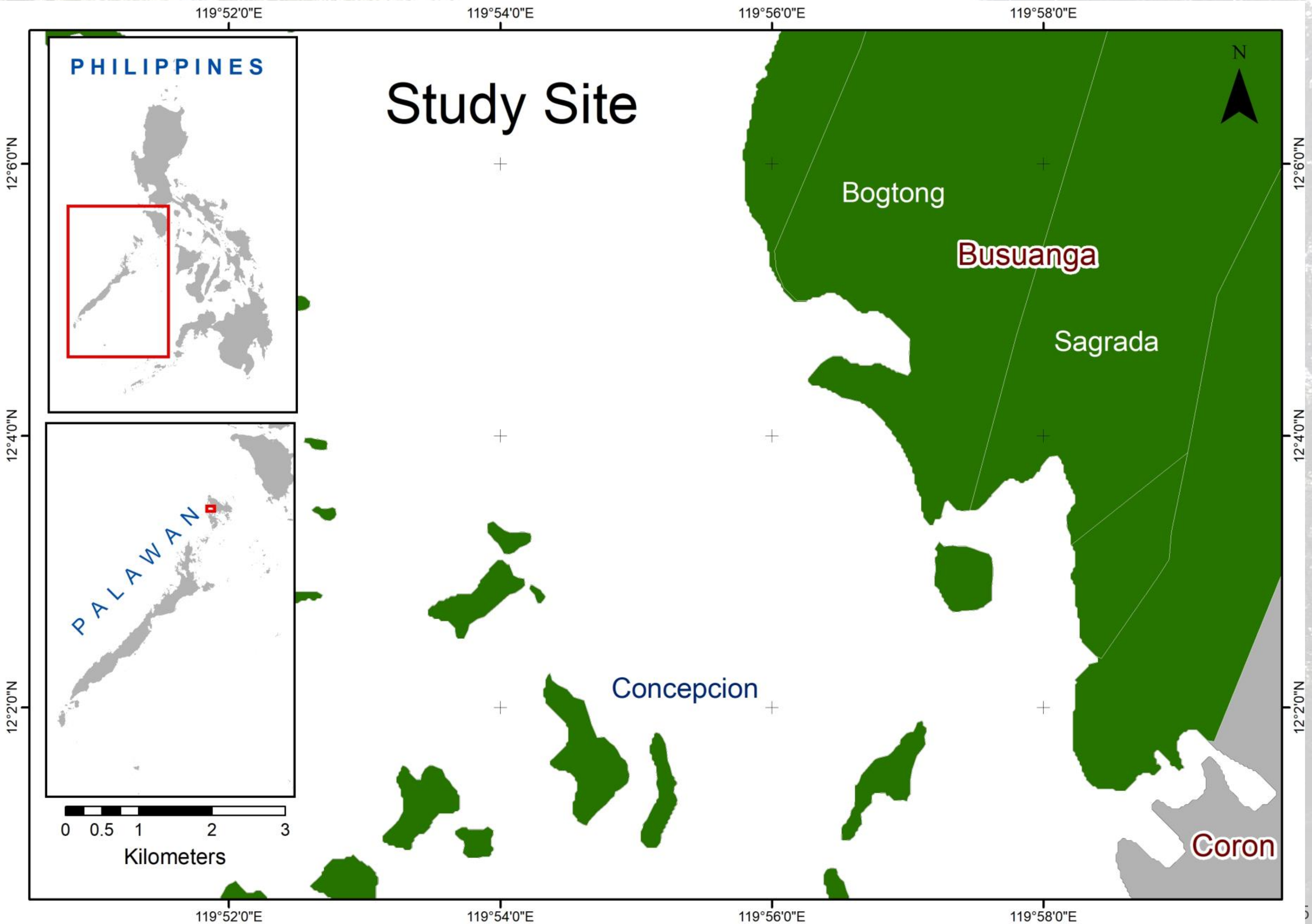
Methodology

Pre-mapping
- Base map preparation
- Participant identification
- Survey questionnaire creation and printing

Mapping Proper
- Preliminary discussions
- Data collection thru actual mapping activity
- Post-collection discussions

Post-mapping
- Processing
- Analysis
- Result Presentation to Community and LGU

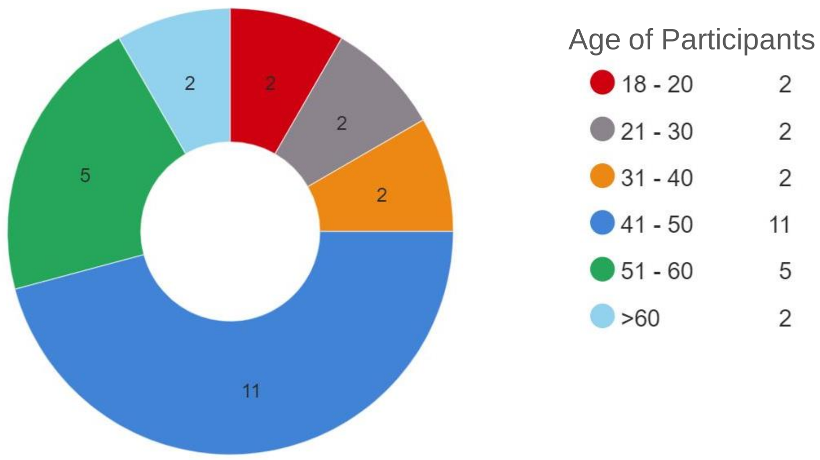
Concepcion, Sagrada and Bogtong, Busuanga

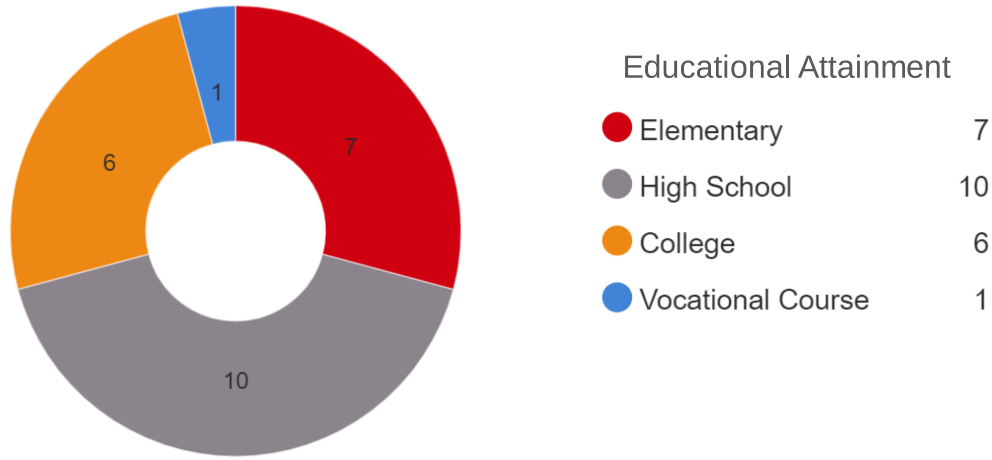


Concepcion, Sagrada and Bogtong, Busuanga

Mapping Proper

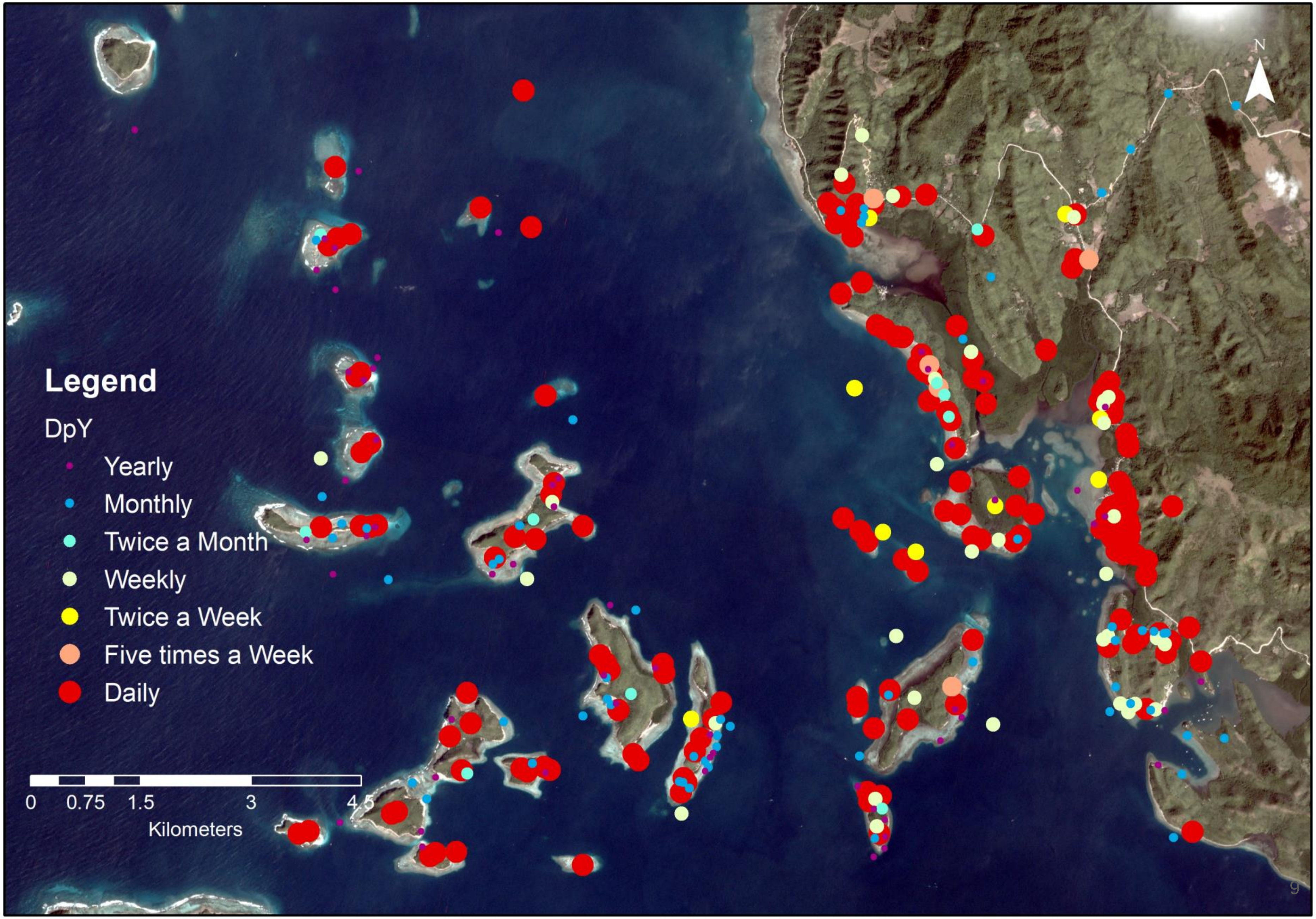
Results: Participants Information





- 14 out of 24 participants were born and are residing in in their respective barangays for at least 18 years.
- All are familiar with and have seen a map of their barangays
- 21 of 24 know how to read a map
- 14 of 24 had experienced creating a map
- 9 of 24 are familiar with digital maps

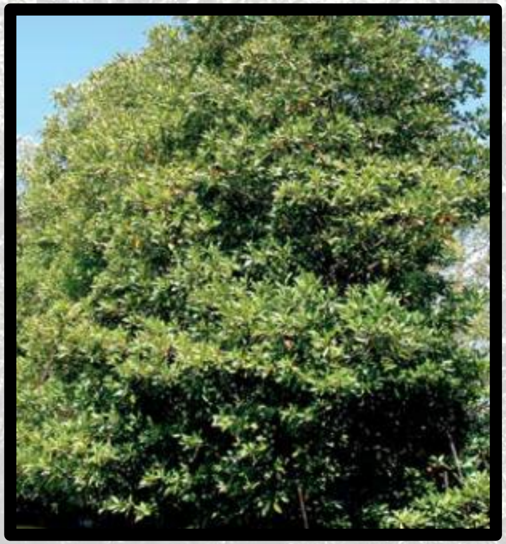
Results: Visited Places by Participants



Results: Mangrove and Seagrass Species

Mangrove Species

- Group 1 – 20 Species in 95 Areas
- Group 2 – 33 Species in 63 Areas
- Group 3 – 13 Species in 93 Areas



Rhizophora, local name:bakhaw

Bruguiera, local name:pototan

Avicennia, local name:bungalon

Results: Mangrove and Seagrass Species

Seagrass Species

- Group 1 – 7 Species in 34 Areas
- Group 2 – 7 Species in 12 Areas
- Group 3 – 3 Species in 12 Areas

Halodule

Cymodocea

Enhalus

Results: Participatory Mangrove Map

Results: Participatory Seagrass Map

Initial Results

Intersection over Union - Mangroves

G1

Data Source	Area in has.
P. Map Result	26.56
Project 1 Data	12.33
Intersection	4.26
Union	34.62
IOU	12.31%

G2

Data Source	Area in has.
P. Map Result	79.65
Project 1 Data	309.50
Intersection	30.82
Union	358.33
IOU	8.60%

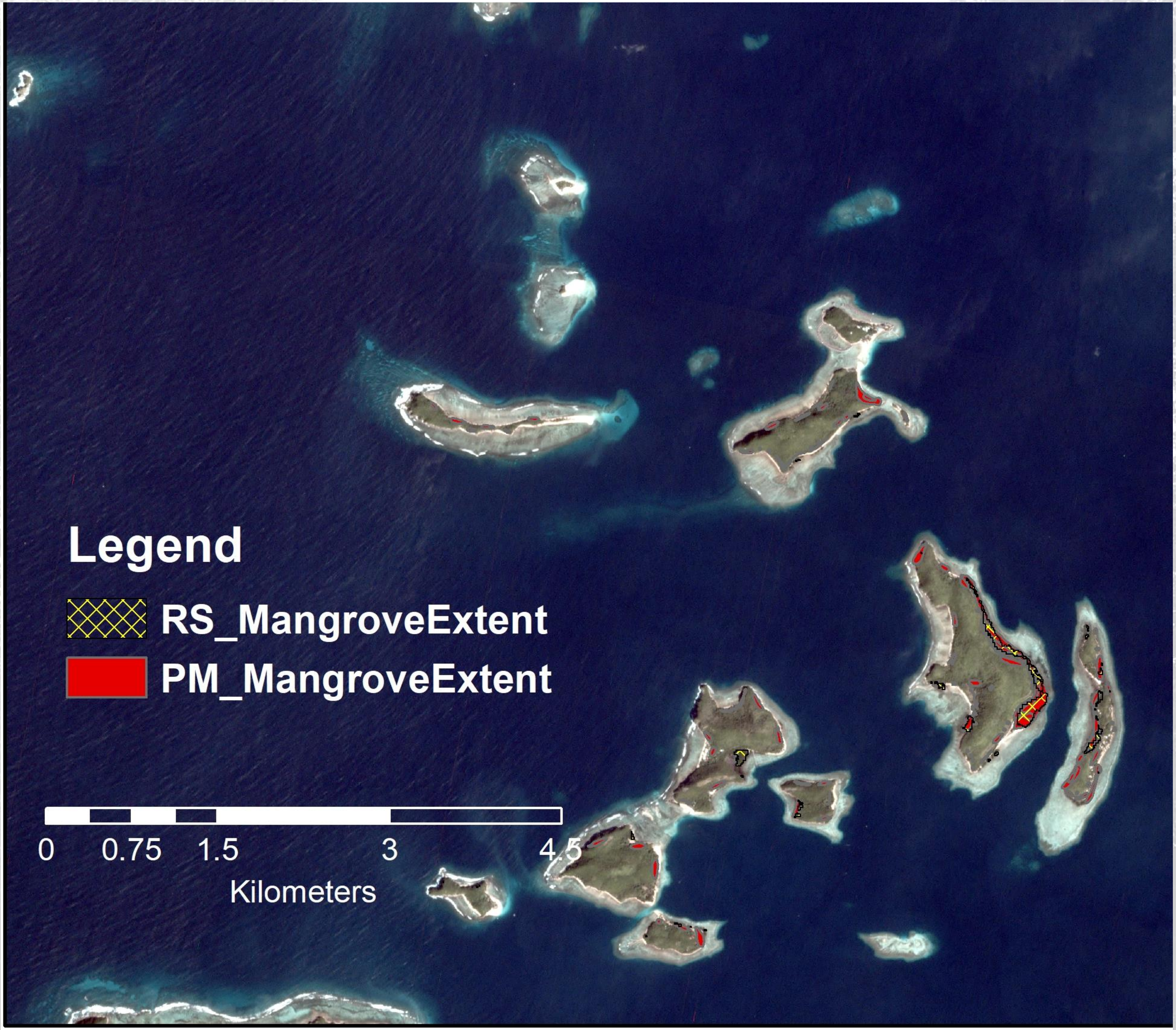
G3

Data Source	Area in has.
P. Map Result	247.47
Project 1 Data	205.07
Intersection	183.93
Union	268.61
IOU	68.48%

OVERALL

Data Source	Area in has.
P. Map Result	**353.67**
Project 1 Data	**460.83**
Intersection	**219.01**
Union	**603.47**
IOU	**36.29%**

Results: Participatory Mangrove Map



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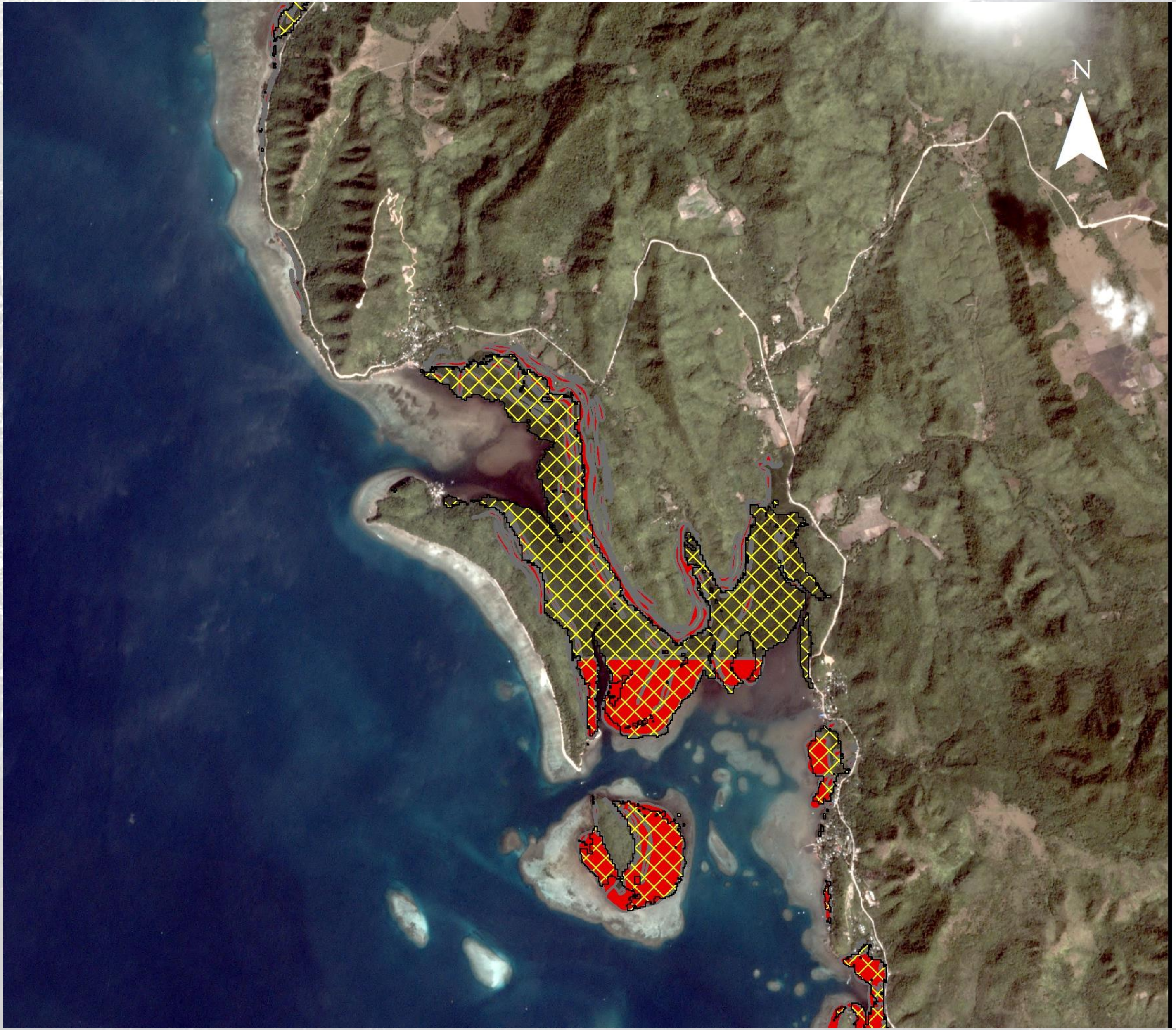

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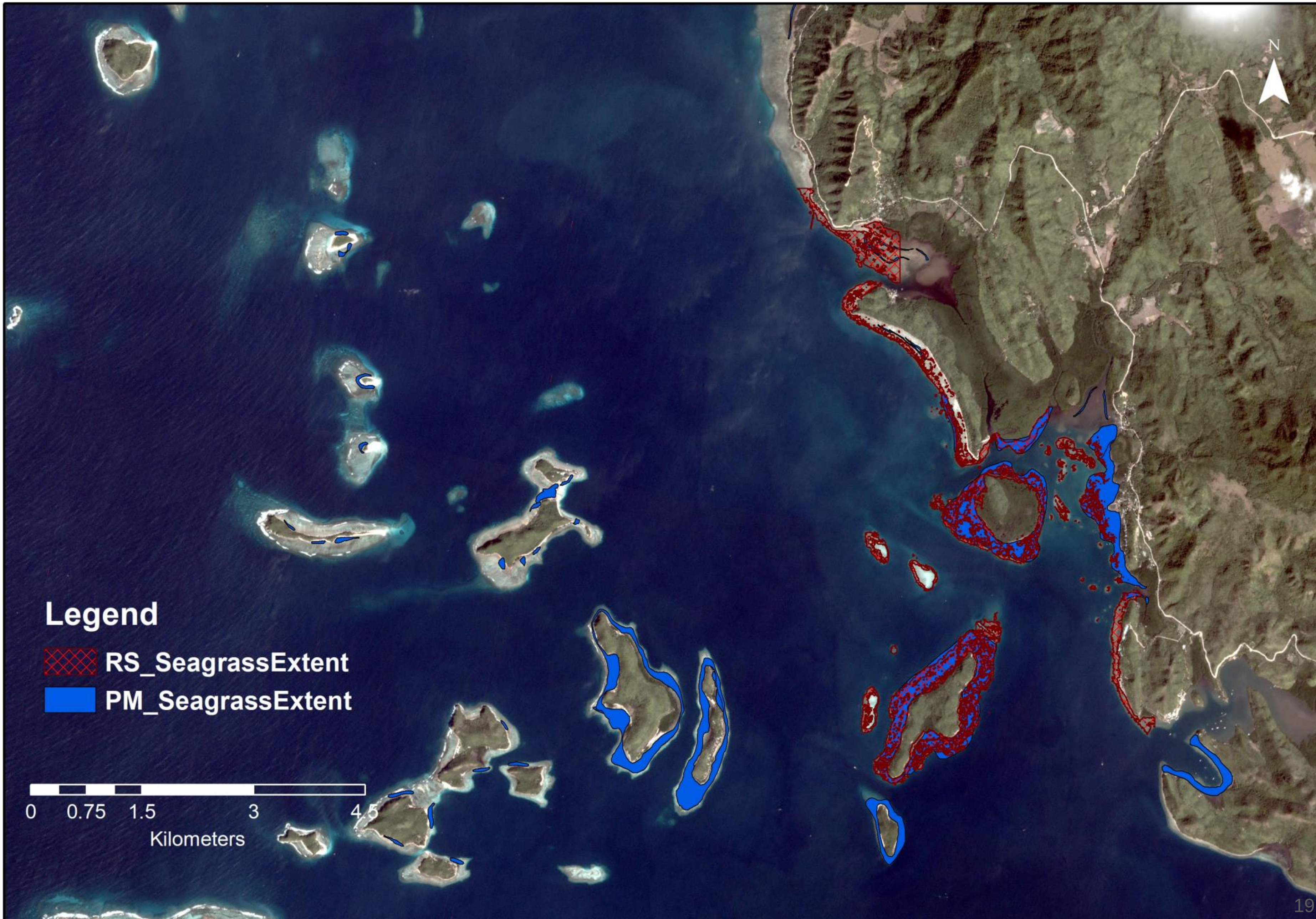
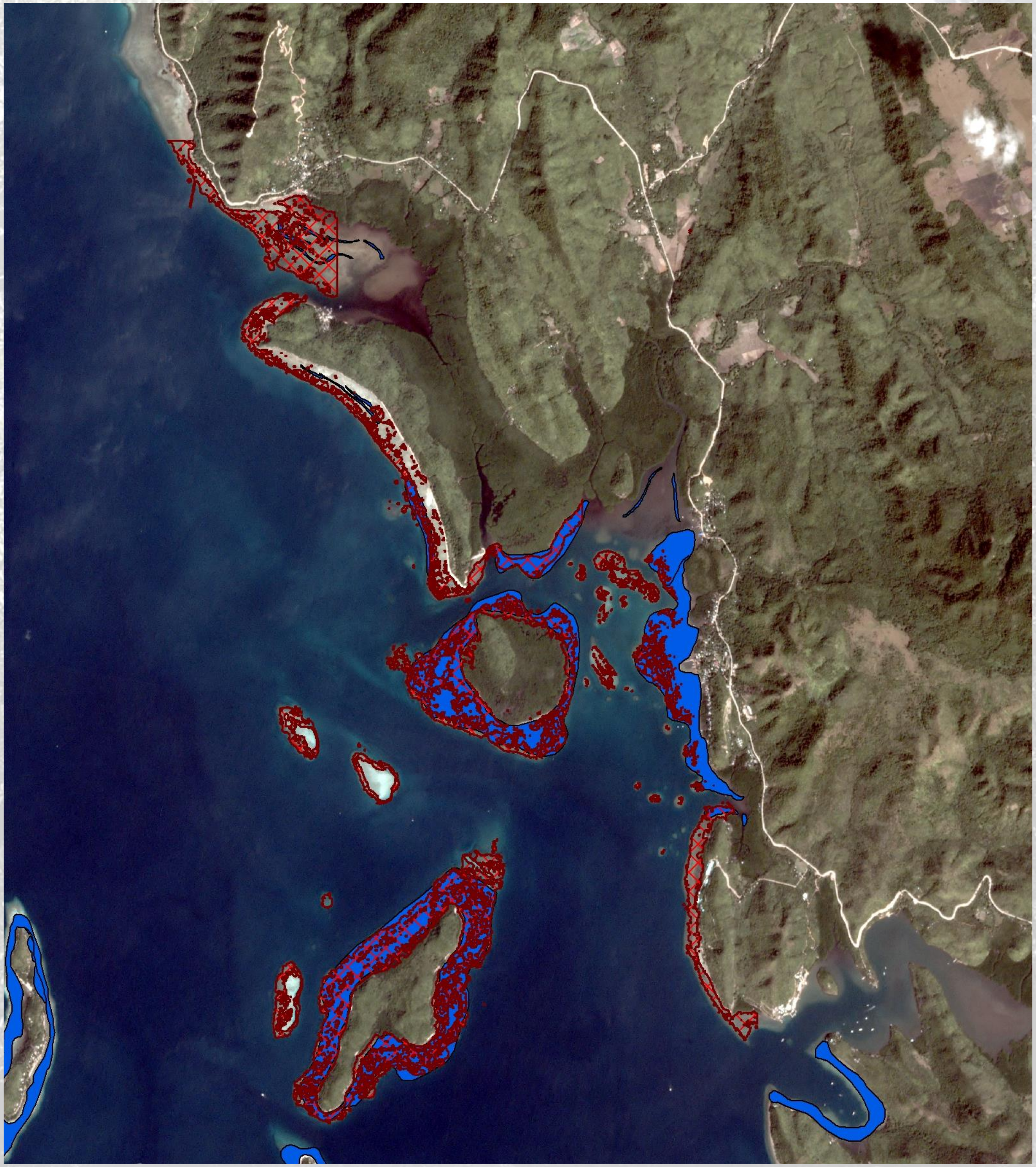
Results: Participatory Seagrass Map



Results: Participatory Seagrass Map



Initial Results

Intersection over Union - Seagrass

G2

Data Source	Area in has.
Community Map Result	6.86
Project 1 Data	117.25
Intersection	2.06
Union	122.06
IOU	1.69%

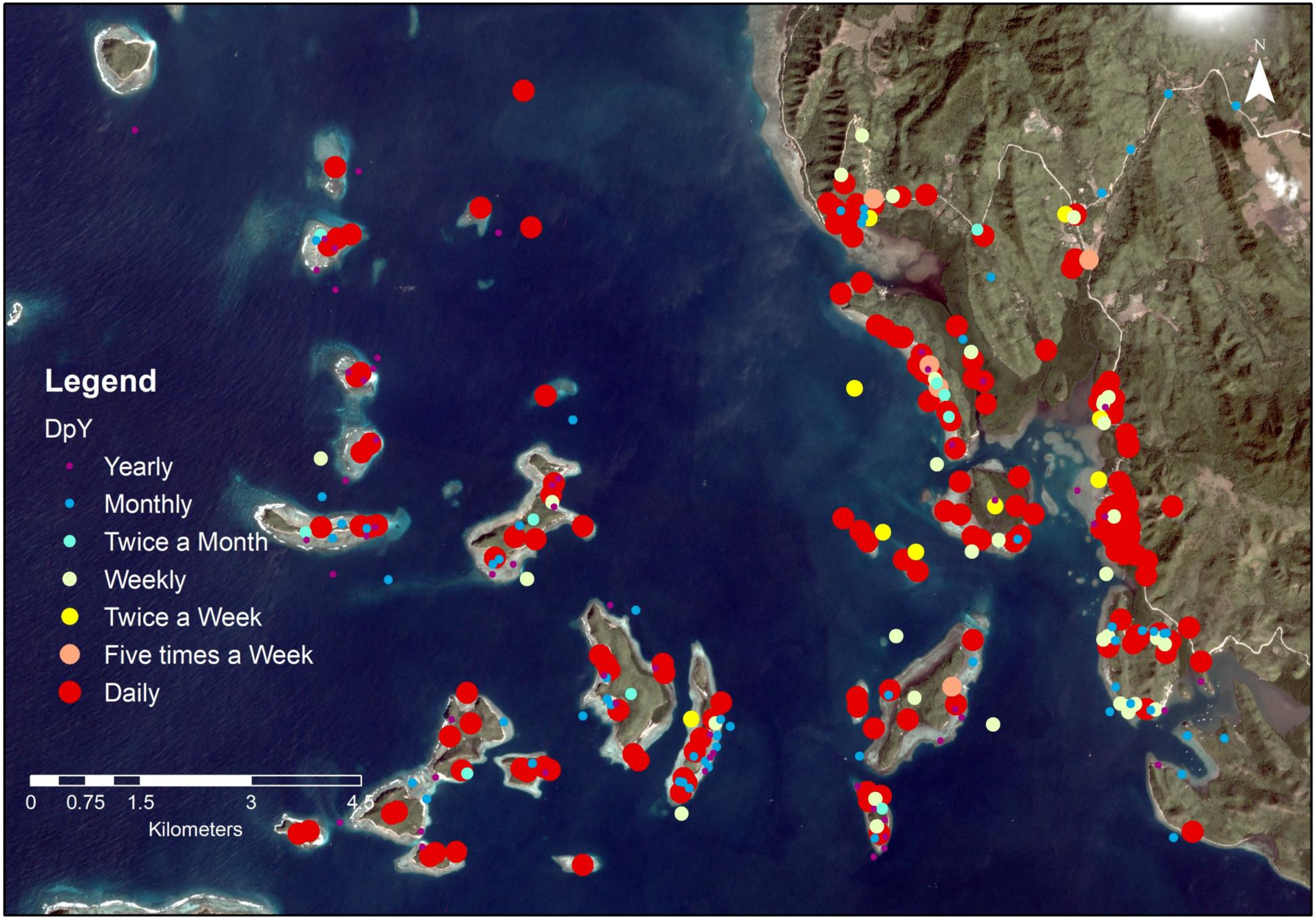
G3

Data Source	Area in has.
Community Map Result	354.63
Project 1 Data	196.93
Intersection	124.93
Union	426.63
IOU	29.28%

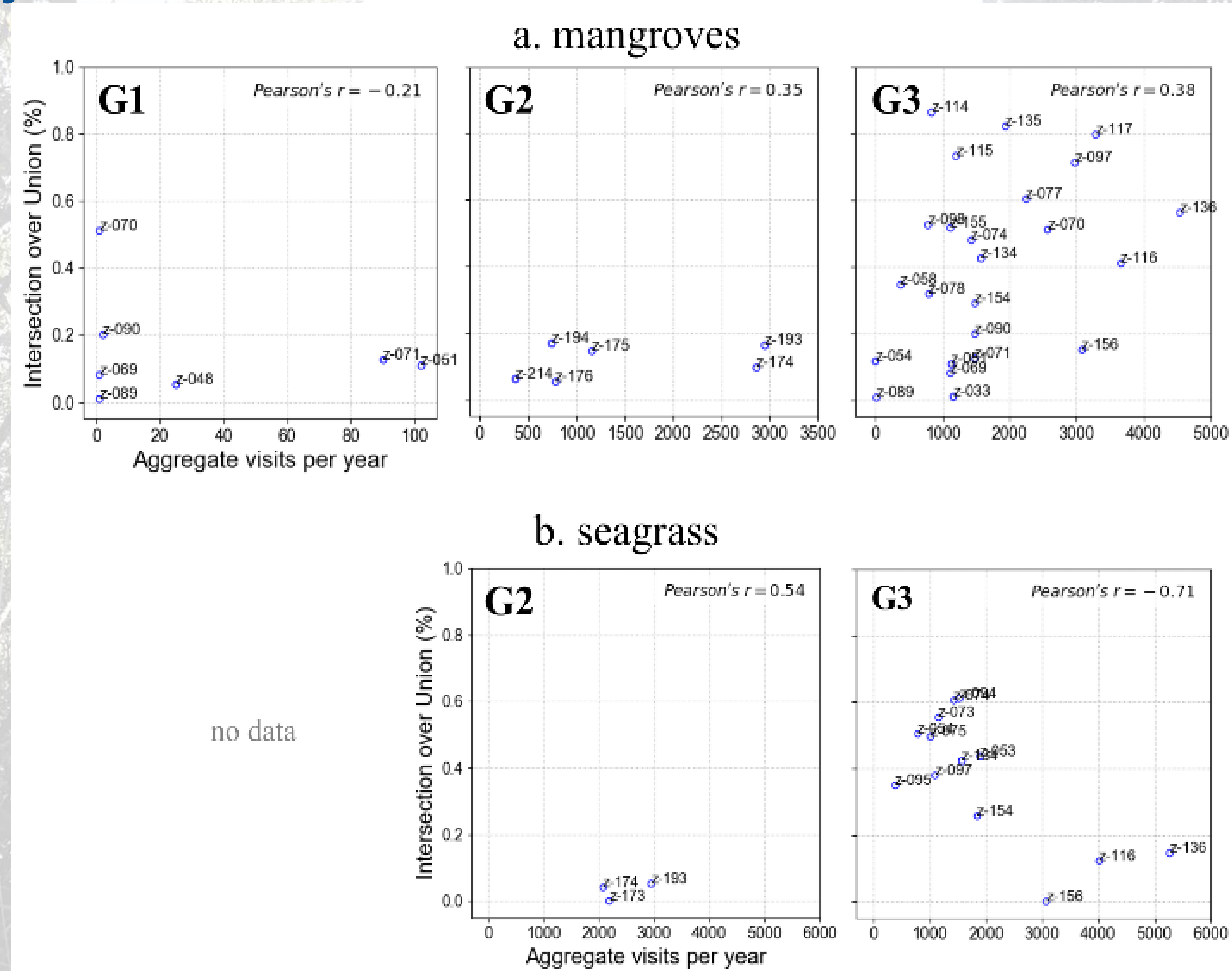
OVERALL

Data Source	Area in has.
Community Map Result	**361.50**
Project 1 Data	**252.00**
Intersection	**126.99**
Union	**486.50**
IOU	**26.10%**

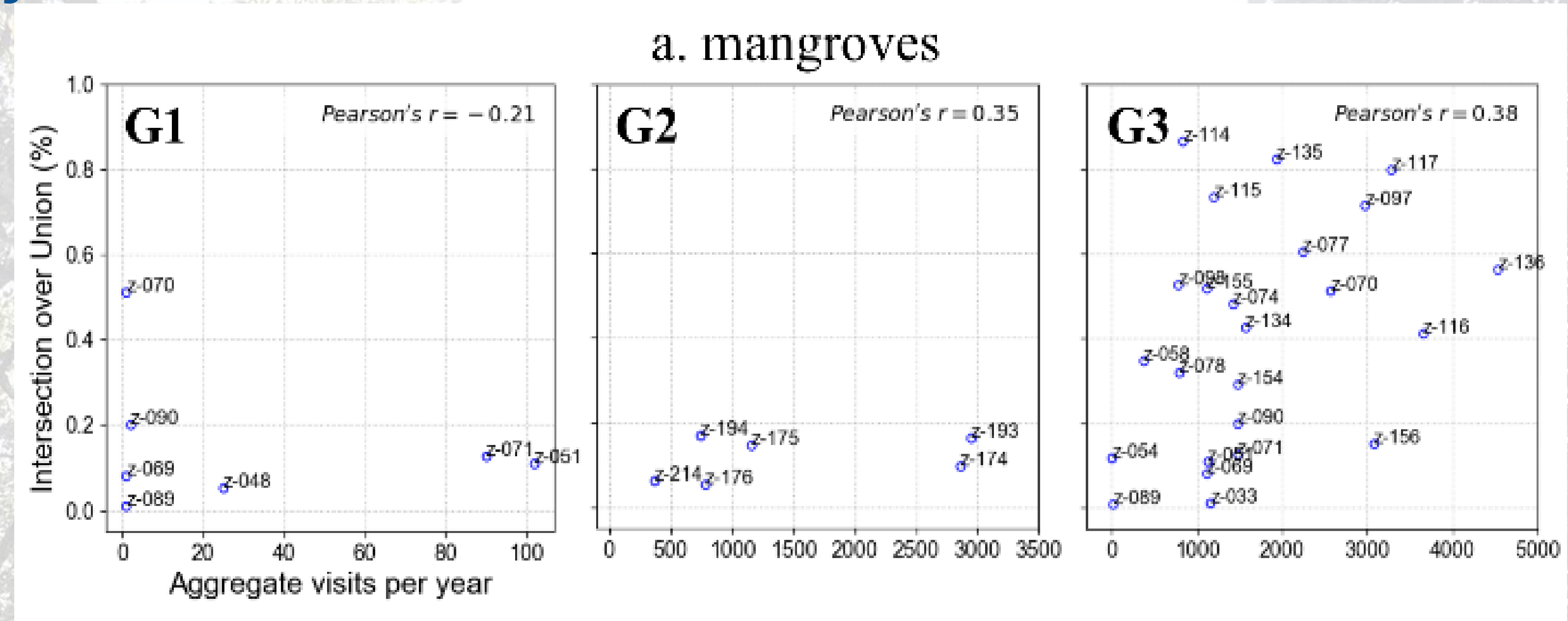
Effect of “proximity” and frequency of visits on map accuracy



Analysis


a. mangroves
G1
Pearson's r = −0.21
G2
Pearson's r = 0.35
G3
Pearson's r = 0.38
Intersection over Union (%)
Aggregate visits per year
z-070
z-090
z-069
z-089
z-048
z-071
z-051
z-194
z-175
z-214
z-176
z-193
z-174
z-114
z-135
z-117
z-115
z-097
z-077
z-136
z-155
z-074
z-134
z-116
z-078
z-154
z-156
z-054
z-033
b. seagrass
no data
G2
Pearson's r = 0.54
G3
Pearson's r = −0.71
Intersection over Union (%)
Aggregate visits per year
z-174
z-193
z-173
z-073
z-095
z-097
z-154
z-116
z-136
z-156

Analysis



IoU is generally positively correlated with frequency of visits, which suggests that degree of familiarity to a location plays a role in producing reliable participatory resource maps

G3 generated the largest correlation coefficient $r = 0.38$.

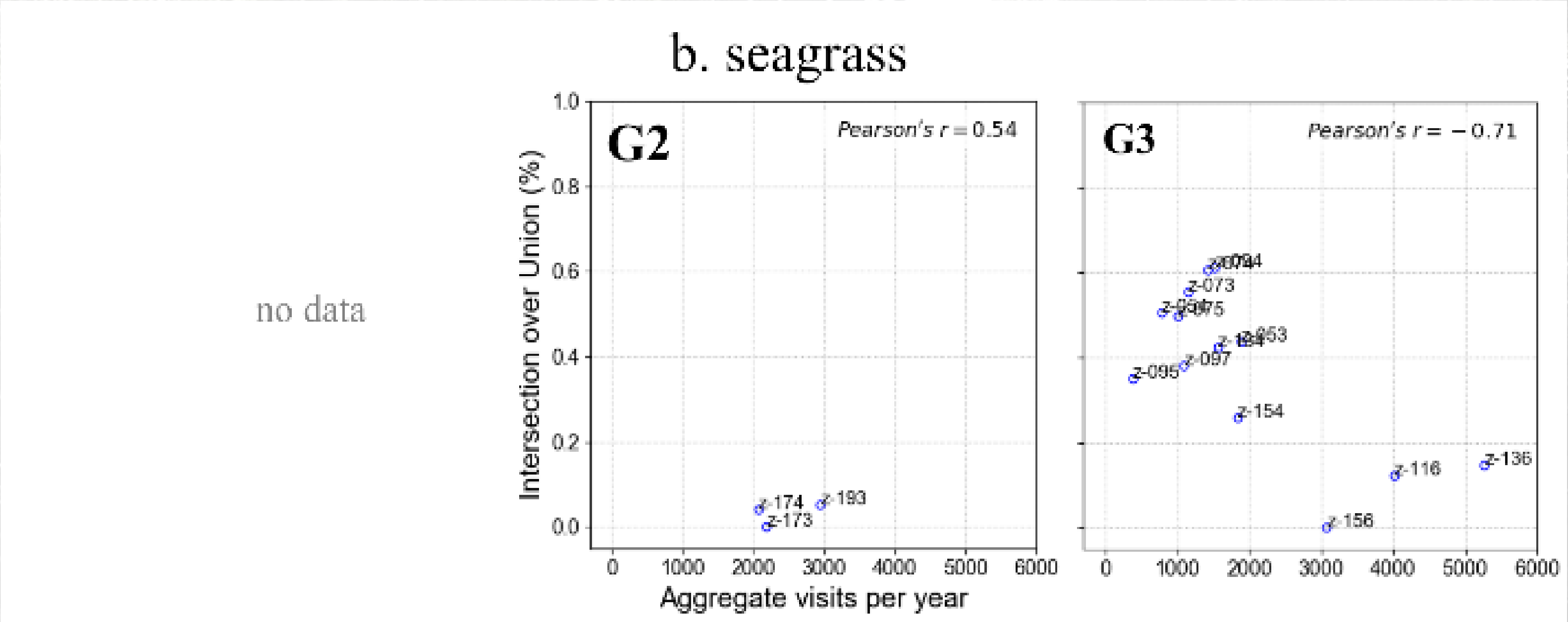
G2 and G1 produce 0.35 and -0.21, respectively. For G1, producing a non-zero IoU was particularly challenging partly because of the limited sizes of mangrove patches in the area

Analysis

Inspection of the scatter plot showed two prominent clusters: (1) very high IoU achieved with $V_{g(z)} < 2000$; and (2) low IoU even when $V_{g(z)} > 3000$.

In the latter, the grid points z-116, z-136 and z-156 are part of the vertical coastline covering west of mainland Concepcion and south Sagrada. In these locations, the participants identified significantly wider seagrass meadows compared to that of derived from PlanetScope images resulting to low IoUs.

Nevertheless, both clusters show positive correlation between IoU and $V_{g(z)}$ – consistent with the findings for mangroves.



Influence of the participants' daily activities

- Maps generated by participants who have jobs or activities that nurture awareness about mangroves and seagrass tend to agree better with remotely-sensed maps
- G3 which was composed of 4 fishermen, 1 MPA guard and 1 barangay official resulted to 68.48% accuracy of mapped mangrove extents relative to the satellite-based map
- On the other hand, G1, which was composed of 3 health workers, 1 nutrition scholar, 3 unemployed individuals, and only 1 MPA guard, was not able to delineate the extents as accurately.
- G2 comprised of 4 barangay officials, 1 MPA guard, 2 mangrove planters, 1 fishermen produced misclassification that prevented the group from generating high IoU resource maps.

Final Remarks

- By measuring the agreement of PM and satellite-based maps, we have established a baseline grasp of the capability of participatory techniques in creating reliable resource maps

- Proximity, familiarity with a location, and type of activity influence the accuracy of participatory maps as such these criteria should be factored in determining the most qualified locals in a resource mapping activity.

- Ultimately, an accurate depiction of the status of blue carbon ecosystem by considering all possible sources of information leads to a better estimate of CO_2 sequestration; and therefore, better planning and conservation strategies.

- Factoring in species information, which was obtained from locals, is the next step.

Future works

- Validation of mangroves and seagrass species participatory map
- Generation of holistic accurate resource map
- Establishment of baseline (ground truth) for which both sources of information are evaluated against; and define relevant accuracy metrics.
- Development of a standard mapping workflow, combining both participatory mapping and 3S technologies (i.e., RS, GIS, GNSS), for integrating local knowledge with natural resource maps

Acknowledgments

- Integrated Assessment and Monitoring of Blue Carbon Ecosystem for Conservation and Adaptive Management (IAMBlueCECAM) Program
- Project 10: Geospatial Decision Support Systems and Capacity Building on Geomatics for Mangrove Seagrass Conservation (CapGeoDSS)
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- Municipality of Busuanga, Palawan
- Barangays Concepcion, Sagrada and Bogtong

Thank you for your attention!

Mapping of Blue Carbon Ecosystems:

Effect of Proximity, Activity Types & Frequency of Visits in the Accuracy of Participatory Maps

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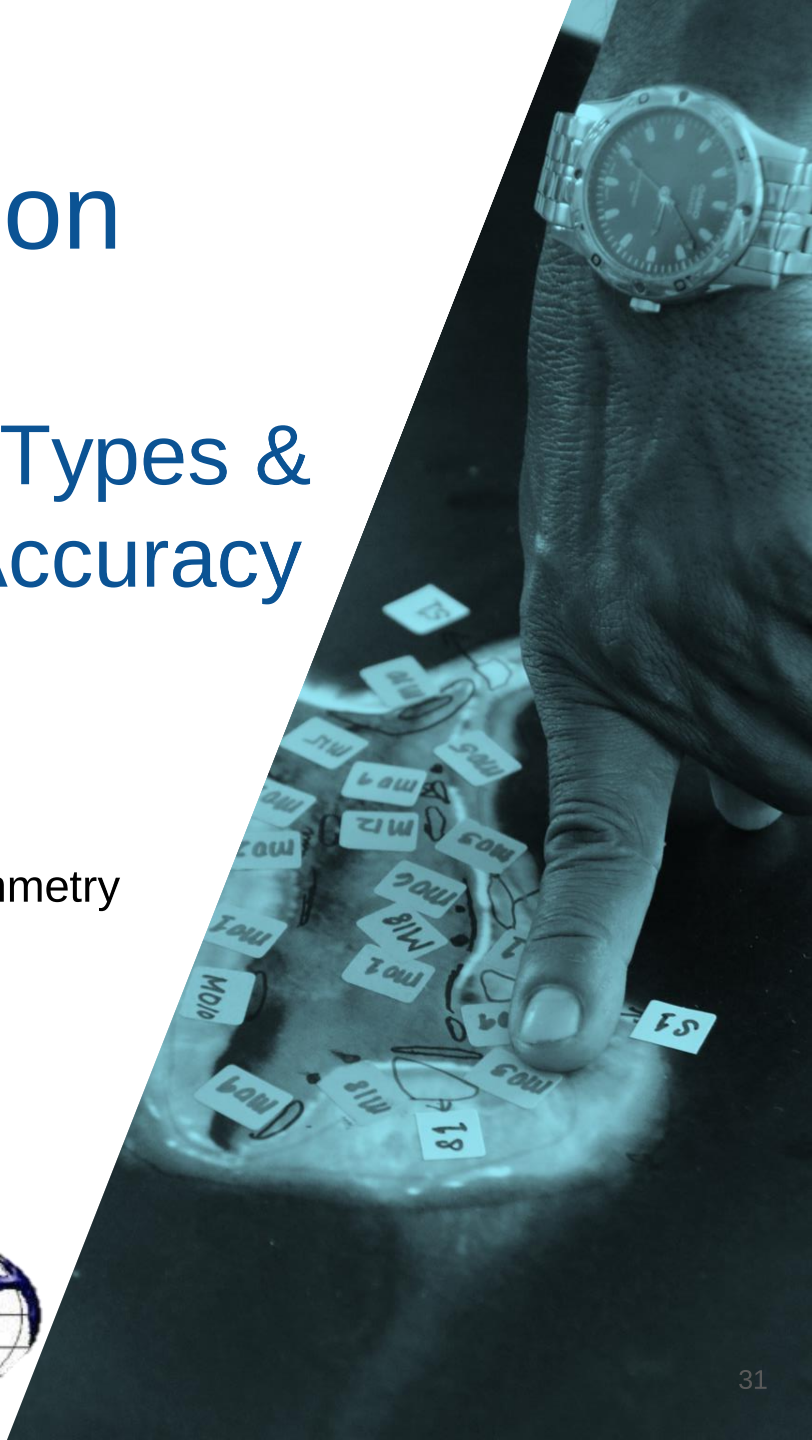

Guide Questions

1. How can we engage more locals to participate in a mapping activity? How can we entice communities to even begin?

2. How can a community (barangay or municipality) sustain such activity? What division, institution or agency can facilitate and provide assistance in this endeavor?

3. What are the challenges and problems in your area that you think participatory mapping can greatly help?