Climate Resilient Vulnerability Assessment in Occidental Mindoro and Palawan

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I. Methodologies of CRVA

A. Hazards

a. Overview of hazard dataset used

In general, there are eight (8) identified natural hazards in the Philippines. These are the following: typhoon, flooding, drought, erosion, landslide, storm surge, sea level rise and saltwater intrusion. The hazard dataset used in this study was from the output of the previous Adaptation and Mitigation Initiative in Agriculture (AMIA) project of the Department of Agriculture. Table 1 summarize the hazard data, its source and resolution.

Table 1. Overview of hazard dataset used for exposure component.

Parameter	**Source**	**Unit of Measurement, spatial and temporal resolution**
Typhoon	UNEP/UNISDR, 2013 (http://preview.grid.unep.ch/index.php?preview=data&events=cyclones&evcat=2&lang=eng)	1 kilometer pixel resolution. Estimate of tropical cyclone frequency based on Saffir-Simpson scale category 5 (> 252 km/h) from year 1970 to 2009.
Flooding	AMIA multi-hazard map / baseline data from Mines and Geosciences Bureau, Department of Environment and Natural Resources (MGB, DENR)	1:10,000 scale. Susceptibility of flood risk for Philippines from the past 10 years
Drought	AMIA multi-hazard map / baseline data from National Water Resources Board	Groundwater potential for the Philippines
Erosion	AMIA multi-hazard map / baseline data from Bureau of Soils and Water Management	1:10,000 scale. Soil erosion classified from low to high susceptibility

Landslide	AMIA multi-hazard maps / baseline data from MGB, DENR	1:10,000 scale. Landslide classified from low to high susceptibility
Storm Surge	AMIA multi-hazard maps / baseline data from Disaster Risk and Exposure Assessment for Mitigation, Department of Science and Technology (DREAM, DOST)	
Sea level rise	AMIA multi-hazard map	Assumption based on 5m sea level rise
Saltwater intrusion	AMIA multi-hazard map / baseline data from the NWRB	Groundwater potential for the Philippines

b. Developing hazard weights

The hazard scores used in this study was given by the partner agency of the AMIA 2 project which is CIAT. It was adopted in the previous Adaptation and Mitigation Initiative in Agriculture project. During the workshops, it was agreed by the researchers and partner RFO's GIS focal person that hazard scores will be the same as the previous project.

Table 2.Hazard scores per Island group based from the previous Adaptation and Mitigation Initiative in Agriculture (AMIA) project.

Hazards	**Island Group**		
	Luzon (%)	Visayas (%)	Mindanao (%)
Typhoon	**20.00**	18.21	16.95
Flood	**19.05**	16.40	15.25
Drought	**14.25**	16.17	16.95
Erosion	**11.43**	12.57	12.71
Landslide	**8.57**	10.72	14.41
Storm Surge	**9.52**	10.39	8.47
Sea Level Rise	**5.71**	8.33	5.08
Saltwater Intrusion	**11.43**	7.21	10.17

B. Sensitivity

Crop selection and collection of occurrence data

The Provincial Agriculture's Office and DA-Field Regional Offices identified the crops that would be consider for analysis. The priority crops for Occidental Mindoro is as follows: **rice, cassava, onion, mango and yellow corn**. While the priority crops for Palawan are **rice, cashew, mango, banana, and coffee**.

The agricultural technicians and representatives from the provincial agriculture's office were asked to give the estimate location of crops. The mapping exercise was conducted to rapidly collect data from the field. A map was provided with features such as road networks, river network, digital elevation model of the province, municipal and barangay boundaries and satellite imagery.

C. Adaptive Capacity

a. List of indicators used

A wide secondary data collection identified sources that were able to provide some of the needed indicators on municipality level. Foremost the National Competitiveness Council (NCC) provided an extensive up-to-date database, but also the Philippines Statistics Authority and previous DA projects were consulted. Furthermore, the data was derived from the International Water Management Institute and the National Mapping and Resource Information Authority derived to calculate indicators for the natural capital component.

Furthermore, the values of the indicators will be integrated in the shapefile municipal boundaries. Each of the indicators were normalized and were treated with equal weights. The sum of the 16 indicators provided the final adaptive capacity index. Five equal breaks were developed to establish the thresholds: 0-0.20 (Very Low), 0.20-0.40 (Low), 0.40-0.60 (Moderate), 0.60-0.80 (High), and 0.80-1.00 (Very High).

II. Results and Discussion

A. Location maps of Crops

a. Palawan

The crop location maps for Palawan is presented below (Figures 2-6). Out of the 23 municipalities, only 11 municipalities have the crop location map. These municipalities are as follows: **Narra, Aborlan, Bataraza, Sofronio Española, Brooke's Point, Rizal, Quezon, San Vicente, Roxas, El Nido, and Taytay.** The municipalities that was not able to give the location of crops were as follows: **Balabac, Cuyo, Culion, Coron, Busuanga, Dumaran, Aracelli, Magsaysay, Agutaya, Linapacan, Caganyancillo, and Puerto Princesa.** Majority of these municipalities are island municipalities and municipality the Puerto Princesa has a strict quarantine policy.

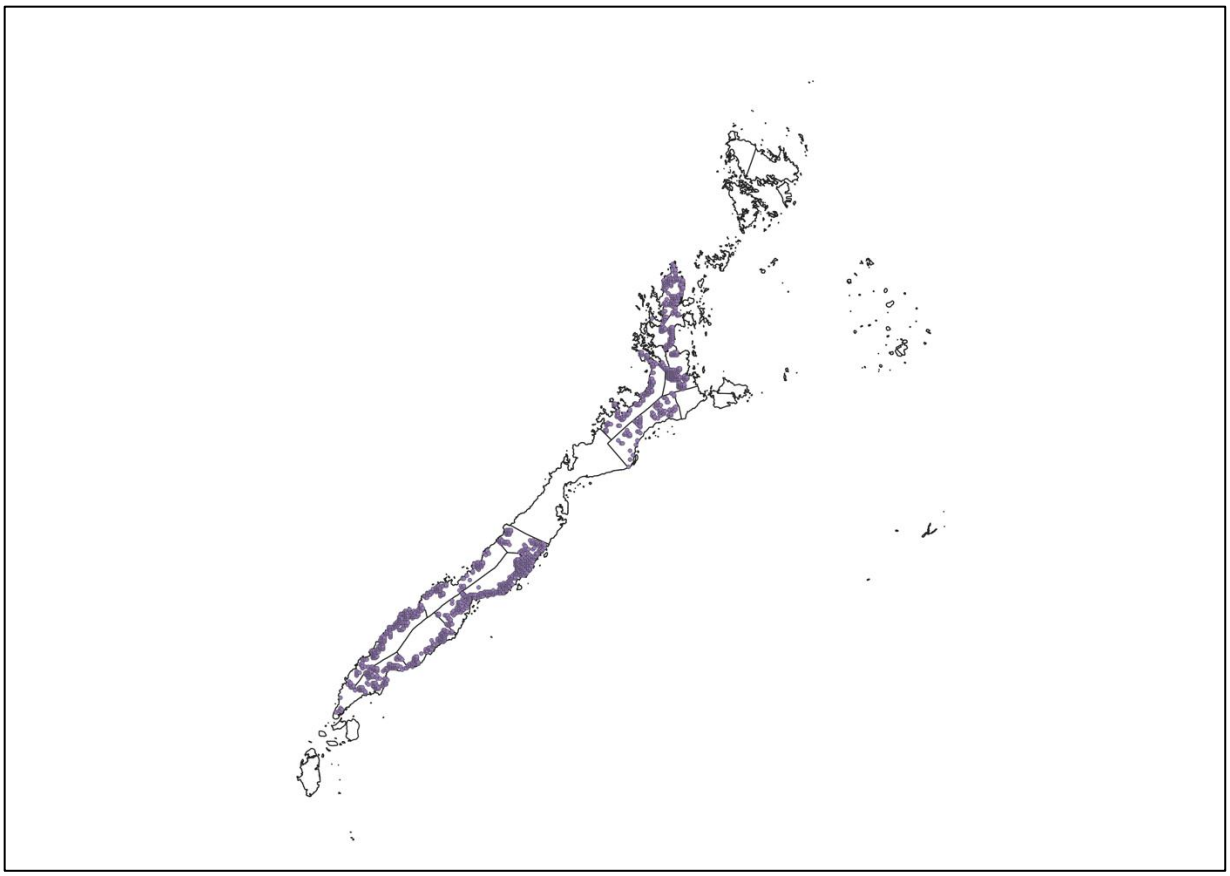


Figure 2. Location map of rice.

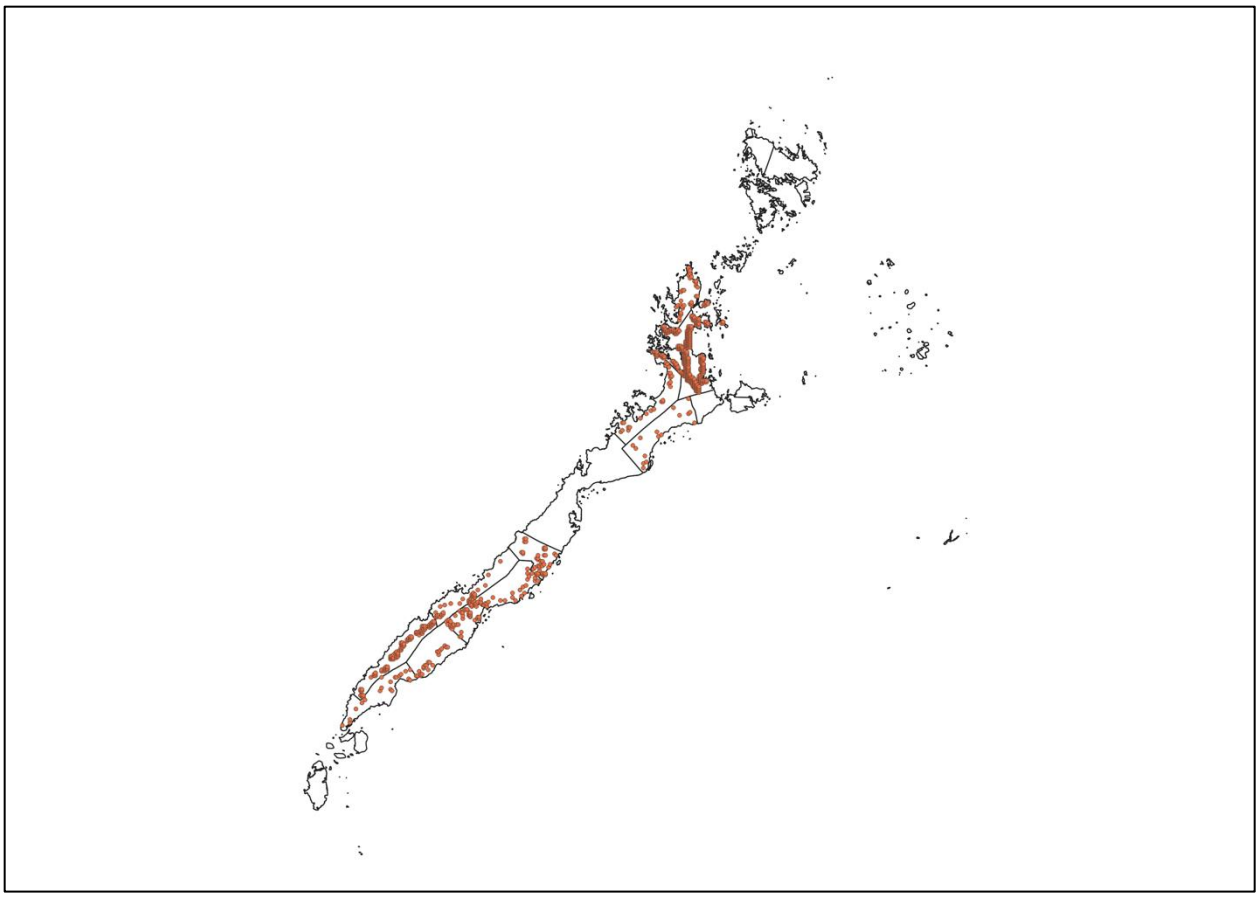


Figure 3. Location map of banana.

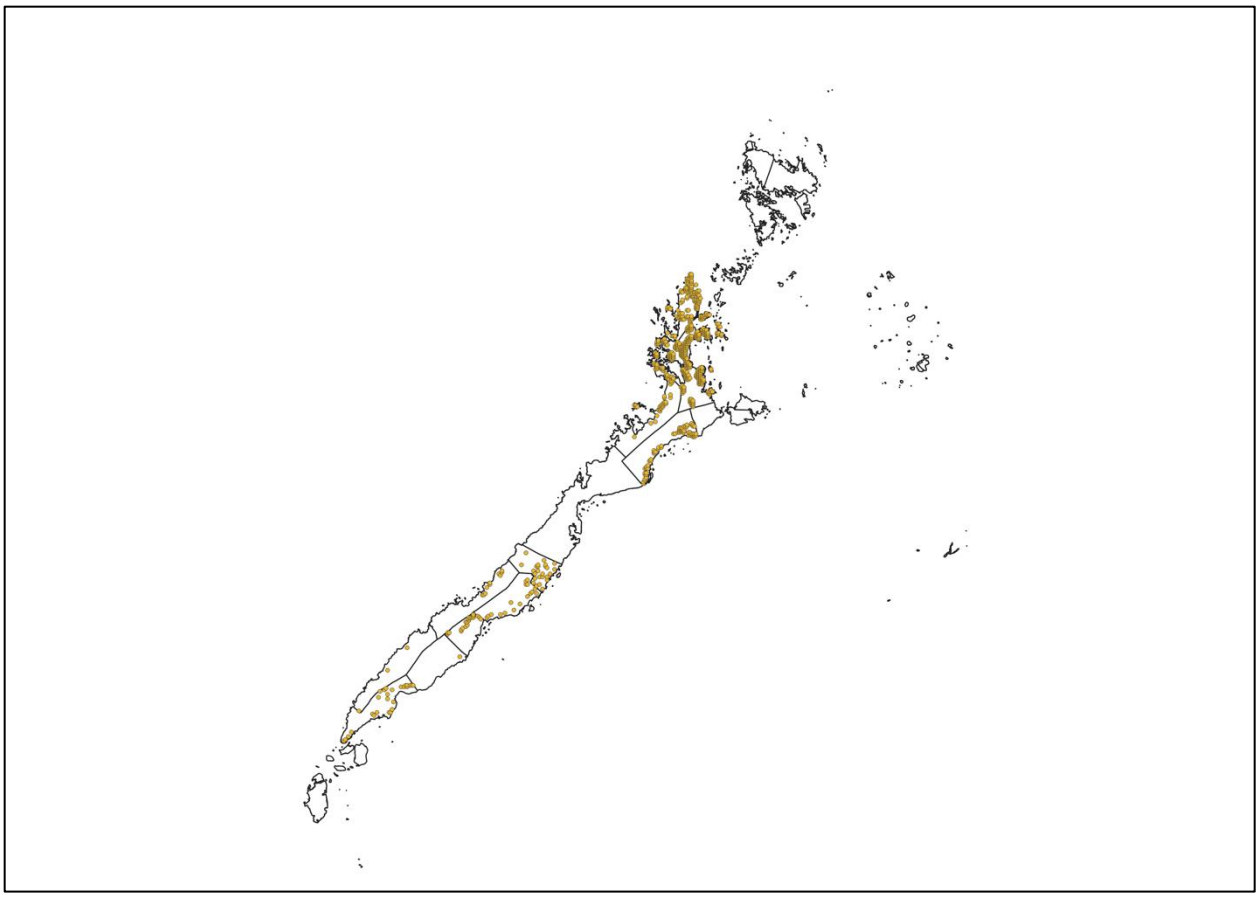


Figure 4. Location map of cashew.

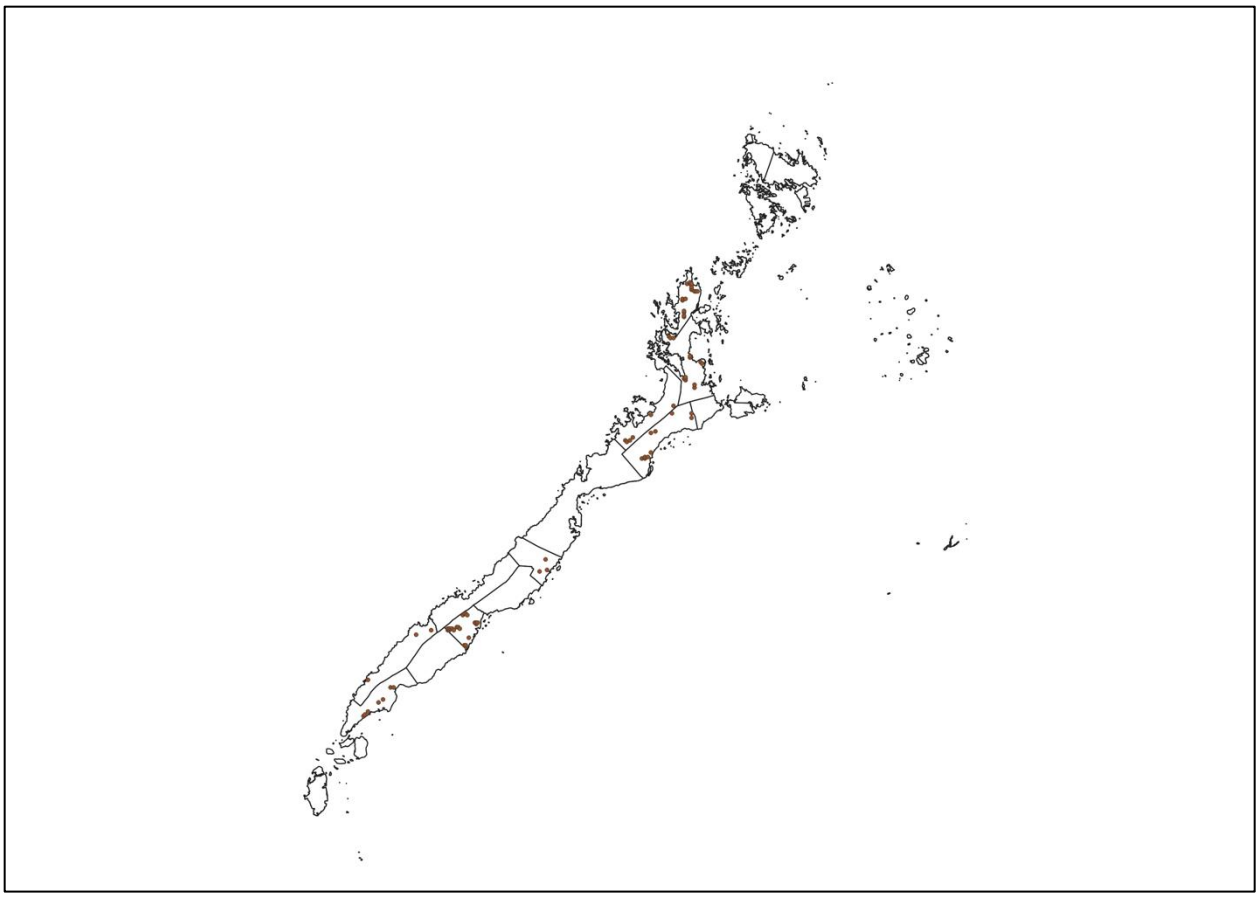


Figure 5. Location map of coffee.

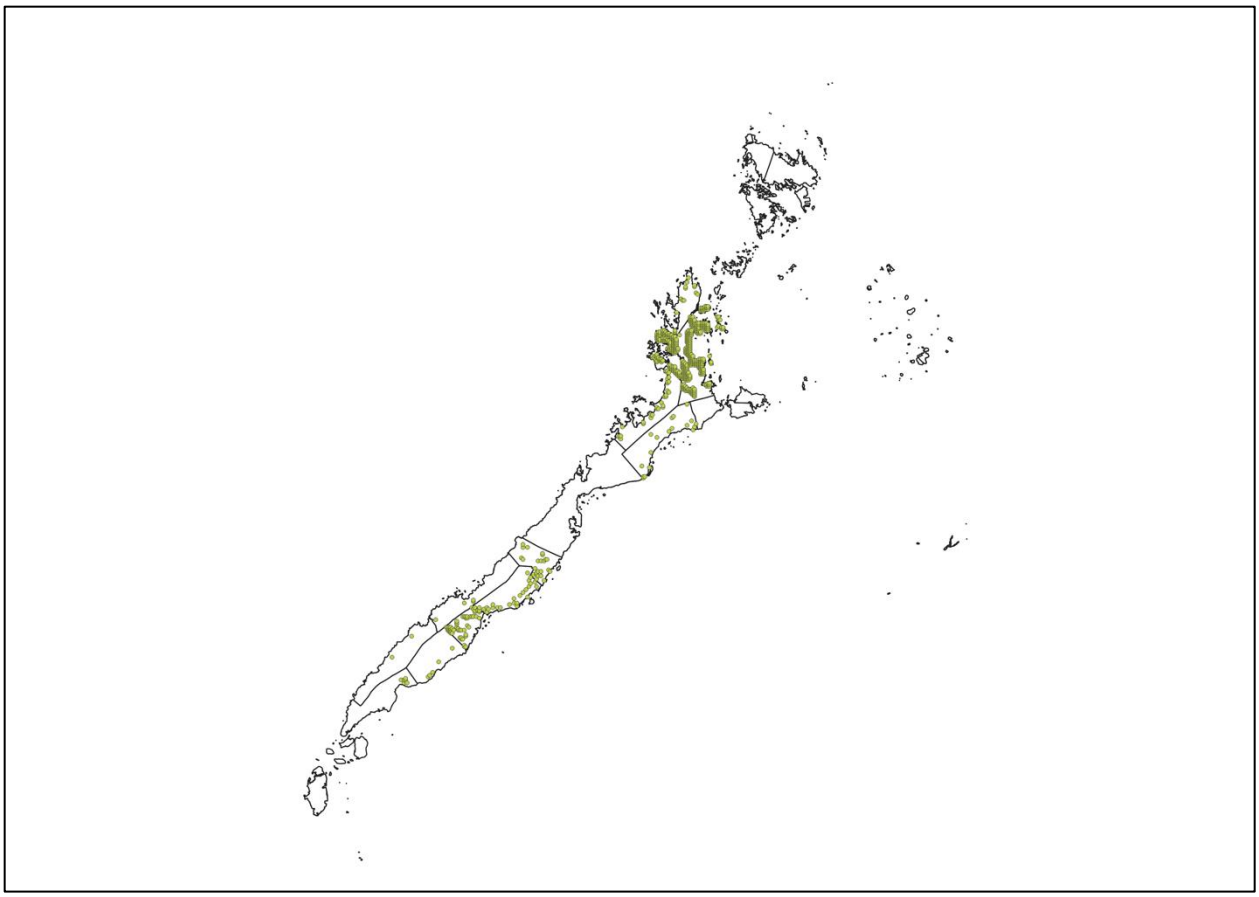


Figure 6. Location map of mango.

b. Occidental Mindoro

Only one municipality was not able to give their crop location map. This is **Lubang island**. The crop location map is presented below.

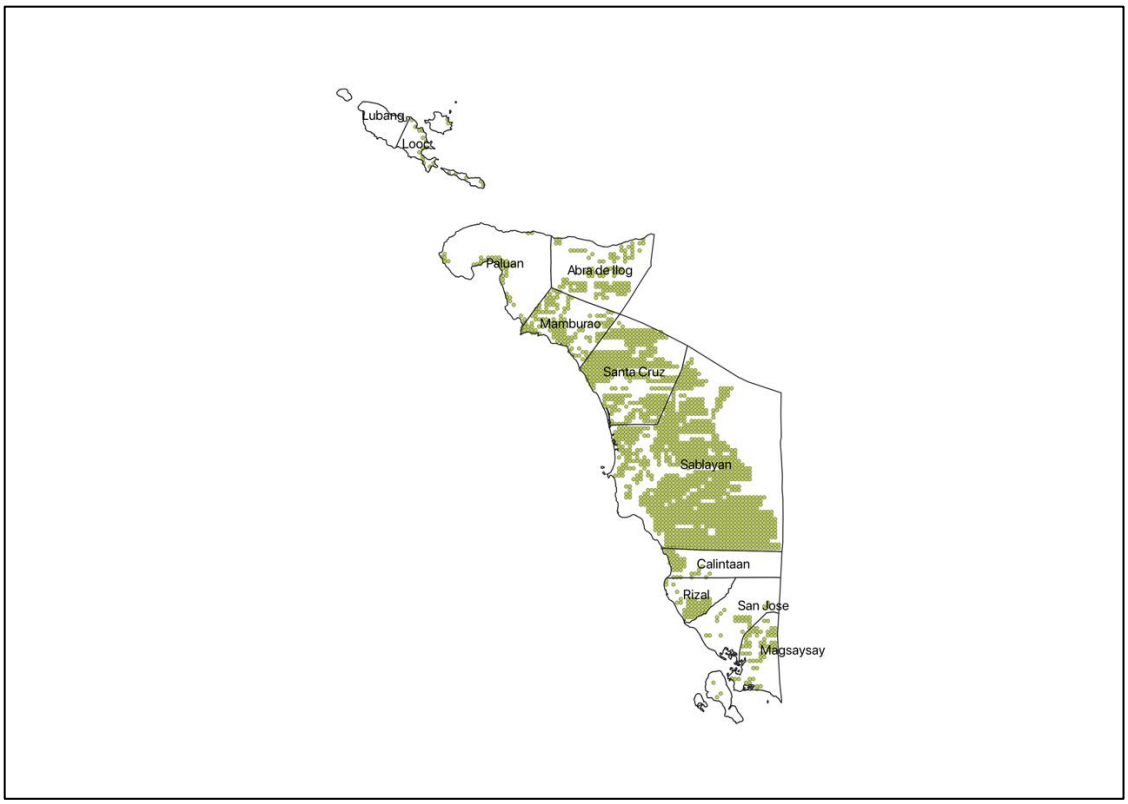


Figure 7. Location map of rice.

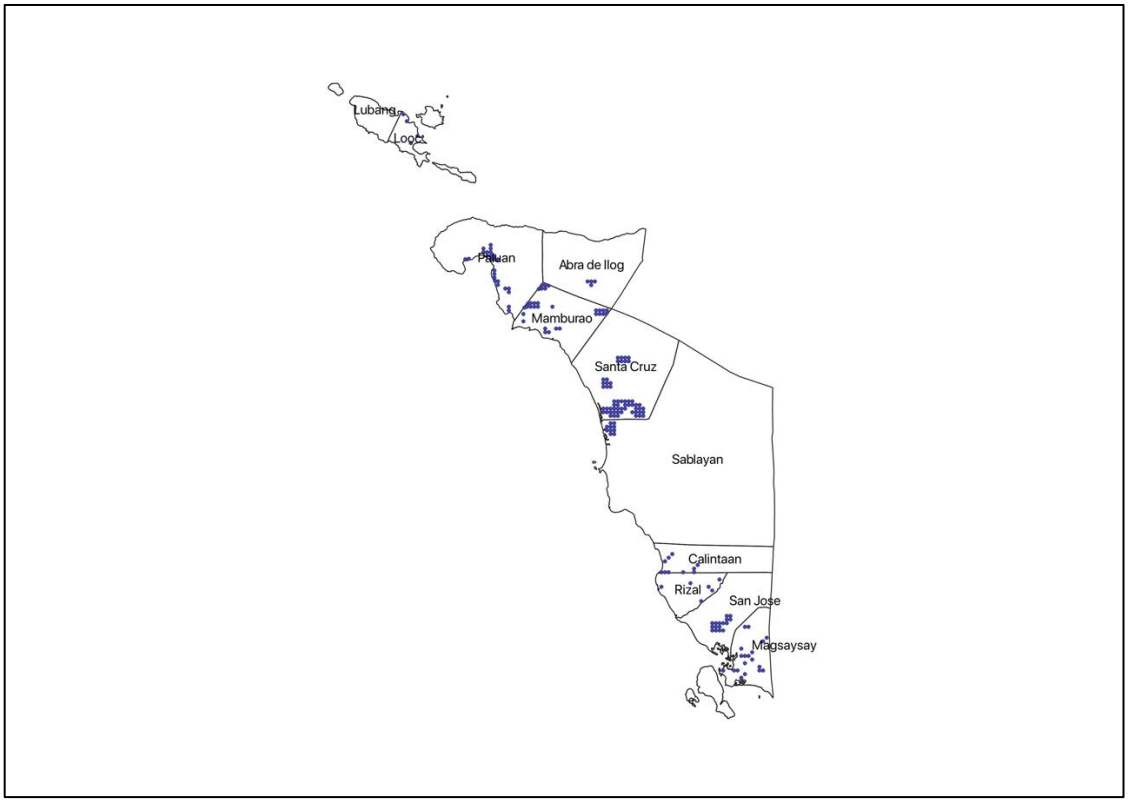


Figure 8. Location map of onion.

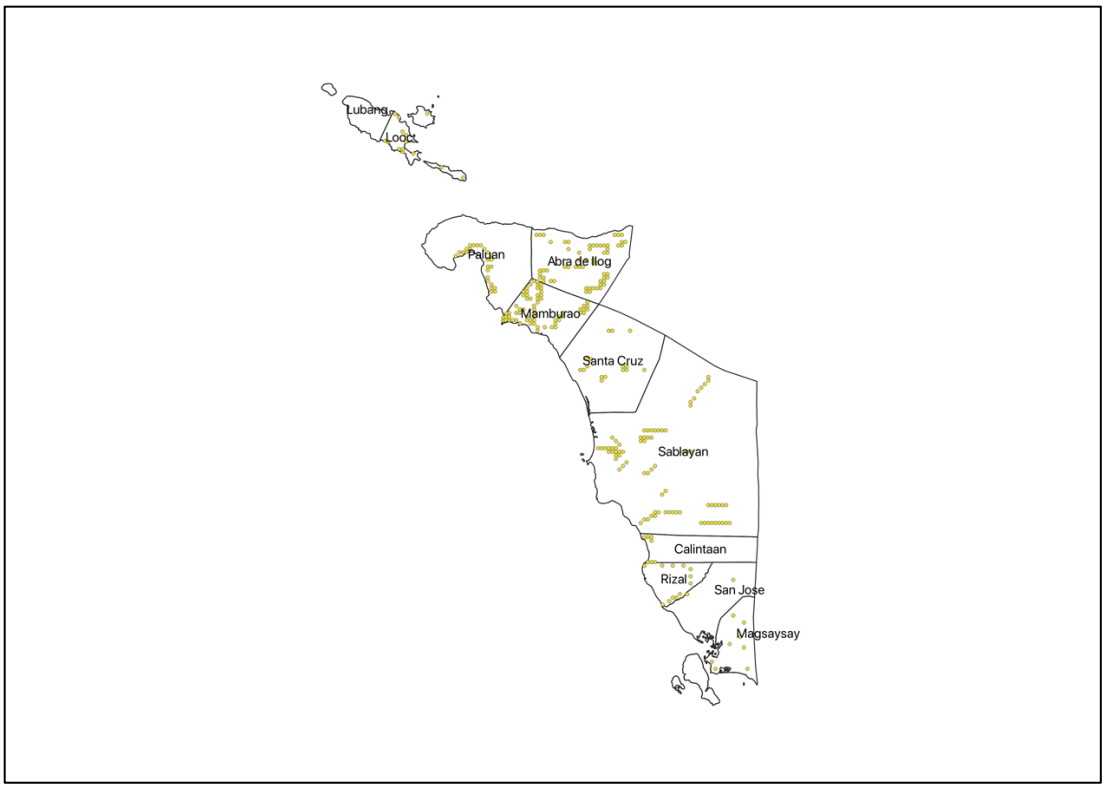


Figure 9. Location map of mango.

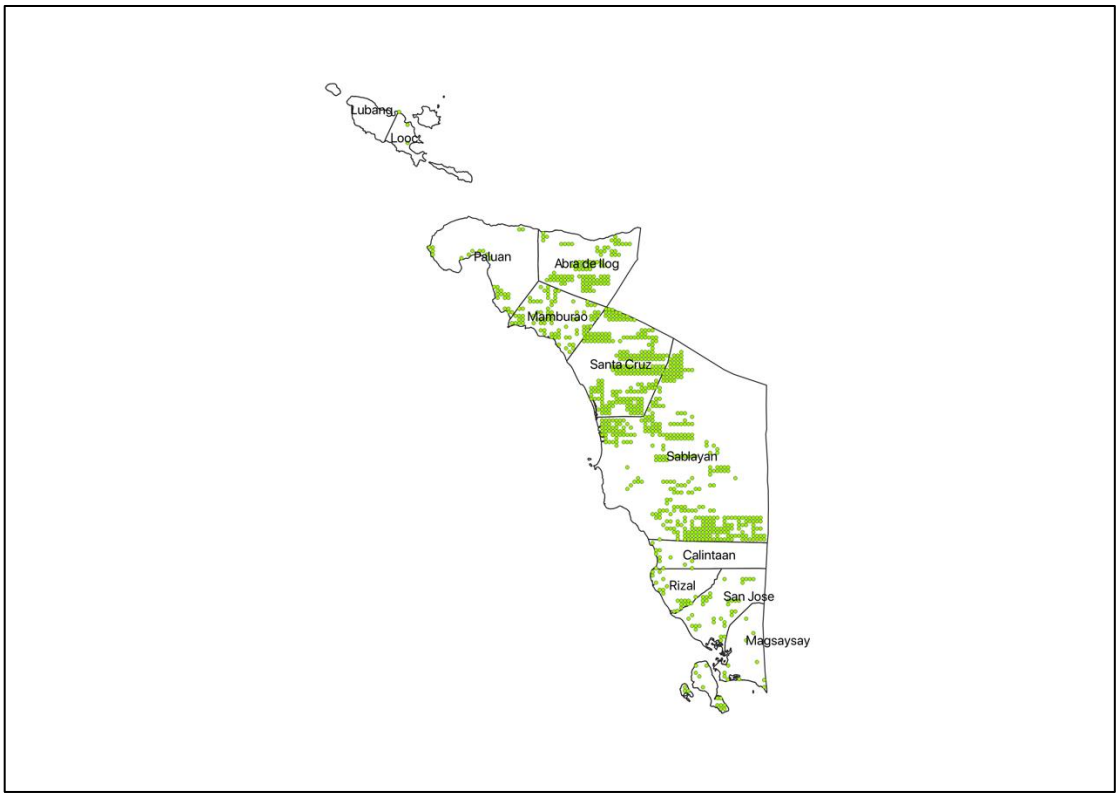


Figure 10. Location map of corn.

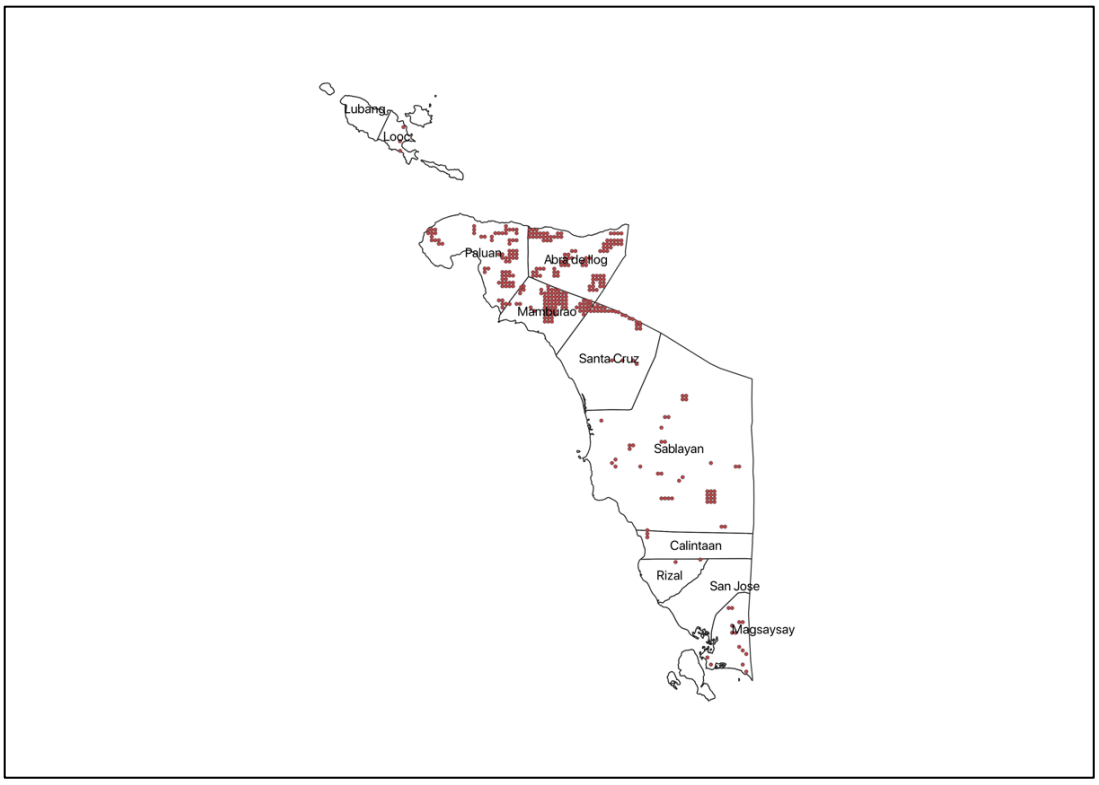


Figure 11. Location map of cassava.

B. Hazard maps

The over all hazard map of Occidental Mindoro showed that the municipalities of Santa Cruz and Sablayan are the most exposed to hazards. These municipalities are found in the central area of the province. While the municipalities of Paluan and Mamburao that are found in the northern part of the province have high exposure to hazards. The eight hazards will be discussed below.

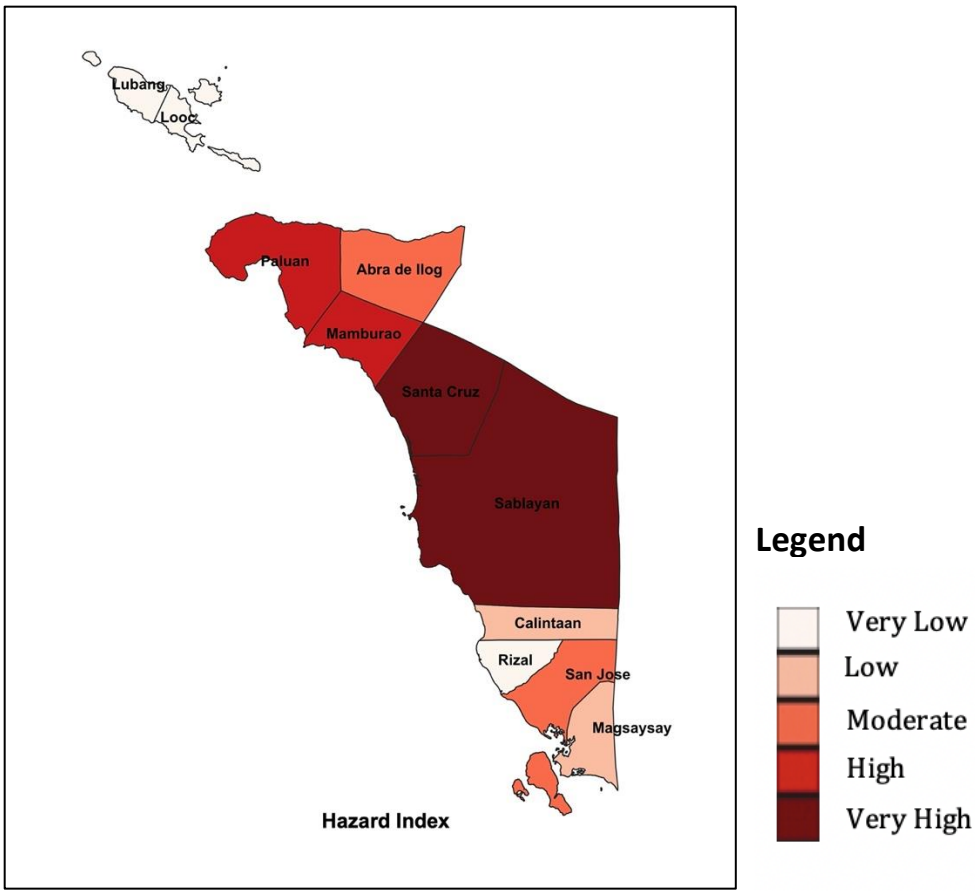


Figure 1. Hazard map of Occidental Mindoro.

Flooding

Flooding is one the major problem in the country during the rainy season or monsoon season. Typhoons also causes flooding in most of the areas in the country. ***The municipalities of Rizal and Magsaysay have high exposure to flooding. These municipalities are found in the southern portion of the province. Adjacent municipalities, Calintaan and San Jose, have high exposure to flooding.***

Landslide

According to the USGS, landslide is the movement of a mass of rock, debris, or earth down a slope. ***The most exposed municipalities to landslide are Abra de Ilog and Sablayan.***

Drought

Drought has a major impact in the agricultural sector. This hazard is also difficult to observe. ***The municipalities that have high exposure to***

drought are found in the central portion of the province. These are Santa Cruz and Sablayan.

Erosion

Soil erosion is occurring process that affects all landforms. In agricultural sector, soil erosion refers to the wearing away of the topsoil by the natural physical forces of water and wind or through forces associates with farming activities such as tillage (OMAFRA, 2018). ***Municipalities of Abra de Ilog and Santa Cruz are the ones who have high exposure to erosion.***

Saltwater Intrusion

Saltwater intrusion decreases the freshwater storage in the aquifers, and can result in the abandonment of supply wells. Furthermore, saltwater intrusion occurs by many mechanisms, including lateral encroachment from coastal waters and vertical upcoming near discharging wells (USGS, 2018). ***Based on the data available, the whole province is not exposed to saltwater intrusion***. It is still considered in the analysis of the over all hazard map of Occidental Mindoro.

Sea Level Rise

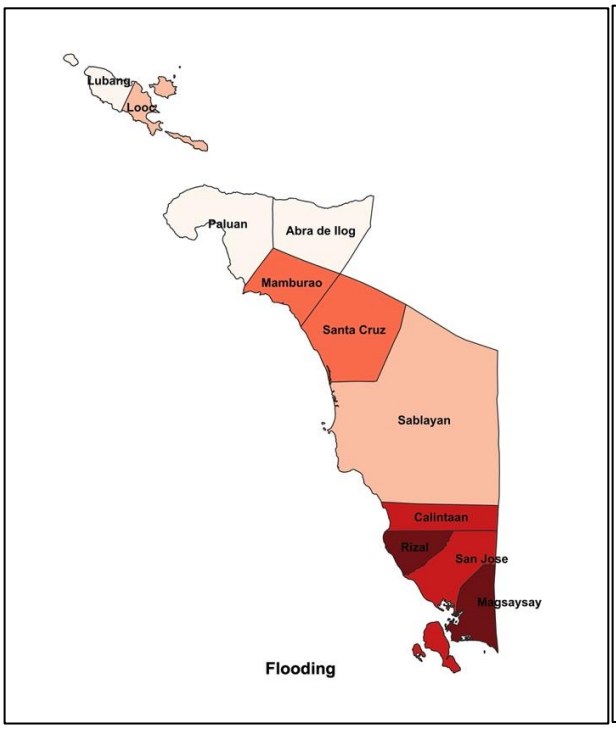
Sea level rise is caused primarily by the two factors related to global warming: the added water from melting ice sheets and glaciers and the expansion of seawater as it warms (NASA). ***The municipalities that have high exposure to sea level rise are Mamburao and Santa Cruz.***

Storm Surge

According to NOAA, storm surge is the abnormal rise in seawater level during a storm. It is measured as the height of the water above the normal predicted astronomical tide. The surge is caused primarily by a storm's winds pushing onshore. The amplitude of the storm surge at any given location depends on the orientation of the coast line with the storm track, intensity, size and speed of storm. ***The municipalities of Santa Cruz and Sablayan are the ones with high exposure to storm surge.***

Tropical Cyclone

On the average, there are about twenty (20) typhoons that enter the Philippine Area of Responsibility every year (PAG-ASA, 2011). ***The municipalities of Lubang and Looc have high exposure to tropical cyclone. These are island municipalities in the northern part of the province.***


Lubang
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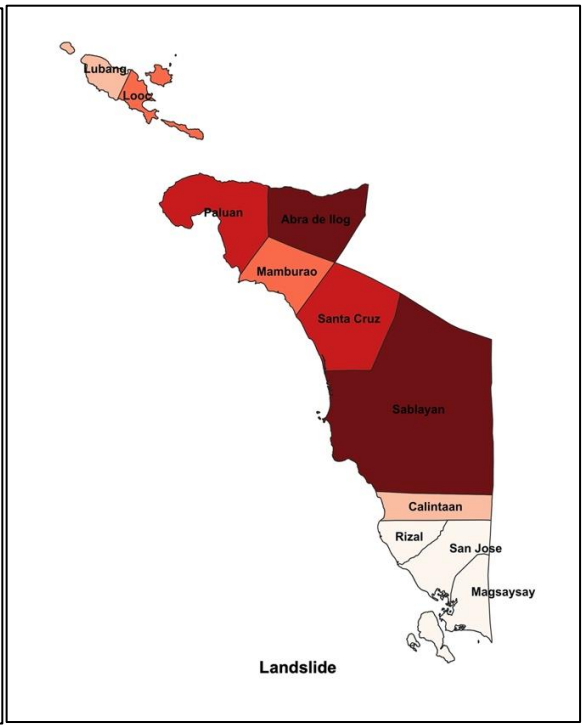
Santa Cruz
Sablayan
Calintaan
Rizal
San Jose
Magsaysay
Flooding


Lubang
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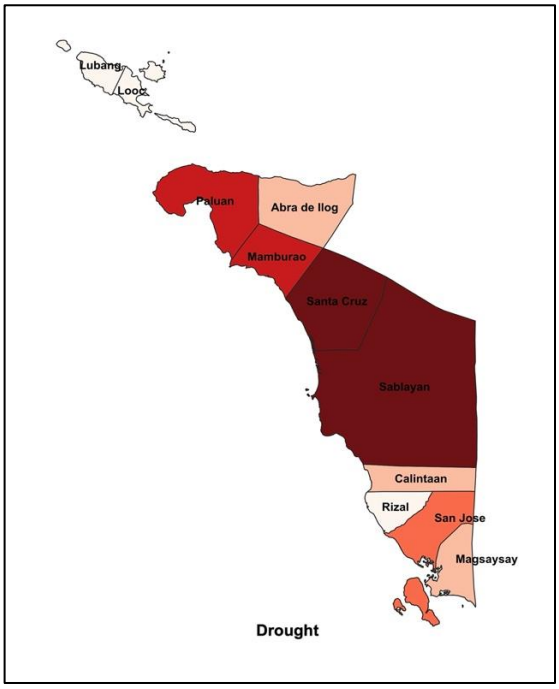
Magsaysay
Landslide


Lubang
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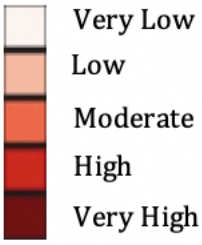
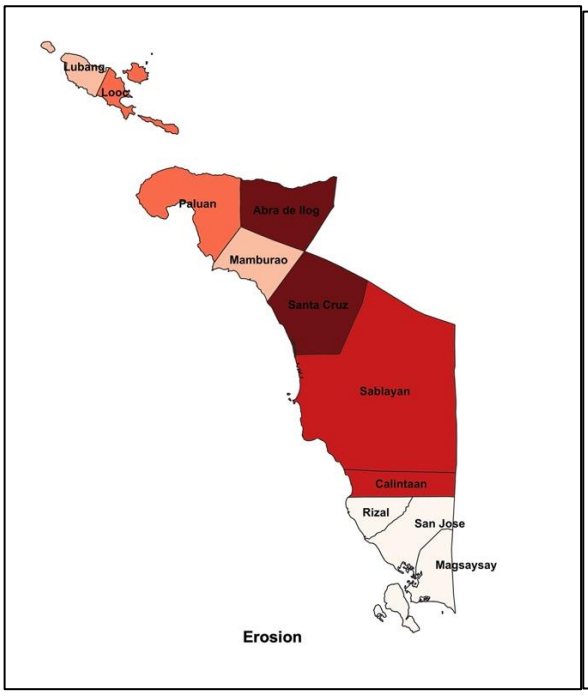
Rizal
San Jose
Magsaysay
Drought

Legend


Very Low
Low
Moderate
High
Very High


Lubang
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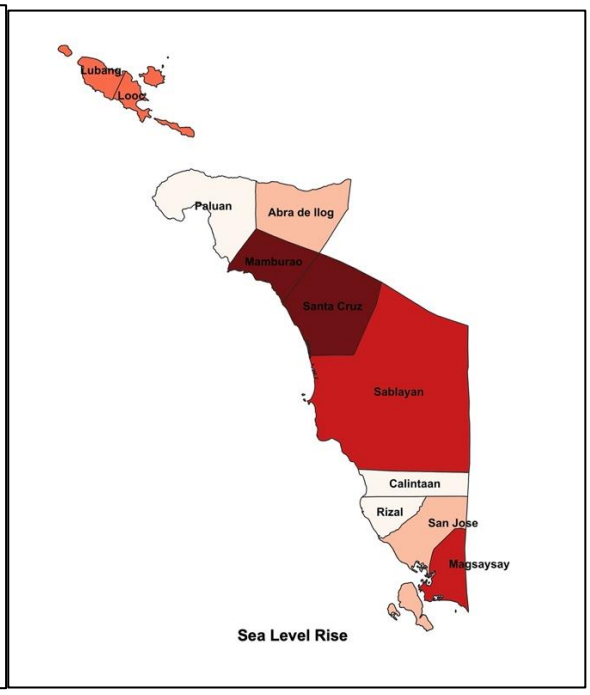
Calintaan
Rizal
San Jose
Magsaysay
Erosion


Lubang
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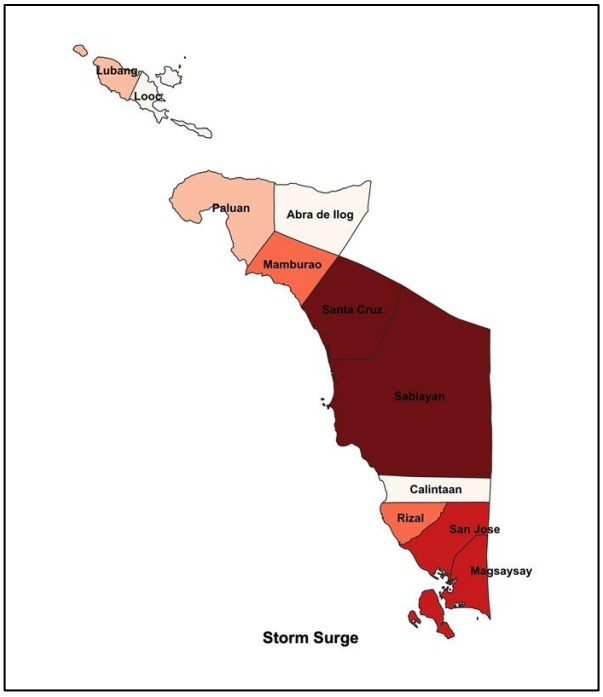
Calintaan
Rizal
San Jose
Magsaysay
Sea Level Rise


Lubang
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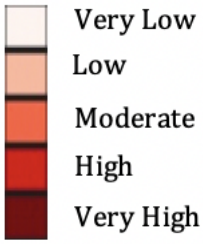
Rizal
San Jose
Magsaysay
Storm Surge

Legend


Very Low
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Moderate
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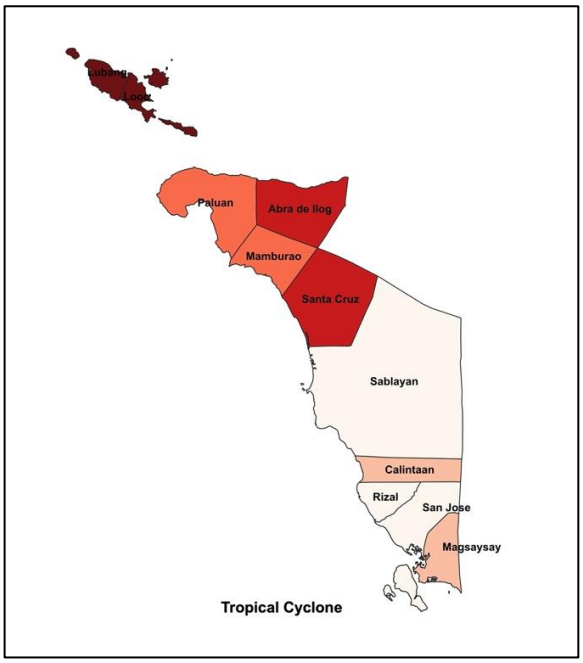

Figure 2. Different types of hazards.

References:

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