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SITE SUITABILITY ASSESSMENT AND CLIMATE VULNERABILITY FOR SWEETPOTATO IN MONCADA, TARLAC, PHILIPPINES

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ABSTRACT

Sweetpotato is a very resilient crop, needs plenty of sunshine, can tolerate drought to some extent but cannot survive water logging, on the other hand, storage roots are sensitive to changes in soil temperature, depending on the stage of its root development. Majority of the farm areas in sweetpotato production are lowland to hilly in which some of the farm lands are highly affected by flood, drought and erosion. Thus, there is a need to assess areas which are vulnerable to climate changes. Moreover, there is a need to evaluate possible suitable areas to meet the increasing demands in sweetpotato delicacies. To address this problem, identifying suitable sites for sweetpotato production and generating climate vulnerability maps could help farmers and local government units (LGU) to assess the proper use of different resource maps for decision making and planning. Five parameters (land use, soil type, groundwater, slope and road accessibility) were used in suitability assessment while the bioclimatic factors, hazards and the existing sweetpotato areas were used for the climate vulnerability analysis. Data were gathered from different agencies and field survey that was processed using MaxEnt and GIS software. Based on the result, majority of the municipality were suitable to highly suitable for sweetpotato production. On the other hand, climate vulnerability assessment shows that the effect climate and hazards to these areas was moderate to extremely vulnerable to these changes in the coming years.

KEYWORDS: Site assessment, Climate vulnerability, Sweetpotato.

1 INTRODUCTION

Sweetpotato is an important staple and emergency food in many countries and is appreciated for its very high nutritional value, both of the tubers and of the young aerial parts.[1] It is also considered as a vegetable, a snack food, ingredients in animal diets and now being used for processed products. Sweetpotatoes are of tropical origin, warm climates is well adapt and grow best during summer. A well- drained sandy loam is desired and heavy clay soils should be avoided as they can delay root development, causing in growth cracks and poor root shape. Sweetpotato needs plenty of sunshine, but shade causes yield reduction.[2] Sweetpotato can tolerate drought to some extent but cannot survive water logging.[3]

The Philippines is reported as one of the most affected countries in terms of climate related risks to agriculture.[4] Crops are both affected by extreme weather as well as the different climate hazards. These include typhoon, landslides, flooding and soil erosion and the magnitude and incidence of these hazards is projected to rise under a climate change scenario.[5] Rainfall is becoming more variable and temperatures are rising consequently leading to increase occurrence of droughts and floods, and changes in the timing and length of growing seasons.[6] Exposure and sensitivity together describe the potential impact that climate change can have on a system.

Site specific sustainable agro-techniques through well designed research is important to improve sweetpotato productivity. Areas, where sweetpotato is already staple food has great potential to improve the farming practices. Thus, identifying a suitable site for sweetpotato production and generating a climate vulnerability map could help farmers and Local Government Units for decision making and planning.

2 MATERIALS AND METHODS

2.1 Study Area

The area for this study focused on the land of Tarlac Province where the total area of 3,053.45 km^2 (305,345 ha) with 37 barangays (Figure 1). Tarlac has dry and wet season. Sweetpotato is the pride of Tarlac, as the province is one of the largest commercial producers of rootcrop in the country. In this study, the three (3) barangay with the largest areas in the municipality was chosen.

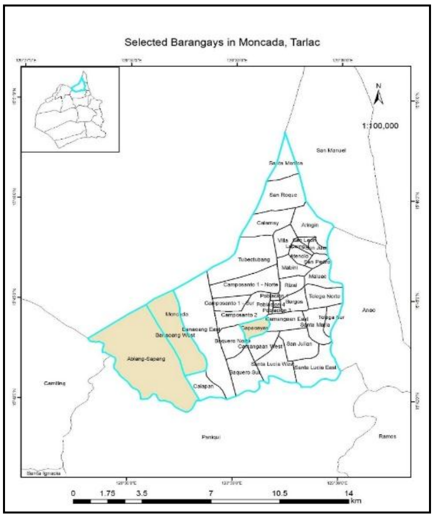


Fig. 1: Map of Moncada, Tarlac, Philippines.

2.2 Site Suitability Analysis

Secondary data and demographic data was collected from different Government organizations. Primary data was gathered through key informant interviews (KIIs) and focus group discussion (FGDs) in relation to sweetpotato areas and the existing farmer practices and management in sweetpotato production.

The five parameters used for the site suitability analysis were processed and analyzed using ArcGIS software. The given parameters are the soil type, slope, land use, groundwater and road accessibility (Figure 2).[7] The identified categories of each parameters have a different score based on its suitability.

The site suitability scoring and weighting system was based in five different parameters with suitability scoring (Table 1). Developing the suitability map of the municipality were done by overlaying the reclassified suitability parameters with their corresponding weights using the Equation 1. Then, it was classified into five suitability classes (Table 2).

Suitability Score = (Land use)*30 + (Soil type)*10 + Groundwater)*5 (1)
+ (Slope)*3 + (Road accessibility)*2

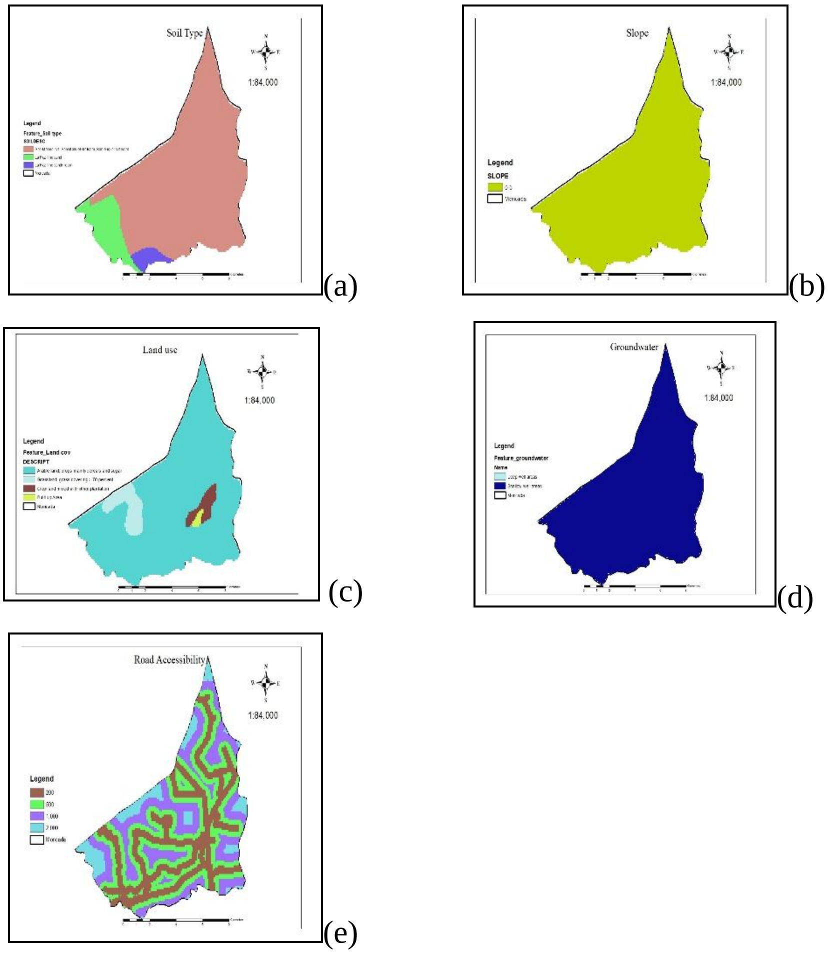


Fig. 2: Site Suitability Parameters Maps (a) Soil type Map (b) Slope Map (c) Land use Map (d) Groundwater Map (e) Road accessibility Map.

Table 1: The Suitability Scoring and Weighting.

Parameters	Category	Scoring	Weighting
Land use	Arable land Grassland, grass covering >70% Build-up area	10 7 0	30
Soil type	Sandy loam Clayloam Fine sand Other types	10 8 5 1	10
Groundwater	Deep well areas Shallow well areas	10 7	5
Slope	0-3 3-8 8-15 15-30 30 and up	10 8 6 2 0	3
Road accessibility (Buffer, meter)	0-200 200-500 500-1000	10 7 4	2

Table 2: The Suitability Classes.

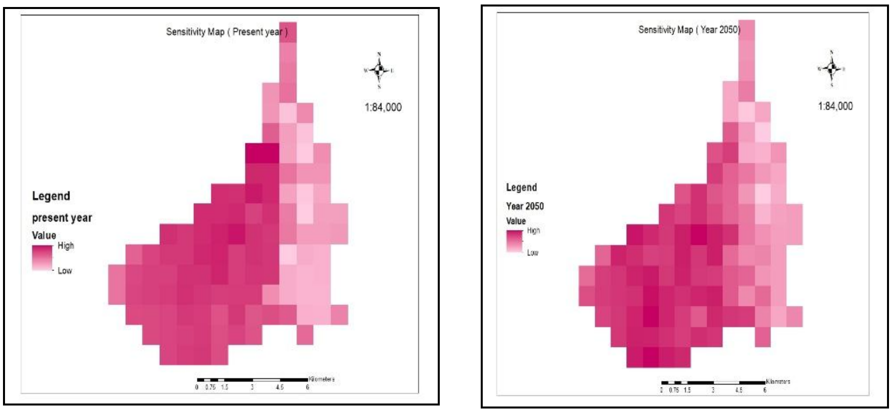
Class	Suitability Score
Highly Suitable	14-13.0001
Moderately Suitable	13-12.0001
Suitable	12-11.0001
Less Suitable	11-10.0001
Not Suitable	10-0.0000

2.3 Climate Vulnerability (Sensitivity-Hazard) Analysis

Sensitivity and exposure together describe the potential impact that climate change can have on a system. This was done by overlaying the sensitivity and hazard within the municipality.

Exposure I. Sensitivity analysis (changes of temperature and precipitation)

Sensitivity analysis was done by identifying the existing crop distribution through focus group discussion in participation of the Municipal Agriculture staff and sweetpotato farmers and the incorporation of bioclimatic data (temperature and rainfall) from the WorldClim. This was processed on the MaxEnt software, a species distribution model (SDM)[4] to produce the sensitivity map (Figure 3).



(a) (b)

Fig. 3: Sensitivity Map (a) Sensitivity Map of Present Year, (b) Sensitivity Map of Year 2050.

Exposure II. Hazards

Exposure represents the climate conditions that stimuli against extreme changes. The hazards such as typhoon, flood, erosion and drought (Figure 4) was considered which mostly affects the area. Secondary data on these hazards were gathered from different organizations and agencies. Hazard weights identification (Table 3) were participated by PDRRMC/MDRRMC staff and AEWs.

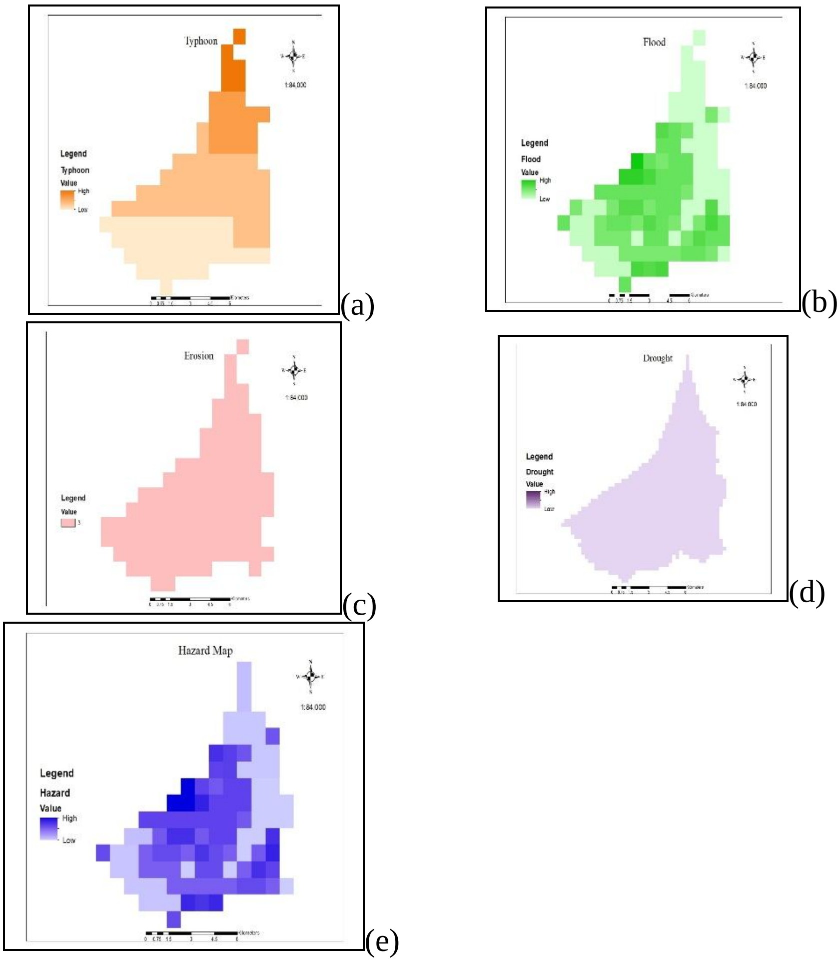


Fig. 4: Hazard Maps (a) Typhoon Map (b) Flood-prone Map (c) Erosion Map (d) Drought Map (e) Final Hazard Map.

Table 3: Hazard Weights.

Exposure II. Biophysical	**Probability of Occurrence**	**National Economy**	**Food Security**	**Houshold Income**	**Key Natural Resources to Sustain Productivity**	**Weight**
Typhoon	3	3	4	4	1	15
Flood	3	4	4	4	1	16
Erosion	1	1	1	1	1	5
Drought (Agricultural/Hydrological)	3	3	3	3	3	15

Note: Weighting the natural hazards into a climate risk exposure

Probability of occurrence: 1 in 1 year = 5, every 5 years = 3, 1 every 10 years = 1

Impact: Insignificant = 1, minor = 2, moderate = 3, significant = 4, disastrous = 5

3 RESULTS AND DISCUSSION

3.1 Sweetpotato Production Areas

The largest area for sweetpotato production in province of Tarlac is Moncada. Three barangays in Moncada were selected in the inventory of the existing crops. The largest area with sweeetpotato production is Ablang Sapang followed by Banaoang West and lastly, Capaoayan having a total farm area of 352.8 hectares with 317 number of famers, 50.9 hectares with 57 numbers of farmers and 3.5 hectares with 2 numbers of farmers, respectively (Figure 5).

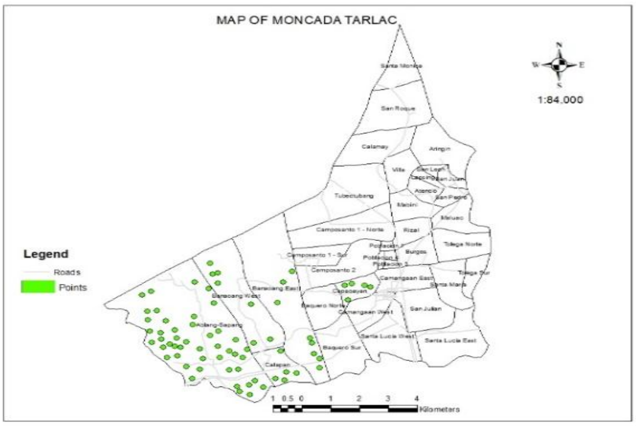


Fig. 5: Sweetpotato Production Areas with 3 Selected Barangays.

3.2 Site Suitability Map

The suitability map shows that the area in Municipality are classified as moderately suitable to highly suitable for sweetpotato production (Figure 6).

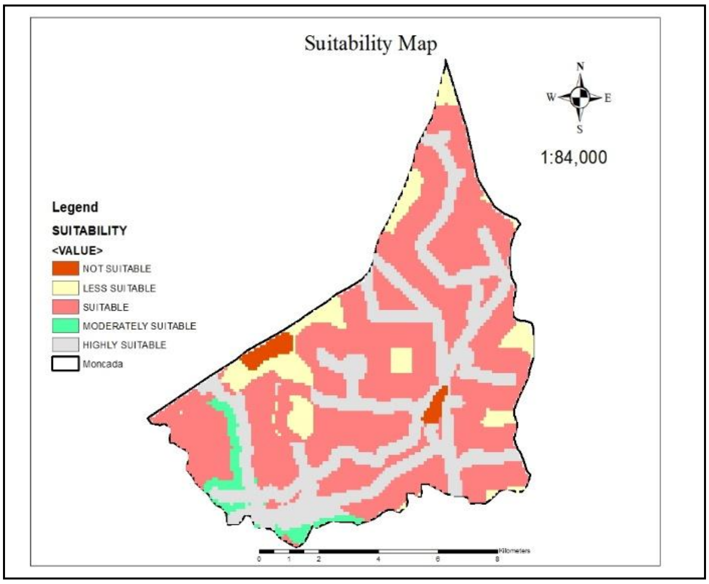
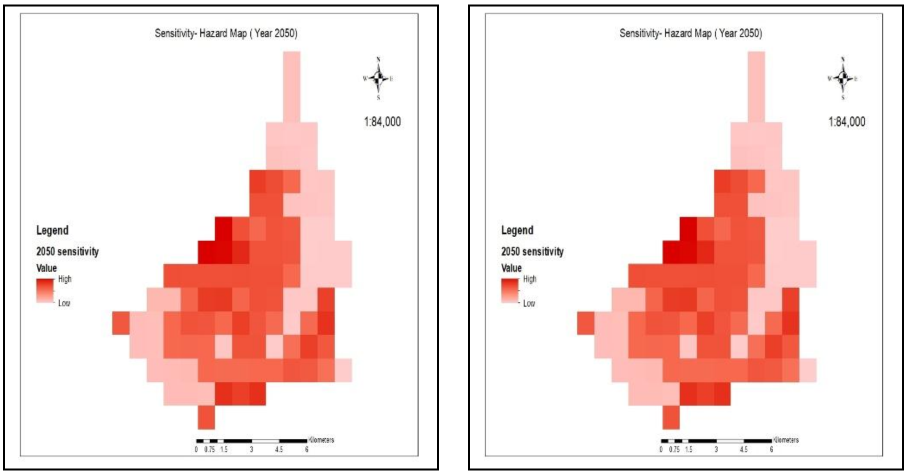


Fig. 6: Site Suitability Map of Sweetpotato in Moncada, Tarlac, Philippines.

3.3 Climate Vulnerability (Sensitivity-Hazard) Map

The impact of the sensitivity-hazard from the present up to year 2050 is moderate to extreme because of the changes in climate (Figure 7). This means that area is vulnerable for crop production.



(a) **(b)**

Fig. 7: Sensitivity-Hazard Map of Sweetpotato in Moncada, Tarlac, Philippines.

4 CONCLUSION

The area of the selected barangays in this study were found out that it is highly suitable, moderately suitable and suitable for sweetpotato production based on the parameters. The information of the impact of climate in the area is also identified together with the hazards defining the risks posed by climate change. This study provides information on sweetpotato that can be used for identifying measures to adapt to climate change impacts.

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