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Original Research Article

Special Pattern and Distribution Land Suitability for Moringa (Moringa Oleifera) in Kupang District

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Abstract: The Kupang Regency in East Nusa Tenggara, Indonesia, experiences 8-9 dry months annually and relies heavily on agricultural and livestock activities, integral to its population. Moringa cultivation for livestock feed is interconnected with these activities. To assess the spatial suitability of moringa plantations, a descriptive study utilized GIS software and overlay methods, incorporating elevation, slope, annual rainfall, temperature data, and land use maps. After excluding forested, residential, and other areas, Kupang Regency's total land area was 288,497 ha. Of this, 114,239 ha were found highly suitable, 138,040 ha moderately suitable, and 36,218 ha unsuitable for moringa cultivation. East Kupang Subdistrict ranked highest in suitable land (16,232 ha), followed by Takari (11,932 ha), Sulamu (9,281 ha), and West Kupang (8,208 ha). Conversely, Fatuleu Tengah (27 ha), Amfoang Tengah (96 ha), and Amfoang Selatan (409 ha) had the least very suitable land. Similarly, Takari (18,279 ha), West Fatuleu (15,784 ha), Fatuleu (14,194 ha), West Amarasi (10,620 ha), and South Amfoang (10,130 ha) excelled in moderately suitable land. In contrast, South Semau (246 ha), East Kupang (434 ha), and Central Kupang (960 ha) had the smallest moderately suitable areas. Unsuitable land for moringa, like South Amfoang (10,270 ha) and Amfoang Tengah (8,932 ha), were prominent. This research aids in identifying optimal locations for moringa cultivation, aligning farming practices with the region's agricultural needs.

Keywords: Moringa Oleifera, Pattern, Distribution, Spacial, Kupang.

INTRODUCTION

Kupang Regency as one of the 22 regencies/cities in East Nusa Tenggara also has 8-9 dry months and the majority of the population is farming and raising livestock. Agriculture and livestock activities are activities that cannot be separated and are very closely related.

Dry land agricultural farming is determined by various inhibiting factors such as soil type, rainfall, fertilizer, weeds etc. In addition to agricultural farming, the area of Kupang Regency with an area of 5,298.13 km 2 is dominated by litosol soil types, alluvial soil, sandy loam soil, and rocky mixed soil with potential for the development of crops. FAO (1976 *in* Hardjowigeno and Widiatmaka (2007) specifically defines that land includes the notion of the physical environment including climate, topography/relief, soil, hydrology, and even the state of natural vegetation, all of which will potentially affect land use. Makaborang, *et al.*, (2009) state that for the development of a commodity it is necessary to zone the commodity based on land suitability class so that the plant can grow in harmony with the climate and existing land conditions.

Moringa (*Moringa oleifera)* is a shrub with a height of 7-11 meters and thrives from the lowlands to the high altitudes from 0 – 1.000 meters above sea level.

Krisnadi (2015) stated that Moringa plants can grow in tropical and subtropical areas in all types of soil and are resistant to dry seasons with drought tolerance of up to 6 months, while Tshabala, *et al.*, (2019) also stated that the optimal temperature for Moringa growth between 18-35 0 C. Moringa is generally tolerant of higher temperatures reaching 48 0 C, but this plant is not resistant to cold temperatures. Meanwhile, Riwu

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Kaho (2019) states that the altitude or elevation of the suitability of plants will affect air temperature and solar radiation. The higher the place above sea level, the lower the air temperature and the level of solar radiation reception, and vice versa.

Therefore, to obtain the pattern and spatial distribution of land suitability for moringa plants in Kupang Regency, it is necessary to research to obtain a land suitability class that will become a reference in further research both as human feed and as supplementary feed for livestock, as well as to support the development of an information system that continues to experience progress is quite rapid in line with developments and increasingly fierce competition in the business world.

RESEARCH METHODOLOGY

Time and Location of Research

This research was carried out in July - November 2020 in Kupang Regency, East Nusa Tenggara Province.

Research Materials and Equipment.

The research material is in the form of climatological data, in the form of daily rainfall data for 10 years from various rain gauge stations in Kupang Regency. Data daily air temperature 1 0 years. Administrative map by village of Kupang Regency, Elevation map and slope class of Kupang Regency, as well as land use map.

The equipment used in this study consisted of a laptop, SAGA GIS *and QGIS software.*

Research Procedure

This research was conducted in the following order:

1. Gather required climate data and base maps.
2. Make a soil map unit with the overlay method some spatial data in the form of slope class maps (%), elevation maps, annual rainfall and annual air temperature using *SAGA GIS and QGIS software* which were then overlaid with administrative map and requirements for growing moringa plants.
3. Conduct land suitability assessment based on FAO and Tshabalala, *et al.*, (2019) & Sishah (2020) classifications using *SAGA GIS software* And *QGIS* so that the land suitability class of Moringa plants is obtained.

The research was conducted in the following manner:

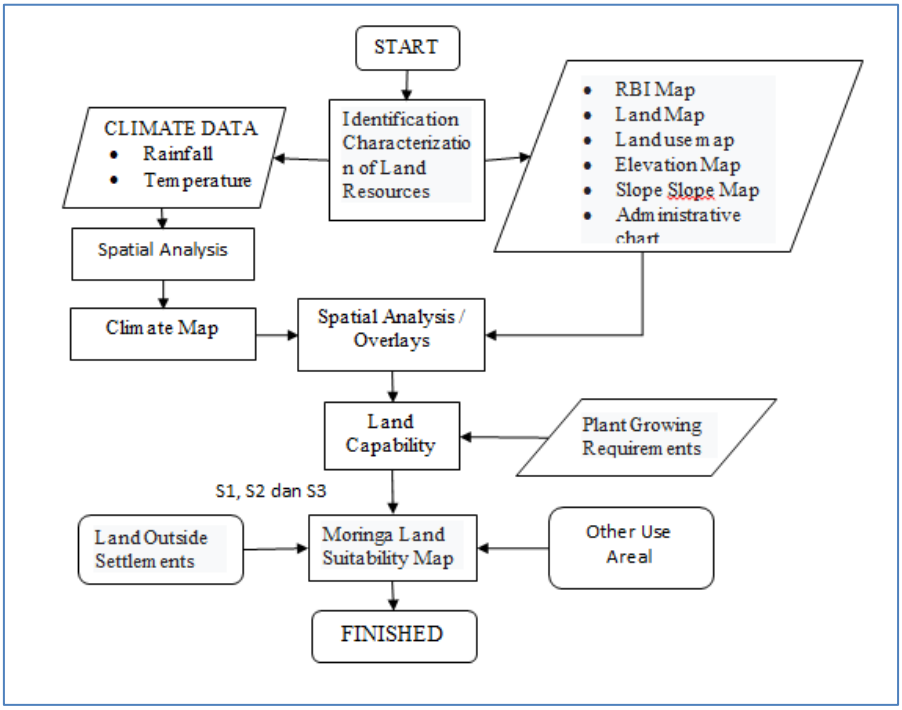

Figure 1: Flowchart of Moringa (Moringa oleifera) Patterns and Spatial Distribution in Kupang Regency

RESULTS AND DISCUSSION

Land suitability analysis was carried out using the overlay method from several spatial data, namely: elevation, slope class (%), annual rainfall and annual air temperature, a map of the land suitability class of Moringa oleifera (Moringa oleifera) was *obtained*.) in Kupang Regency.

In addition to the land suitability criteria above, the results of the land suitability analysis of the 4 indicators have been clipped to forest areas and residential areas.

This makes land that has a suitability class (*suitable)* for moringa plants in the Regency to be more operational because these lands are located in non-

forest areas or other use areas (APL) and outside residential areas or other built-up areas.

Table 1: Area of Land Suitability Level According to District Administrative Area in Kupang Regency

Administrative Region (District)	Land Suitability Level Area (Ha)			
	Very suitable	Fairly suitable	Not suitable	Grand Total
Amabi Oefeto	3,765	1,611		5,376
Amabi Oefeto Timur	4,692	8,213	760	13,665
Amarasi	2,623	6,347	339	9,309
Amarasi Barat	2,964	10,620	798	14,383
Amarasi Selatan	1,310	8,483	1,725	11,518
Amarasi Timur	4,277	7,483	437	12,197
Amfoang Barat Daya	2,501	4,199	874	7,574
Amfoang Barat Laut	2,688	4,096	1,179	7,963
Amfoang Selatan	409	10,130	10,270	20,809
Amfoang Tengah	96	2,120	8,932	11,148
Amfoang Timur	2,131	3,067	1,016	6,214
Amfoang Utara	1,623	5,565	2,538	9,726
Fatuleu	7,132	14,194	520	21,846
Fatuleu Barat	7,438	15,784	4,098	27,321
Fatuleu Tengah	27	2,246	319	2,592
Kupang Barat	8,208	3,207	7	11,422
Kupang Tengah	5,503	960	1	6,465
Kupang Timur	16,232	434	20	16,686
Nekamese	3,162	3,680	272	7,114
Semau	7,602	2,037		9,640
Semau Selatan	5,468	264		5,732
Sulamu	9,281	3,133	44	12,458
Taebenu	3,176	1,885	75	5,136
Takari	11,932	18,279	1,994	32,205
Grand Total	114,239	138,040	36,218	288,497

Based on Table 1. above, it can be seen that on average in the 24 administrative areas of the Kupang Regency sub-districts, the level of land suitability for the development of Moringa plants (*Moringa oleifera)* ranges from very suitable, moderately suitable to not suitable. Of the 288,497 ha of total land analyzed, where this land is not included in forest areas, settlements and other uses, there are 114,239 ha of land that are very suitable for the development of moringa plants, 138,040 ha are quite suitable for the development of moringa plants, and 36,218 ha are not suitable for the development of moringa plants.

Land suitability distribution of moringa plants (*Moringa oleifera)* in Kupang Regency consisting of East Kupang District which is the area with the widest suitability class level for Moringa plants with the widest area of 16,232 ha, followed by Takari District with an area of 11,932 ha, Sulamu District with an area of 9,281 ha, and West Kupang District with an area 8,208 ha. Likewise, the widest area of land for the development of Moringa plants, which in the land suitability class is sufficiently suitable, respectively, is in Takari District with an area of 18,279 ha, West Fatuleu District with an area of 15,784 ha, Fatuleu District with an area of 14,194 ha, Amarasi Barat District with an area of. 10,620 ha and South Amfoang District covers 10,130 ha.

The widest land area that has a non-suitable land suitability class is in a row in South Amfoang District with an area of 10,270 ha, Amfoang Tengah District with an area of 8. 932 ha and Fatuleu Barat District covering an area of 4,098 ha.

From Figures 2 and 3 below, it can be seen that the pattern and distribution of land suitability for Moringa (Moringa *oleifera)* plants in Kupang Regency, East Kupang District is the area with the widest land suitability class level for Moringa plants, followed by Takari sub-district, Sulamu sub-district, and Kecam a West Kupang. The smallest land area at the very suitable land suitability level is found in Fatuleu Tengah District, Amfoang Tengah District, and Amfoang Selatan District.

The widest area of land for the development of moringa plants in the land suitability class is sufficiently suitable respectively in Takari District, West Fatuleu District, Fatuleu District, West Amarasi District and South Amfoang District. While the smallest land area in the Moringa land suitability class is quite suitable, respectively, South Semau District, East Kupang District and Central Kupang District.

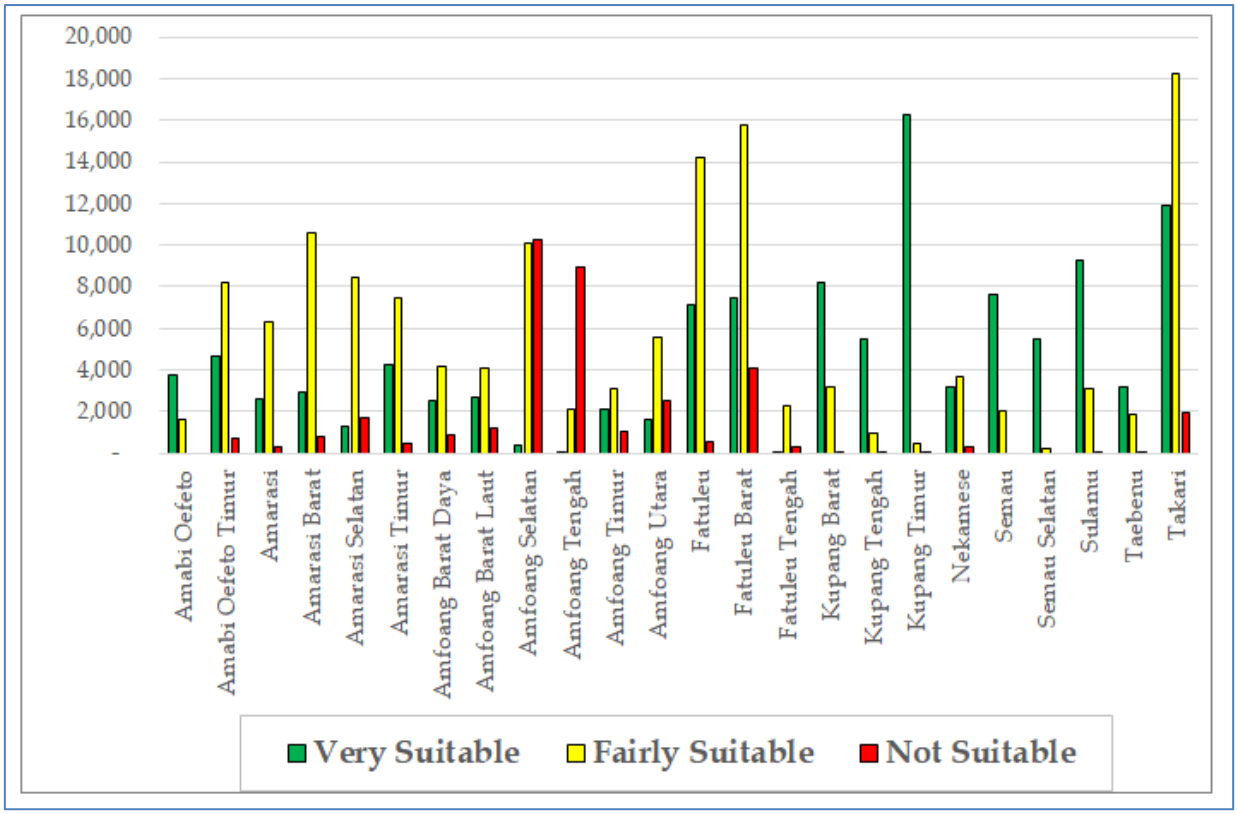

Figure 2: Graph of Land Suitability for Moringa Plants (*Moringa oleifera)* by District Area in Kupang Regency

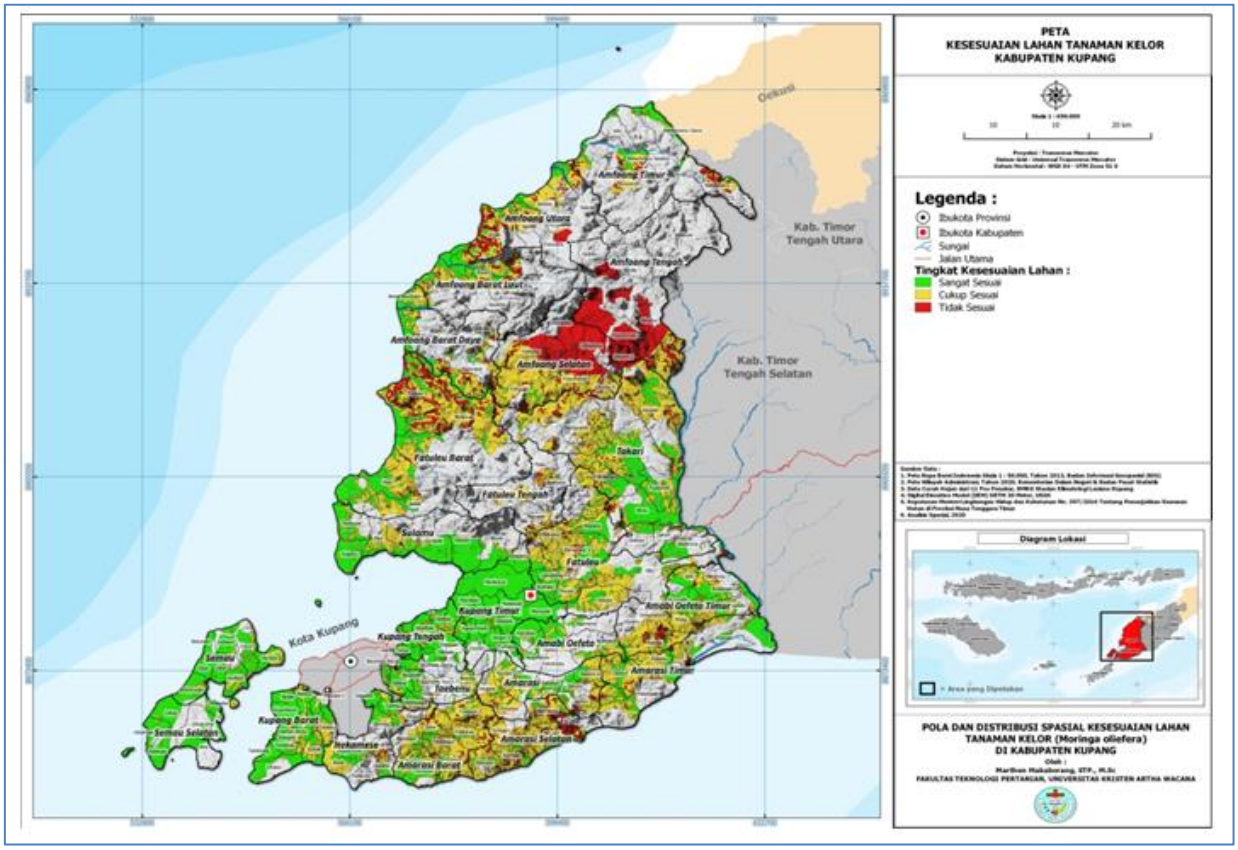

Figure 3: Pattern and Spatial Distribution of Moringa Plants in Kupang Regency

CONCLUSIONS AND SUGGESTIONS

CONCLUSION

From the results of the research and discussion conducted, it can be concluded:

1. The total area of Kupang Regency after deducting the forest area, residential area and other land uses is 288,497 ha consisting of 114,239 ha of land that is very suitable for the development of moringa plants, 138,040 ha is quite suitable and 36,218 ha is not suitable.
2. East Kupang District is the area with the widest land suitability class level for moringa plants (16,232 ha), followed by Takari District (11,932 ha), Sulamu District (9,281 ha), and West Kupang District (8,208 ha).
3. The widest area of land for the development of moringa plants in the moderately suitable land suitability class is in Takari District (18,279 ha), Fatuleu Barat District (15,784 ha), Fatuleu District (14,194 ha), Amarasi Barat District (10,620 ha) and South Amfoang District (10,130 ha).
4. While the development of moringa plants in land classes is not suitable, the widest area is in South Amfoang District with an area of 10,270 ha followed by Amfoang Tengah District with an area of 8,932 ha.

SUGGESTION

From the results of the study, it can be suggested that the cultivation and development of moringa plants should be treated on land with a very suitable and quite suitable suitability class.

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