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Analysis of Coconut (Cocos Nucifera L) Commodities Based on Land Suitability in the Pining District of Gayo Lues

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ABSTRACT
Using a survey method, this study aimed to examine the characteristics of the land and the direction of land usage for cultivating coconuts. The land's features are described in a land map created from the overlapping findings of each land map unit, which serves as a foundation for additional study to fit the environment for growing coconut plants. According to the results of the analytics and planning of the land conservation of coconut crops in Gayo Luwes, for the crops to survive, it is vital to pay attention to soil characteristics such as temperature, rainfall, soil type, and the number of wet months. Gayo Luwes District is a coconut region in the centre of the country. Not only were the results of matching for the coconut commodity in each SST obtained by using map-based planning geographic information systems, but it was also discovered that rainfall ranged from 3100 mm/year, temperatures went from 23oC to 24oC, base saturation was in the very low to low category (3.91% -35.16%), pH H2O is classified as acidic (4.6-4.9), drainage is slightly obstructed, relatively fast and good, slopes are sloping to steep (12%-26) and textures with values little fine, smooth and rather rough are the limiting factors dominant. Other findings also suggest that applying organic material in garbage and compost to Red Yellow Podzolic soil in Batanghari, Jambi, increases Ca-dd and base saturation, and liming is done to raise the pH of H2O in soil units. Moderate to high levels of management can improve the slope limiting factor, such as delaying erosion, establishing a terrace, planting according to the contour, and growing covering plants. Irrigation and irrigation systems can assist in increasing the factors that limit rainfall.

INTRODUCTION

Agriculture is a significant economic development industry since it employs most low-income people in developing countries (Sirappa & Susanto, 2010). Among the measures that can be implemented to promote a prosperous society is to boost agricultural productivity (Nurmiaty & Yassin, 2019).

Manage land resources, soil, water, climate, and the environment to plan agricultural development (Riza et al., 2022). Poor land resource management can lead to degradation, decreasing production and land productivity (Astuti & Paksi, 2022). As a result, land usage must be carried out continuously using a conceptual approach to land assessment. It must be controlled carefully not to harm the ecosystem (Zulkarnain & Hartanto, 2020).

A complex attribute of a field of land is its quality. Each land quality has a

performance that influences its suitability for a specific application. Quality is assessed or evaluated directly on the field, but it is generally established by an awareness of the soil's characteristics (FAO, 1976; (Silalahi et al., 2023).

Method of valuing land What is meant is an assessment of land suitability. Land adaptability describes the suitability of land for specific uses (Suheri et al., 2018). Land suitability can be evaluated both in its existing state (fit land actual) and after repair (conformity land potential) (Sadonoa et al., 2019).

The agriculture industry is the mainstay of the regional economy (Paendong et al., 2020). Agriculture is the first sector to contribute significantly to the Gross Regional Domestic Product (GRDP), followed by the retail commerce sector, the processing industry, and the government administration sector (BPS, 2021). The agricultural sector's GRDP in 2016-2020 is as follows: 737.88, 793.38, 759.08, 751.89, and 781.37 billion rupiahs. Meanwhile, the wholesale trade sector has a GDP (Gross Domestic Product) value of just one-third that of agriculture (BPS, 2021).

The contribution of the plantation sub-sector in Gayo Lues Regency's economic growth in the agricultural sector is quite genuine, as it is one of the key contributors to Gayo Lues Regency's GRDP in the farming sector. Gayo Lues Regency plantation commodities such as coffee, coconut, candlenut, tobacco, citronella, patchouli, aren, coconut, and areca nut have made Gayo Lues Regency the primary production centre for these commodities (particularly candlenut, tobacco, citronella, and patchouli) to the Medan marketing area. (Syarifuddin, 2022). The improved production capacity of these goods has significantly impacted the community's economy, directly increasing the economic growth of the Gayo Lues Regency (Bappeda, 2021).

Pining District is one of Gayo Lues Regency's sub-districts. Pining District also has the most significant area, with 1350.09 Km2 (24.33%), and is located at Lat 4.11035 Long 97.58778. According to RTRW regulations, a spatial pattern plan has been prepared for Gayo Lues Regency, Pining District, separated into protected areas covering an area of 86,019.53 Ha, while agricultural designated areas in general cover 9,397.3 Ha.

Citronella, coffee, coconut, candlenut, and tobacco are the plantation commodities produced in the Pining District. Coconut is the most important agricultural commodity in Pining District. The Locations Quotient (LQ) and Shift-shift-share analysis algorithms determine coconut as a leading commodity (Mardesci, 2019). Integrated means that the things cultivated have competitive and comparative values that can encourage regional economic growth and are sustainable, which means that agricultural commodities are developed with a land-suitability approach (Mawardati et al., 2022). The land suitability strategy is implemented by managing land following the growing conditions of plants. Land use that does not correspond to its appropriateness class will have negative consequences, both physically and economically. Land damage can occur when land use is not in conformity with the land's carrying capacity (Mather, 1986). Meanwhile, land unsuitability has an economic influence on land output.

Land attributes that can be measured or estimated are called land characteristics (Djaenudin, 2011). For example, slope, rainfall, soil texture, accessible water capacity, and adequate depth are defined and reported in each land/land map unit resulting from surveys or land resource mapping efforts. The data is utilized for interpretation and land evaluation of a particular commodity.

Land suitability refers to a land's suitability for a specific purpose, including agricultural and non-agriculture (Djaenudin, 2011). The correlation between the physical qualities of the environment, such as climate, soil, terrain (floor, topography/relief, rocks), hydrology, and criteria 7 of land use or crop growth

conditions, determines an area's adaptability class for agricultural development. So, this study examines the soil's characteristics and appropriateness for developing the coconut commodity in Gayo Luwes.

RESEARCH METHODS

From March 2022 to June 2022, this study was conducted in the field and the laboratory. Survey field implementation in people's plantations (as designated by the spatial use plan) in Pining District, Gayo Lues Regency. The data used in this study are both primary and secondary. Direct data comes from firsthand observations in the field. In contrast, secondary data comes from associated institutions such as the Regional Development Planning Board (Bappeda) Gayo Lues Regency, the Central Bureau of Statistics (BPS) Gayo Lues Regency, and others.

The survey method utilized is based on Map Units Land (SPL). 5 SST results overlays are achieved by accounting for the height factor as a condition for plant growth. Soil samples were collected from each unit on the territory included in the SPL map. That plant was deemed a commodity excellence in the District pinning Regency Gayo Lues, Aceh.

The land valuation method uses the delimit method, which refers to the magnitude of the limiting factor soil properties (FAO, 2008). Land suitability class is obtained by combining land characteristic search plant with suitability criteria land.

At this stage, land characteristics such as temperature, rainfall, drainage, soil texture, soil depth, coarse material, surface rock, nutrients and erosion are assessed. For soil analysis carried out in the laboratory of PT. Socfindo Medan. Furthermore, this analysis uses the Geographic Information System (GIS) application with the overlay method, which aims to determine the current characteristics of the land and then match it with existing plant growth conditions to obtain directions for the development of superior commodities in Pining District, Gayo Lues Regency. The results of this analysis are in the form of a land use direction map in Pining District, Gayo Regency Lues.

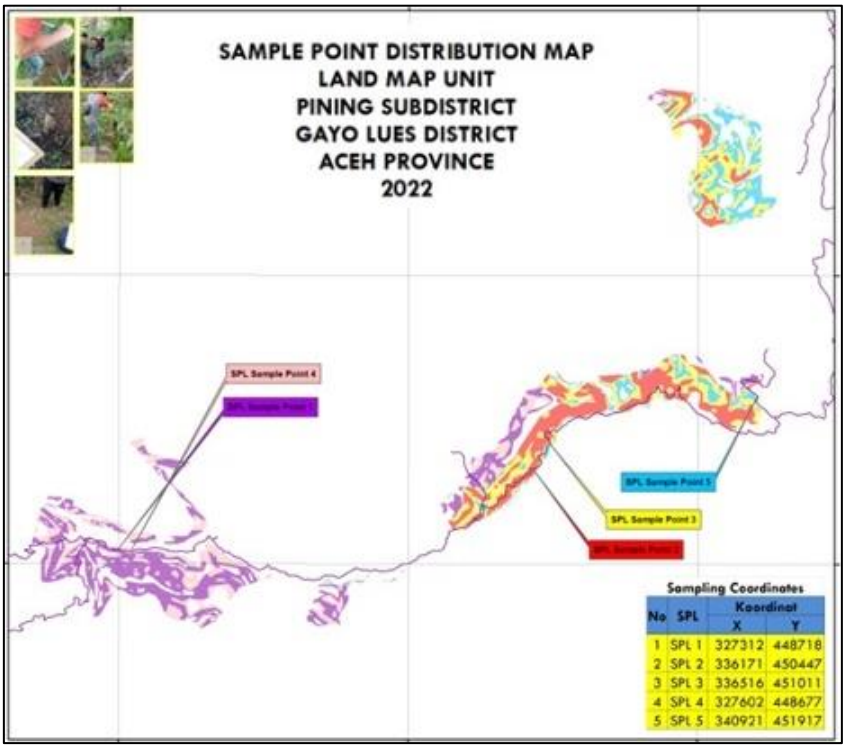

Figure. 1 Sample Distribution Map (Source: Data Processing, 2022).

The land map units (SPL) found in the observation area are dispersed across multiple villages, with PMK soil type features, slope levels varying from 12 - 26%, heights ranging from 381 - 531 meters above sea level, and plantation land cover types.

RESULTS AND DISCUSSION

Air Temperature

Sun exposure comprises the length and duration of orientation and the size of the sun's angle of incidence. The higher the air temperature, the stronger the sunlight. The elevation of the land surface. The higher a location on land is above sea level, the colder the air. The land surface absorbs and emits heat faster than the sea surface. The Braak Formula equation is used to forecast and estimate the temperature in the Land Map Unit (SST), which is 26.3°C - (0.01xheight (meters)x0.6°C), resulting in an approximate temperature of 23°C to 24 °C.

Rainfall

Rainfall (mm) is the height of rainwater collected in a rain gauge on a flat surface that does not absorb, leak, or flow. The amount of rainwater that collects on a flat surface but does not evaporate soaks in or flows. Indonesia is a country with a lot of numbers. Because the area is at a different altitude, the rainfall fluctuates. Rainfall 1 (one) millimetre, defined as one millimetre of water accommodated in an area of the one-meter square on a flat surface holding one millimetre of water flat water adapted as high as one millimetre or accommodated water as high as one litre. The specified Land Map Unit (SPL) rainfall distribution is 3,100 mm/year (RTRW Gayo Lues Regency, 2013).

Number of Wet Months

Oldeman's formulas are used to determine the number of wet months, humid months, and dry months. Wet months have a monthly rainfall of more than 200 mm, humid months have a monthly rainfall of 100-200 mm, and dry months have rain of less than 100 mm. Data indicates that the wet month is obtained for eight months, whereas the wet month is two months.

Land Characteristics

According to the USDA, soil texture parameters in the study region are determined using a texture triangle diagram. The soil textures at the observation sites ranged from slightly fine (loamy loam) to fine (sandy clay) and somewhat coarse (sandy loam), with a low percentage of coarse particles (15%) and good drainage. The availability of oxygen for plant roots is related to drainage conditions. Root growth and development are influenced by adequate rooting depth.

Table 1. Land Characteristics in SST

Land Characteristics	SPL 1	SPL 2	SPL 3	SPL 4	SPL 5
Temperature	24,11	23,17	23,61	24.01	23,48
Rainfall	3100	3100	3100	3100	3100
Number of Wet Months	8	8	8	8	8
Drainage	Slightly Obstructed	Rather Fast	Good	Slightly Obstructed	Good
Texture	Clay Clay (Ah)	Sandy Clay (H)	Sandy Clay (Ak)	Clay Clay (Ah)	Sandy Loam (Ak)
Coarse material (%)	<15	<15	<15	<15	<15
Soil Depth (cm)	100	100	100	100	100
CEC	46.01(ST)	27.31(T)	39.01(T)	27.27(T)	61.56(ST)
KB (%)	4.37(SR)	35.16(R)	3.91(SR)	8.74(SR)	8.26(SR)
H2O pH	4.7(M)	4.6(M)	4.9(M)	4.8(M)	4.9(M)

C-Organic (%)	0.89(SR)	0.87(SR)	0.74(SR)	0.74(SR)	1.33(R)
N-Total (%)	0.15(R)	0.09(SR)	0.08(SR)	0.20(R)	0.13(R)
P2O5 Ex HCL (%)	0.82(ST)	0.98(ST)	1.74(ST)	0.80(ST)	0.96(ST)
K2O (%)	0.36(ST)	0.13(T)	0.33(ST)	0.81(ST)	0.20(ST)
Slope (%)	23	26	23	14	12
Erosion					
Puddle (cm)	F0	F0	Fo	F0	F0
Length (days)	-	-	-	-	-
Surface Rock (%)	<5	<5	<5	<5	<5
Rock Outcrops (%)	<5	<5	<5	<5	<5

(Source: Data Processing, 2022).

The soil depth is deep (> 60 cm), and the slope ranges from 12-26%, with a very low to moderate level of erosion threat. The steep slope will speed surface drainage, increasing the risk of erosion. The soil in the study region is red-yellow Pedzolic. CEC values range from high to extremely high, namely 27.27 - 61.56 me/100 g, and base saturation values range from very low to moderate, 3.91 - 35.16%. The pH value in the observation region is between 4.6 and 4.9. The C-Organic weight is graded as low to low, ranging from 0.74 to 1.33%.

Table 2. Assessment of Land Suitability Class

Coconut Commodity	Land Map Unit (SPL)				
	1	2	3	4	5
Actual Land Suitability	S3 (nr3, eh1)	S3 (oa1, nr3, eh1)	S3 (w1, nr2, nr3, nr4, eh1)	S3 (w1)	S3 (t1, w1, rc1, nr2, nr3, eh1)
Potential Land Suitability	S2 (t1, w1, nr3, eh1)	S2 (t1, w1, oa1, nr3, eh1)	S2 (t1, w1, nr2, nr3, eh1)	S2 (t1, w1, nr2)	S2 (t1 ,rc1)

(Source: Data Processing, 2022).

The N-total value is relatively low, ranging between 0.08 and 0.20%. P-available is classified as very high, ranging from 0.80 to 1.74%. K is rated as high to very high, ranging from 0.13 to 0.81% (Djaenudin et al., 2011) classified data on land suitability for coconut. Figures 2 and 3 depict the present and projected land suitability classes for coconut commodities.

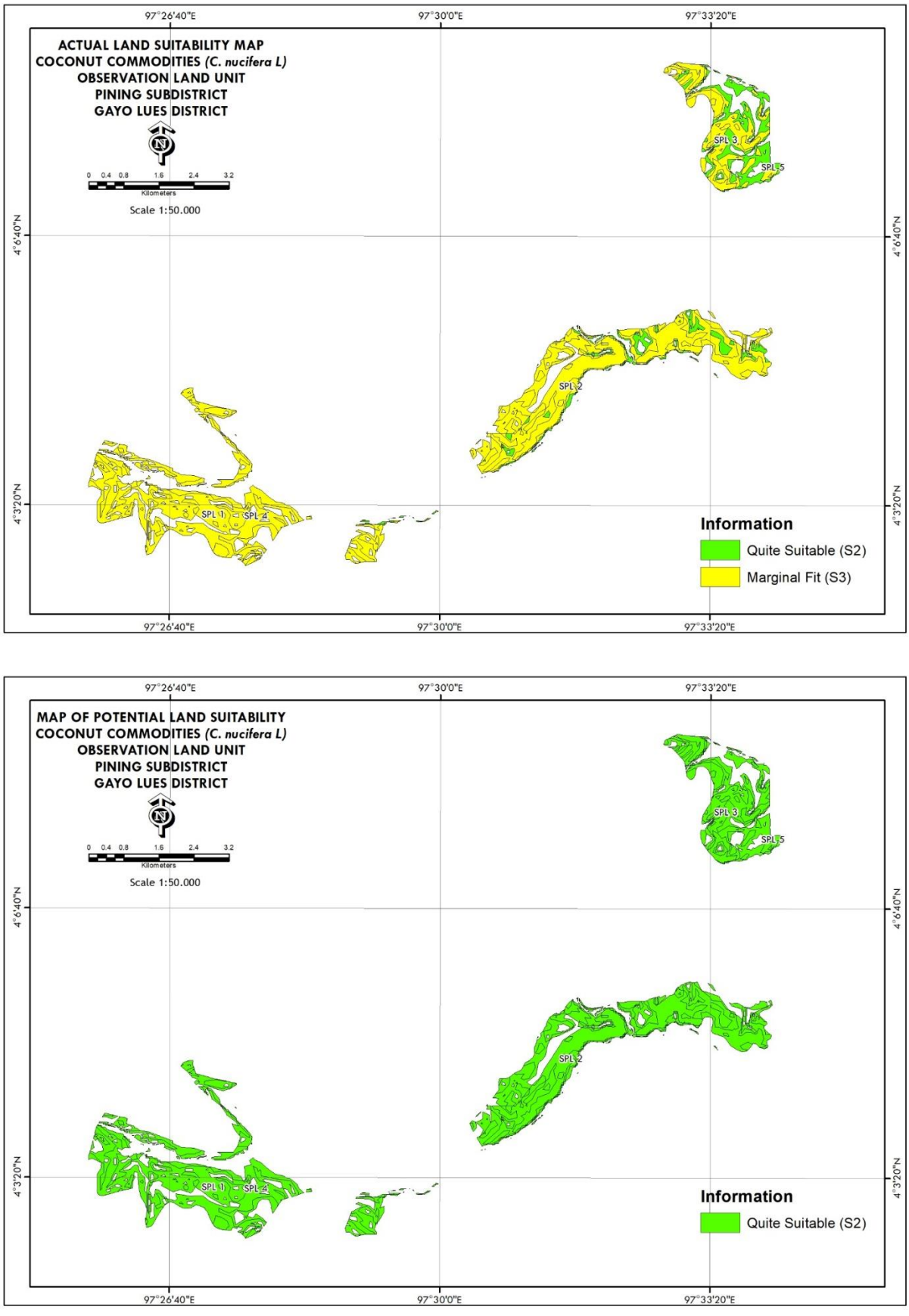

Figure 3. Potential Land Suitability Map for Coconut (Source: Data Processing, 2022).

From the results of matching for the coconut commodity in each SST, it was found that rainfall ranged from 3100 mm/year, temperatures ranged from 23oC to 24oC, base saturation was in the very low to low category (3.91% -35.16%), pH H2O is classified as acidic (4.6-4.9), drainage is slightly obstructed, relatively fast and good, slopes are sloping to steep (12%-26%) and textures with values little fine, smooth and rather rough are the limiting factors dominant. Except for the limiting variables of temperature and texture, these limiting parameters can be enhanced with moderate to high levels of control, allowing them to go up one level (Raju, 2022).

The pH of the soil in the observation area is characterized as acidic. Acidic pH significantly impacts plant nutrient absorption, particularly nutrients N, P, and K. Acidic pH circumstances prevent these three nutrients from being absorbed and neglect the use of inorganic fertilizers (Wulandari, 2019). As a result, when the pH is low or acidic, a treatment to raise the pH is required, particularly the delivery of dolomitic lime (CaMg (CO3)2). Lime is used to raise soil pH, increase Ca elements, increase the availability of P and Mg elements, minimize Fe, Mn, and Al poisoning, boost microorganism life, and mend root nodules. Furthermore, the base saturation characteristics in the research region are of poor value. The organic matter content of each horizon represents the amount of organic matter accumulated under various environmental conditions. (Yusuf & Yusron, 2021). Base saturation can be improved with moderate to high management degrees, specifically by introducing organic matter and residual ash. Repairing/creating drainage can help to enhance the limiting factor for drainage.

As a result, the appropriateness class for base saturation increased from marginal to highly acceptable (S2) (Mujiyo et al., 2021). Sutono (2002) demonstrated that applying organic matter in the form of manure and compost to the Red Yellow Podzolic soil in Batanghari, Jambi increased Ca-dd and base saturation, and liming was performed to raise the H2O pH in the land unit. Slope limiting factors can be improved with moderate to high degrees of management, namely by slowing erosion, building terraces, planting parallel to the contour, and planting cover crops. Irrigation and irrigation systems can help to improve rainfall-limiting factors.

Land Use Planning

Policies for regional growth require agricultural commodity development directives, which can be carried out by deducting existing land (20.1 Ha of planted land) from prospective ground. To get guidelines for the use of 1,489.11 Ha of coconut land. Coconut commodity development can be carried out by considering the planted types and recommended varieties with advantages, such as hybrid and other high-yielding coconuts (Uristiasi et al., 2019). Furthermore, the regional government must intervene to support the development of increased production of these agricultural commodities, such as assistance with production infrastructure and, if possible, subsidized aid to farmers. Developing agrarian things is expected to maintain the area's sustainability in the Pining District.

CONCLUSION

Coconut commodities have a possible land suitability class S2 (very suitable), with temperature, rainfall, base saturation, pH H2O, drainage, texture, and slope as limiting criteria. The land use direction for coconut development is 1,489.11 Ha. Regarding land use based on land suitability, particularly in Pining District, policymakers, in this case, the Government of Gayo Lues Regency, can adopt policies such as preparing a Detailed Spatial Plan (RDTR) to direct land use for agricultural commodity development.

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