GIS based: mapping of Multy Purpose Tree Species (*Durio zibethinus*) in Perkebunan Tambunan Village, Langkat District, North Sumatera Province, Indonesia

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Abstract. *Durio zibethinus* (durian) in Indonesia is known as one of the types of Multy Purpose Tree Species (MPTS). Durian is a Malvaceae family. It grows naturally as well as is planted on community agroforestry land in Langkat Regency, North Sumatra. This study aimed to map the distribution of land suitability of *Durio zibethinus* using Geographic Information System (GIS) in Perkebunan Tambunan Village, Salapian Sub district, Langkat District. This study was conducted from February 2019 to July 2019 at the USU Experimental plantation, Perkebunan Tambunan Village, Salapian Sub district. Soil physical and chemical properties analysis were conducted in Central Laboratory and Soil Biology Laboratory, Faculty of Agriculture, Universitas Sumatera Utara (USU). The evaluation of land suitability distribution using GIS was conducted in Laboratory of Forest Inventory, Faculty of Forestry, USU. The land suitability of *Durio zibethinus* in Perkebunan Tambunan Village was marginally suitable for all land units (Land Unit 1, 2 and 3).

1. Introduction
Land is a physical environment factors that affect the potential use, such as: soil, climate, hydrology, relief and vegetation. These land characteristics include land factors that can be measured/estimated in size, such as: slopes, rainfall, soil texture, water availability and so on. One type of land characteristic can affect more than one type of land quality. Soil texture can affect water availability, whether or not land is easily cultivated, erosion sensitivity [1,2,3]. The basic framework for evaluating land suitability is to compare the requirements needed for specific land uses. Physical, social, economic factors and environmental resources conservation for sustainable use are factors that needed to be considered to achieve the objectives of land evaluation.

Several studies on land suitability have been carried out for various types of crop commodities in several locations using GIS technology [4-11,12-18]. GIS technology has been widely used in evaluating land suitability [8,9,10]. One of the most important biodiversity is *Durio zibethinus*, commonly found in South-East Asia, includes many varieties. It is native to Indonesia. The plant particularly grows in a tropical climate. A humid atmosphere and a shady environment are required for its growth. One place that has the
potential to be found *Durio zibethinus*, namely: Langkat, North Sumatra Province, Indonesia. In this area, *Durio zibethinus* known as the local name "durian". It can be found in community agroforestry lands. Many studies also have been reported about *Durio zibethinus* in different places [19-23]. Study of land suitability for *Durio zibethinus* as one of Multy Purpose Tree Species (MPTS) has never been conducted, especially in this location. Data and information about the suitability land of *Durio zibethinus* in Perkebunan Tambunan Village are still limited, therefore, the objectives of this study were to analyse the suitability land (actual and potential) of *Durio zibethinus* and map the distribution of land suitability class in Perkebunan Tambunan Village.

2. Materials and methods

2.1. Area of study
This study was conducted at the Universitas Sumatera Utara (USU) Experimental plantation, Perkebunan Tambunan Village, from February 2019 to July 2019. Salapian Sub district consists of 17 villages. Perkebunan Tambunan is one of village that located in Salapian Sub district, Langkat Regency, North Sumatra Province, Indonesia. Salapian Sub district is approximately 66.9 km from Medan City, which can be reached in about two hours. Based on data from the Central Statistics Agency of Salapian District in 2018, Salapian District has an area of 221.73 km².

2.2. Collection of data
Soil physical and chemical properties was analysed in Laboratory of Soil Biology and Central Laboratory, Faculty of Agriculture, USU. The GIS data processing was conducted in Laboratory of Forest Inventory, Faculty of Forestry, USU. The tools used in this research, such as: are Arc GIS Software, hardware (set of computers), Global Positioning System (GPS), digital cameras, earth borer, hoe, ring sample, sifter, pH meter and stationery. The first activity carried out in this study was the collection of secondary data, such as: temperature and rainfall data, land use maps, land maps and topographic maps from the North Sumatra Forest Area Consolidation Agency (BPKH).

2.3. Data analysis
Land suitability evaluation of *Durio zibethinus* was done by comparing the quality of land obtained from field surveys with specified land use requirements [24-26]. Land suitability can be assessed both actual and potential. According to FAO, the land suitability class is divided into four levels, namely: highly suitable (S1), moderately suitable (S2), marginal suitable (S3) and not suitable (N). The final result of the classification was determined based on the worst class by giving all the constraints that exist. Changes in classification to a better level are possible if all existing obstacles can be corrected.

3. Result and discussion
Actual land suitability (ALS) classes *Durio zibethinus* in Perkebunan Tambunan Village, Salapian Sub District based on the land unit is shown in Table 1.

The ALS class distribution of *Durio zibethinus* in Perkebunan Tambunan Village, Salapian Sub district is presented in Figure 1. The distribution of potential land suitability class for *Durio zibethinus* in Perkebunan Tambunan Village, Salapian Sub district is presented in Figure 2.
Table 1. The actual land suitability (ALS) and potential land suitability (PLS) of *Durio zibethinus* at Perkebunan Tambunan Village, Salapian Sub district based on land unit

| Land unit | ALS   | PLS   | Area Ha | (%)  |
|-----------|-------|-------|---------|------|
| 1         | S3 wa | S3 wa | 553.58  | 59.31|
| 2         | S3 wa | S3 wa | 355.29  | 38.06|
| 3         | S3 wa | S3 wa | 24.44   | 2.63 |
| Total     |       |       | 933.31  | 100.00|

Note: S3 = marginally suitable, water availability/annual rainfall (wa)

Figure 1. Distribution area of actual land suitability of *Durio zibethinus* in Perkebunan Tambunan Village, Salapian Sub district

Based on Figure 1 and Figure 2, it can be seen that the ALS and PLS classes of *Durio zibethinus* were S3 or marginally suitable in Land Unit (LU) 1, LU 2 and LU 3. This means that the land in Perkebunan Tambunan Village has limiting factors that are difficult to overcome for sustainable use, thereby reducing resulting productivity [26,27]. The limiting factor of land in this village is water availability/annual rainfall (wa). The improvement efforts cannot be made in rainfall (wa) due to unpredictable nature so that the suitability of *Durio zibethinus* cannot be changed. Rainfall as a climate variable can change from year to year, as can monthly rainfall, when compared to the same month in different years. The average size depends on the area of observation. In general, the greater the annual rainfall, the smaller the average. The average large rainfall must be calculated as an inhibiting factor for agriculture. The nature of the inhibiting factor is to reduce the stability of production and increase the danger of crop failure, something that can cause levels of food shortages. This also applies to rainfed agriculture without any irrigation. Rainfall as a factor inhibiting the production of food crops can be assumed that an area that has a different rainfall has a different level of food production with other regions. The condition of dryland agriculture in Perkebunan Tambunan Village is presented in Figure 3.
Figure 2. Distribution area of potential land suitability of *Durio zibethinus* in Perkebunan Tambunan Village, Salapian Sub district

Figure 3. Land use condition of dryland agriculture in Perkebunan Tambunan Village

4. Conclusion
Both the ALS and PLS classes of *Durio zibethinus* were S3 or marginally suitable in all land units. This means that the land in Perkebunan Tambunan Village has limiting factors that were difficult to overcome for sustainable use. The limiting factor of land in this village is water availability/annual rainfall (wa). The improvement efforts cannot be made for rainfall (wa).

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