Land Suitability for kemenyan cultivation in Sari Laba Jahe Village, Sibiru-biru Sub-district, Deli Serdang District, North Sumatra Province

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Abstract. Kemenyan (Styrax spp.) is commonly found in North Sumatra, especially in the Tapanuli and Dairi Regions. This study aimed to determine the suitability class of kemenyan at agroforestry land in Sari Laba Jahe Village, Sibiru-biru Sub-district, Deli Serdang District, North Sumatra Province. This study was conducted from August 2019 to April 2020. Soil survey was conducted in order to collect the characteristics of the land at the study site. Soil sampling was collected based on land units. Soil samples were analyzed in the central laboratory, Faculty of Agriculture, Universitas Sumatera Utara. Land suitability was evaluated based on the matching method between data from laboratory analysis and data from survey in the field with the available land suitability criteria. The results showed that the actual land suitability classes for kemenyan in Sari Laba Jahe Village, were not suitable (N) with erosion hazard (er), and root zone medium (rc) limiting factors which accounted for 62.78%), marginally suitable (S3) with root zone medium (rc) limiting factor which accounted for 8.21%, and moderately suitable (S2) with limiting factors water availability (wa), root zone medium (rc), nutrient retention (nr) limiting factors which accounted for 29.01%. The erosion hazard (eh) limiting factors can be overcome, so that the potential land suitability in Sari Laba Jahe Village can be increased to Moderately suitable (S2) which accounted for 31.99% and marginally suitable (S3) which accounted for 67.98%. Based on the potential land suitability in Sari Laba Jahe Village only 0.03% was not suitable (N) in Sari Laba Jahe Village.

1. Introduction

'Kemenyan' (Styrax sp.) is a sap-producing tree with high economic value, which is one of the leading plants in the province of North Sumatra, especially in the Tapanuli area. Kemenyan are a source of life and social prestige for a family as measured by how large a family's land of kemenyan is owned by a family. Kemenyan trees have important economic value and the sap can be tapped after 5 - 6 years of age. Kemenyan sap produced by the Styracaceae family of trees is classified as non-timber forest products. Kemenyan is a large tree, can reach 20 - 40m in height and 60 - 100 cm in diameter. Straight stem with slight branching. The grooved skin is not too deep (3 - 7 mm) with a burgundy skin color [1].

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North Sumatra province's plantation statistics data (2020) shows that North Tapanuli and Humbahas have the largest area of Kemenyan plantations in the province of North Sumatra [2]. Kemenyan trees require shade early in their growth [1]. This species is tolerant, that is, it can grow in the shade of trees. At the seedling level this species requires shade, but in subsequent growth once it reaches tree size, the crown requires direct sunlight. In the period of tapping the canopy of this plant requires full light while the stalks should be relatively less because to avoid damage to the bark (dry and hardened skin). This character needs to be considered as the basics of Kemenyan cultivation in the field. Several studies related to kemenyan have been conducted [1-10].

The demand for Kemenyan sap is still increasing, hence, very beneficial for the Kemenyan farming community in particular and has an economic value that will continue to be empowered as one of the prima donna for potential plantation crops contributing to Regional Income in North Sumatra Province. The main benefit of Kemenyan tree cultivation is for the production of Kemenyan sap and timber production. Therefore, the development of Kemenyan tree cultivation outside the Kemenyan center area certainly needs to be considered, both in the form of community forests, community forests and intercropping plantation patterns.

The suitability of land for planting Kemenyan needs to be considered because the factor of place to grow is very important for the success of planting. One way to assess land suitability is to compare the requirements for planting site of Kemenyan with potential development areas [1]. The mixed planting system is the method most widely practiced. The intercropping system with seasonal crops is relatively rarely used on young Kemenyan plants because of the character of the Kemenyan tree, which still requires shade. The mixed planting system is mostly done after the Kemenyan plant reaches the tree phase> 20 cm in diameter. The mixed planting system of Kemenyan plants becomes the staple crop and several types of potential plants to be cultivated with Kemenyan, including Gambir (Uncaria gambir Roxb), Coffee (Coffea robusta, Coffea arabica), Cinnamon (Cinnamomum sp.) and various types of fruits such as Durian. (Durio zibethinus), Duku (Lansium domesticum), Jengkol (Pithecellobium jiringa), Pete (Parkia speciosa), Rambutan (Nephelium lappaceum). The people in Sibiru-biru Sub-district generally use their land by planting various types of fruit trees, combined with forest trees and plantation crops. Considering that there is no information regarding land suitability classes for kemenyan plants and land suitability maps are not available and in order to cultivate kemenyan plants especially in Sibiru-biru Sub-district, Deli Serdang Regency, North Sumatra Province, Indonesia, this research needs to be done to provide information. Thus data and information will be obtained about which locations are suitable and unsuitable for the development of kemenyan. In addition, by conducting land evaluation, it will be known what factors are limiting in land management for kemenyan plants in Sibiru-biru Sub-district, Deli Serdang Regency, North Sumatra Province, Indonesia. The purpose of this study was to evaluate the land suitability class for kemenyan in Sibiru-biru Sub-district.

2. Methodology

This research was conducted in Sari Laba Jahe Village, Sibiru-biru Sub-district, Deli Serdang Regency, North Sumatra Province, Indonesia, from August 2019 to April 2020. Sari Laba Jahe Village has high agricultural potential. According to data from the Central Bureau of Statistics, (2018) Sibiru-biru Sub-district is located in the Deli Serdang Regency, North Sumatra Province [11]. Sibiru-biru Sub-district geographically, is located between 3 ° 28’ - 3 ° 47’ North latitude and between 9 ° 86’ - 9 ° 87’ East Longitude, with an area of 89.69 km². Most of the people of Sari Laba Jahe Village work as farmers. In general, the community applies a monoculture planting system such as rubber and applies an agroforestry garden system.

Data collection was carried out by taking representative soil samples in the field based on land units [12]. A land unit is a part of land that has specific characteristics. Soil samples are needed to analyze the physical, biological and chemical properties of soil [13]. Kemenyan plant land suitability analysis was carried out by matching methods [12-17] between data obtained from primary data, secondary data, and laboratory data with kemenyan land suitability criteria. To determine the distribution of land suitability classes of kemenyan in Sari Laba Jahe Village, GIS technology is used as has been used by several
previous researchers [18-27]. The land characteristics used in this study are land characteristics that can represent land quality, namely, temperature (tc), water availability (wa), oxygen availability (oa), nutrient retention (nr), erosion hazard (eh), flood hazard (fh) and land preparation (lp). Determination of land characteristic values related to soil depth such as texture, Cation Exchange Capacity (CEC), soil reaction or acidity (pH), C-organic, and alkaline saturation (KB) adjusted to the depth of the root zone of the evaluated plant. The results of the actual and potential land suitability class assessment are presented in the form of tables and maps that provide information on the land suitability class of each plant for each assessed land unit. The assessment and presentation of the results of the land suitability class is based on FAO (1976), namely: S1, S2, S3 and N. The characteristics of land suitability required by plants refer to the Small Book of the Kemenyan Tano Batak Precious Gum. Ministry of Forestry, Forestry Research and Development Agency, Forestry Research Institute, Aek Nauli. Simalungun Regency. North Sumatra.

3. Results and Discussion

The land unit in the research location consists of 11 classes which are the overlay result of the land map, land use map and slope map in Sibiru-biru Sub-district. Each class has a different area. Land unit III with an area of approximately 495.41 Ha (56.64%) is the largest land unit and the smallest is land unit II with an area of approximately 0.28 Ha (0.03%). Land cover is one that is considered in land evaluation. Land cover is a description of a land. The land cover in Sibiru-biru Sub-district, especially Sari Laba Jahe Village, is settlement, dry land agriculture and rice fields. The land cover at the research location is dominated by dry land agriculture found in land units I, III, VI, VIII, IX, X with a land area of 765.06 Ha (or equal to 87.47% of the total land cover area at the study location) . Paddy land cover is found in land units IV and XI with an area of 86.58 Ha and residential land cover is in land units II, V, VII with an area of 23.04 Ha.

Land suitability can be assessed both in actual and potential. Actual land suitability is the suitability of land carried out under current land use conditions without any input for improvement. Potential land suitability is the suitability of land carried out in conditions after being given input for improvement, such as the addition of fertilizers, improvements or terraces, depending on the type of limiting factor. From the results of the GIS analysis, the actual and potential land suitability areas at the research locations in 11 land map units scattered in Sari Laba Jahe Village can be seen in Table 1 and the actual and potential durian land suitability maps can be seen in Figures 1 and 2. Results From the comparison (matching), it is known that the actual land suitability class for plants in Sari Laba Jahe Village, Sibiru-Biru Sub-district is Not suitable (N), marginally suitable (S3), and moderately suitable (S2). The results of the actual and potential land suitability evaluation can be seen in Table 2. The actual and potential land suitability of kemenyan is described in detail in Table 2 and Table 3.

Table 1. Area of actual and potential land suitability for kemenyan (Styrax benzoin)

| Land Unit | Actual Land Suitability | Potential Land Suitability | area Ha | (%) |
|-----------|-------------------------|---------------------------|--------|-----|
| 1         | N rc,eh                 | N rc                      | 4.75   | 0.54 |
| 2         | N eh                    | S3 rc,eh                  | 0.28   | 0.03 |
| 3         | N eh                    | S3 rc,eh                  | 495.41 | 56.64|
| 4         | N eh                    | S2 wa,rc,eh               | 26.06  | 2.98 |
| 5         | S2 wa,rc,nr             | S2 wa,rc                  | 3.26   | 0.37 |
| 6         | S3 rc                   | S3 rc                     | 11.28  | 1.29 |
| 7         | S2 wa,rc,nr             | S2 wa,rc                  | 19.50  | 2.23 |
| 8         | S2 wa,rc                | S2 wa,rc                  | 118.34 | 13.53|
| 9         | S2 wa,rc,nr             | S2 wa,rc                  | 1.75   | 0.2  |
| 10        | S2 wa,rc,nr             | S2 wa,rc                  | 133.53 | 15.27|
| 11        | S3 rc                   | S3 rc                     | 60.52  | 6.92 |
| Total     |                         |                           | 874.68 | 100 |

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Table 2. Area of actual land suitability for kemenyan (Styrax benzoin)

| Actual Land Suitability | Land Unit | area Ha | (%) |
|-------------------------|-----------|---------|-----|
| N eh                    | II, III, IV | 521.75  | 62.75 |
| N rc,eh                 | I         | 4.75    | 0.03 |
| S3 rc                   | VI, XI    | 71.8    | 8.21 |
| S2 wa,rc, nr            | V, VII, IX, X | 158.04 | 15.48 |
| S2 wa,rc                | VIII      | 118.34  | 13.53 |
| Total                   |           | 874.68  | 100  |

Actually kemenyan has quite suitable land suitability (S2) in land units V, VII, VIII, IX and X; according to marginal (S3) for land units VI, XI and currently unsuitable (N1) for land units I, II, III and IV. The limiting factors are erosion hazard (eh), water availability (wa), root media (rc), nutrient retention (nr) and slope (eh). The limiting factor for nutrient retention is also a limiting factor on the actual land suitability of kemenyan. Improvement efforts were made to overcome the inhibiting factors of nutrient retention (nr), namely soil CEC and C-Organic by adding organic matter. It will improve the suitability of land between the land and the types of plants that are evaluated for its suitability so that it will increase productivity and provide more benefits to the people who cultivate the kemenyan land. However, the weakness is that if the limiting factor on the land includes moderate and high levels of repair, it will be very difficult to repair it. If repairs are carried out, it will require a large amount of energy and costs.

Improvement efforts can be made to inhibit land slope by making terraces, planting crops parallel to the contour and planting land cover crops. Improvement of slopes can be done by terracing, planting parallel to the contour and also planting land with land cover which can reduce the danger of erosion on slope inhibiting factors that are too steep. Improvement efforts cannot be carried out on rooting media (rc), namely on soil texture and soil depth, so that the kemenyan suitability of several land units is potentially constant, namely: S2, S3, and N. Root zone media, namely soil texture, is a serious limiting factor because soil texture cannot change in a short time so that the limiting factor of root media in the form of soil texture cannot be improved. Root zone media, namely soil depth, is a serious limiting factor because soil depth cannot be improved because the existing depth is an effective soil depth that is good for plant growth.

Table 3. Area of actual land suitability for kemenyan (Styrax benzoin)

| Potential Land Suitability | Land Unit | area Ha | (%) |
|---------------------------|-----------|---------|-----|
| N rc                      | I         | 4.75    | 0.03 |
| S3 rc                     | VI, XI    | 71.8    | 8.21 |
| S3 rc,eh                  | II, III   | 495.69  | 59.77 |
| S2 wa,rc                  | V, VII, VIII, IX, X | 276.38 | 29.01 |
| S2 wa,rc, eh              | IV        | 26.06   | 2.98 |
| Total                     |           | 874.68  | 100  |

Based on the results of land evaluation of the kemenyan plant in Sari Laba Jahe Village, it can be concluded that the development of the kemenyan plant in Sari Laba Jahe Village can be carried out especially on land units IV, V, VII, VIII, IX, and X because the results of the land suitability evaluation show land suitability. S2 (moderately suitable). In land units II, III, VI, XI, the potential land suitability level is S3 (marginally suitable). Meanwhile, land unit I does not match the rc limiting factor. Based on Figure 3, it can be seen that the actual land suitability of kemenyan is S2, S3, and N. The map of actual land suitability class and potential kemenyan can be seen in Figures 3.
4. Conclusion
Based on the results of land evaluation of the kemenyan plant in Sari Laba Jahe Village can be carried out especially on land units IV, V, VII, VIII, IX, and X because the results of the land suitability evaluation show land suitability, S2 (moderately suitable). In land units II, III, VI, XI, the potential land
suitability level is S3 (marginally suitable). Kemenyan plants can still be cultivated, but efforts still need improvement.

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