Spatial Analysis For *Pinus merkusii* Land Suitability At Agroforestry Land In Telagah Village Sumatera Utara Indonesia

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**Abstract.** *Pinus (Pinus merkusii)* is commonly found in North Sumatra Forest. Community of Telagah Village, Sei Binge Sub District, Langkat, North Sumatera, generally manage the land with agroforestry system. *Pinus* is the one of agroforestry constituent in the community land in Telagah Village. This study aimed to analyse the suitability of the land for *pinus* in Telagah Village Sei Bingai Sub District, Langkat District, North Sumatra, Indonesia. This research was conducted on May to September 2018. The survey method was conducted to collect soil samples in the field. Spasial analysis for *pinus* land suitability was evaluated based on the matching method. The reference and criteria were adopted from the Land Suitability for Agricultural Plants by the Centre for Soil and Agroclimate Research, Bogor-Indonesia. The Geographic Information System (GIS) was used to map the actual and potential land suitability in Telagah Village. The results showed that the actual land suitability classes for *pinus* in this area were moderately suitable (S2) (97.26%) and marginal suitable (S3) (2.74%). The potential land suitability classes for *pinus* in this area were Suitable (S1) (52.04), moderately suitable (S2) (46.04%) and marginal suitable (S3) (1.92%) in Telagah Village. The temperature (tc) and erosion hazard (eh) were the dominant of limiting factor in this area.

1. **Introduction**

*Pinus (Pinus merkusii)* is classified in Pinaceae family, which has various local names such as: tusam (Indonesian), uyam (Aceh), son song bai (Thai), mercus pine (trade), mindoro pine (Philippines), and tenasserim pine (Inggris). the selection of this species is preferred because of the availability of seeds, rapid growth rate, can be a pioneer, and can grow on marginal lands [1, 2). Land suitability evaluation needs to be done to be a basis for consideration in land use decision making [3]. Land evaluation is a process of assessing the potential of a land for certain uses. Land suitability is the suitability of a land for certain uses [4, 5, 6, 7]. Land evaluation results are used as a basis for rational land use planning, so that land can be used optimally and sustainably [8]. Land suitability classes into two namely: actual and potential land suitability class [5, 9, 10]. The process of land evaluation is comparing the requirements requested by the type of land use that will be applied to the properties of the land that is owned by the land to be used.

Geographical Information System (GIS) is a tool that can be apply for land suitability. One application of GIS is mapping the results of land evaluation and presenting the results in the form of maps to show the spatial distribution of geographical phenomena including characteristics that are in accordance with those on the surface of the earth [2, 11, 12, 13, 14]. The GIS also has been widely applied in various...
fields. Land evaluation results can be described in the form of maps using GIS technology. It is used for data collection, storage, analysis and manipulation of geographic references.

Pinus can be found in several places, including on community lands, such as in agroforestry land. One place that has the potential to be found in Telagah Village, Sei Bingai Sub District, Langkat, North Sumatra, Indonesia. Research on mapping of land suitability for Pinus as one of agroforestry plants in this location has never been done. Hence, this study aimed to analyse the suitability of the land for Pinus in Telagah Village Sei Bingai Sub District, Langkat District, North Sumatra, Indonesia.

2. Materials and Methods

This research was conducted on May to September 2018 in Telagah Village, Sei Bingai Sub District, Langkat, North Sumatra, Indonesia (Figure 1). The survey method was conducted to collect soil samples in the field. The tools used in this research were: abney level, altimeter, label, scales, plastic bag, hoe, Haga hypsometer, compass, camera, stationery, and tally sheet. Land suitability classification (LSC) was evaluated based on the matching method Ritung et al [16]. The reference and criteria were adopted from the Land Suitability for Agricultural Plants by the Centre for Soil and Agroclimate Research, Bogor-Indonesia [8]. The SIG was used to analyze the spatial distribution of land suitability classes, both actual and potential.

Figure 1. Map of Telagah Village, Sei Bingai Sub District, Langkat, North Sumatra, Indonesia

The results of the assessment of the land suitability classes were presented in the form of tables and maps that provide a class description of the land suitability of pinus. The assessment and presentation of land suitability class results were based on FAO [16]. There are four classes, namely: Highly suitable (S1), Moderately suitable (S2), marginal suitable (S3), and not suitable (N). The same method has been used in analyzing the suitability of potato in Siosar [14]; in analyzing the suitability of oil palm [19], and in analyzing the suitability of trees in Besitang Watershed [1]; analyzing the suitability of Jati in Arboretum USU [6] and in analyzing the suitability of alpukat and durian in Karo District [17].
3. Results and discussion

The Land Unit Area in Telagah Village Sei Bingai District was presented in Table 2 and delineated in Figure 1 and Figure 2.

| Land Unit | Area     | %     |
|-----------|----------|-------|
| I         | 2,422.70 | 52.04 |
| II        | 206.39   | 4.43  |
| III       | 38.22    | 0.82  |
| IV        | 99.34    | 2.13  |
| V         | 1,799.47 | 38.65 |
| VI        | 89.33    | 1.92  |
| Total     | 4,655.45 | 100.00|

The results showed that the land unit consists of 6 classes (Table 1) with different areas. The widest land unit was land unit I covering approximately 2,422.70 ha (52.04% from total area), followed by land unit 5 covering approximately 1,799.47 ha (38.65% from total area).

The land suitability classes for Pinus were moderately suitable (S2) and marginal suitable (S3) in Telagah Village (Table 2). There were suitable (S1) found at agroforestry land in this village based on analyse of potential land suitability. There were no not suitable (N) classes were found at agroforestry land in this village.

Class S3 means that lands having limitations, which are severe for sustained application of a given use and will so reduce productivity or benefits or increase required inputs that this expenditure will be only marginally justified [16, 19]. There were several limiting factors in land suitability evaluation in the area, namely: the availability of water (wa), erosion hazard (eh), and root zone medium (rc), Oxygen availability(oa) and nutrient retention (nr). The water availability (wa) was the dominant limiting factor in this area. Land suitability classification (actual and potential land suitability class of Pinus) in Telagah Village, Sei Bingai Sub District was presented in Table 2 and Table 3 and delineated in Figure 2 and Figure 3.
Table 2. The actual land suitability classes for *Pinus merkusii* in Telagah Village

| Actual Land Suitability | Area (Ha) | %  |
|-------------------------|-----------|----|
| S2,nr                   | 2,422.70  | 52.04 |
| S2,tc,eh                | 1,898.80  | 40.79 |
| S2,tc,nr                | 206.39    | 4.43  |
| S3,eh                   | 38.2      | 0.82  |
| S3,rc                   | 89.33     | 1.92  |
| **Total**               | **4,655.45** | **100.00** |

Figure 2. Map of actual land suitability in Telagah Village

Table 3. The potential land suitability classes for *Pinus merkusii* in Telagah Village

| Potential Land Suitability | Area (Ha) | %  |
|---------------------------|-----------|----|
| S1                        | 2,422.70  | 52.04 |
| S2,tc                     | 2,105.19  | 45.22 |
| S2,tc,eh                  | 38.2      | 0.82  |
| S3,rc                     | 89.33     | 1.92  |
| **Total**                 | **4,655.45** | **100.00** |
Figure 3. Map of potential land suitability in Telagah Village

Based on Table 2, Figure 2 dan Figure 3, in this area were moderately suitable (S2) (97.26%). It means that in Telagah village, *Pinus merkusii* was moderately suitable to be developed. *Pinus merkusii* was preferred because it can increase people's income. Wood and pine sap can be sold easily so that it can increase people's income. *Pinus merkusii* is a gondorukem-producing tree. Gondorukem is used to mix ingredients such as: batik makers, soap, paint and varnish, paper, while turpentine is used for oil paint, a mixture of perfumes, detergents, flavoring agents, protective coating, insecticides, lubricants, medicine, plastic, rubber.

4. Conclusions
The actual land suitability classes for Pinus in this area were moderately suitable (S2) (97.26%) and marginal suitable (S3) (2.74%). The potential land suitability classes for pinus in this area were Suitable (S1) (52.04), moderately suitable (S2) (46.04%) and marginal suitable (S3) (1.92%) in Telagah Village. The temperature (tc) and erosion hazard (eh) were the dominant of limiting factor in this area.
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Acknowledgments

We are grateful to the Organizing Committee of the 14th Pacific RIM BIO-BASED Composite Symposium 2018 for give us an opportunity to present of this work on 30 October 2018, at the Swiss Bell Hotel, Makassar, as well as, University of Sumatera Utara, the students of Department of Forest Management, Faculty of Forestry, USU who have conducted research in Sei Bingai, Langkat, North Sumatera Province, Indonesia.