Potential species from the Dipterocarp family at Mandailing Natal Forest Production Management Unit, North Sumatra, Indonesia

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Abstract. Sumatra has extensive forests, rich in tree species, especially the Dipterocarpaceae species, which have high economic and ecological value in the development sector. The enormous number of Dipterocarpaceae species and the paucity of herbarium collections make identifying species quite easy. The study’s goal was to learn more about the Dipterocarpaceae family tree's species, diameter, and height in the Mandailing Natal Forest Production Management Unit (KPHP) in North Sumatra. Diameter and height data of Shorea sp was based on secondary data processing. The inventory revealed that the Dipterocarpaceae family has 12 different species. Trees in the Dipterocarpaceae family have an average diameter of 44.5 cm and a height of 20 cm. This inventory is expected to offer information on the several Dipterocarpacea families that can be found in this area, particularly those with high economic value and those that are protected.

1. Introduction
The Forest Management Unit Region IX, Mandailing Regency, North Sumatra, is one of the habitats for tree species in the Dipterocarpaceae family. Dipterocarpacea is a plant family that has very important economic value in the national development sector and in terms of ecology. From an economic standpoint, the majority of dipterocarpaceae species generate commercial timber to suit a variety of needs both at home and abroad [1].

In addition, several types of Dipterocarpaceae also produce resin and fruit of high value for export commodities and, from an ecological perspective, as a source of germplasm. The number of Dipterocarpaceae species found in Indonesia is 301 species. The most common genus is Shorea with 143 species, followed by Dipterocarpus: 48 species, Hopea: 48 species, Vatica: 42 species, Dryobalanops: 7 species, Anisoptera: 7 species [2,3].

The wood of Dipterocarpaceae species has a high trade value and is very well known and widely used for human needs. In addition to the wood, several types of shorea are known as fruit producers that have trade value, known as tengkawang fruit. Tengkawang is used as a basic ingredient for making chocolate, cosmetics, margarine, soap and candle industries [2,3].

Wood from Dipterocarpaceae is well-known and widely used for human needs, with a high trade value. Aside from the wood, certain species of shorea are notable for producing tengkawang fruit, which has a commercial value. Tengkawang is a key ingredient in the production of chocolate, cosmetics, margarine, soap, and candles. However, the existence of this endemic plant is almost extinct [4,5].
Species presence data for various regions is still very general. In this regard, research has been conducted with the goal of determining the existence of Dipterocarpaceae species as a valuable source of information for managing Dipterocarpaceae species diversity in a given area. The number of Dipterocarpaceae species found as the main support for wood production from natural forests must be known with certainty. Therefore, data and information on the species, diameter, and height of Dipterocarpaceae trees in the Mandailing Natal Forest Management Unit, North Sumatera, are needed.

The findings are likely to provide information about Dipterocarpaceae species, particularly those with high economic value, which will be useful in forest conservation and conservation planning, as well as estimating their potential in coming years.

2. Materials and Methods

2.1. Time and Location

The field research was carried out at the Production Forest Management Unit Mandailing Natal-North Sumatra. The location of the study sites is shown in figure 1. The Mandailing Natal area is located at an altitude between 0-1,000 m above sea level with temperatures ranging from 230°C-320°C with humidity between 80-85%. Geographical location: 98° 52' 22" - 99° 31' 57" east longitude, 0° 19' 16" - 1° 18' 8" north longitude. Data collection was carried out to obtain information related to Dipterocarpaceae species groups from various literature sources and online interviews in May-June 2021, while the diameter and height data of Shorea sp was based on secondary data processing. Secondary data obtained from Report on the Results of the Inventory of Timber Forest Products for the Mandailing Natal Forest Management [1].

![Figure 1. Location of research study](image)

2.2. Materials and Tools

The tools used in this research are 1 unit of compass, 1 unit of Global Positioning System (GPS), 2 measuring tapes, 1 unit of camera, tent, recorder, work map, identification card, and 1 unit of GPS. Tally sheet, stationery, compass, machete, ax, and other field equipment. Computers or laptops for
document collection and processing, as well as stationery. The material used is Dipterocarpaceae species that stand in natural forests.

2.3. Collection and analysis of data
Interviews and field observations were used to acquire data. Primary and secondary data were used in the investigation. Deep interviews or oral questionnaires were used to acquire primary data. A Deep interview is a conversation between the researcher and the research informant. The draft question tries to ask structured questions while reducing the number of needless questions in the research. Information collected from secondary data is then calculated and assessed descriptively.

3. Result and Discussion

3.1. General Condition of Research
The research was conducted in the Production Forest Management Unit Mandailing Natal area, which has an area of 153,361 Ha. It has a wide range of soil types, with Red Yellow Podsolic (PMK) and Brown Alluvial dominating. Generally, Mandailing Natal is located in a steep area with a slope of more than 40%, which covers 51% of the total district area.

The climatic conditions of Mandailing Natal Regency are classed as climate type A (very wet) with a value of Q = 10% with an average monthly rainfall ranging between 170-621 mm, according to the Schmidt Fergusson classification [1]. In the province of North Sumatra, the majority of the forests are heterogeneous. Ecological benefits, such as sustaining biodiversity and protecting water systems, are received from these natural forests.

Based on the wide coverage area of the Production Forest Management Unit (KPHP) at Mandailing Natal, it is necessary to have a Forest Management Resort (RPH). The Production Forest Management Unit (KPHP) Mandailing Natal is divided into six (6) RPH based on accessibility, watershed and other considerations, as shown in Table 1.

| No | Forest Management Resort | area (ha) | % |
|----|--------------------------|-----------|---|
| 1  | Muarasoma                | 18,695    | 12.19 |
| 2  | Guo batu                 | 23,387    | 15.25 |
| 3  | Tagilang Julu            | 24,365    | 15.89 |
| 4  | Tabuyung                 | 21,835    | 14.24 |
| 5  | Singkuang                | 41,626    | 27.14 |
| 6  | Batu Mundom              | 23,453    | 15.29 |
|    | Total area               | 153,361   | 100  |

3.2. Inventory of Dipterocarpaceae species
The Shorea genus, often known as the Meranti group, is one of the Dipterocarpaceae tribe's genera that grows in the lowlands. The meranti group is separated into four primary groups in the world of trade: the red meranti group, yellow meranti group, white meranti group, and the balau group. [2] [4]

Taxonomically, trees in the Meranti tribe have hard, heavy wood and some species grow very slowly. Meranti-merantian sprouts tend to like shade. Dipterocarpaceae members have a number of ecological constraints that limit their growth and dispersion. Soil, climate, and altitude are the most important elements. [5]. The following is the taxonomic classification of meranti plants [2]:

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doi:10.1088/1755-1315/912/1/012003
Kingdom: Plantae  
Division: Magnoliophyta  
Class: Magnoliopsida  
Order: Malvales  
Family: Dipterocarpaceae  
Shorea, Dipterocarpus, Vatica, Cotylelobium, Anisoptera, Dryobalanops, Hopea

Based on the results of the inventory and secondary processed data [2], the number of trees belonging to the Dipterocarpaceae family is 2030 trees. The statistical description of the diameter and height of the Dipterocarpaceae family is presented in table 2. In this study, we used 2030 trees spread over 12 species of the Dipterocarpaceae family. The largest number of species is Shorea sp, while the least number is Shorea javanica (white meranti) and Intsia bijuga (merbau).

The average diameter of the Dipterocarpaceae family is 44.5 cm, and the average height is 20.5 m. The Shorea johorensis Foxw tree species has the largest average diameter of 62 cm, with a maximum diameter of 150 cm. Palaquium sp has the smallest diameter of 30 cm. The type of Agathis dammara (star resin) has the largest average total height of 26 m, while Palaquium sp has the smallest average total height of 17 m. The Vatica sp tree species has a maximum height of 47 m at the research site.

From the results of the analysis conducted by [6], the average diameter and height of plants aged 4 years are Shorea leprosula 4.80 cm and 5.67 m, Shorea parvifolia 4.18 cm and 5.61 m, Shorea ovalis is 3.96 cm and 5.91 m, and Shorea smithiana is 3.43 cm and 5.05 m.

Table 2. Statistical description of tree diameter and height of Dipterocarpaceae species

| No | Local name | Scientific name          | ∑ tree | diameter (cm) | Total hight (m) |
|----|------------|--------------------------|--------|---------------|-----------------|
|    |            |                          |        | mean | min | maks | mean | min | maks |
| 1  | Bania      | Shorea platyclados       | 48     | 55   | 20  | 153  | 21   | 14  | 42   |
| 2  | Cengal     | Hopea sangal Korth       | 68     | 54   | 20  | 160  | 21   | 16  | 30   |
| 3  | Damar Bintang | Agathis dammara        | 2      | 36   | 33  | 36   | 26   | 16  | 26   |
| 4  | Kapur      | Dryobalanops aromatica   | 432    | 36   | 17  | 154  | 20   | 7   | 33   |
| 5  | Keruing    | Dipterocarpus hasseltii  | 88     | 36   | 20  | 65   | 19   | 13  | 31   |
| 6  | Mayang     | Palaquium sumatranum    | 274    | 30   | 20  | 70   | 17   | 9   | 30   |
| 7  | Meranti    | Shorea sp                | 834    | 41   | 16  | 25   | 22   | 2   | 17   |
| 8  | Meranti Merah | Shorea johorensis      | 35     | 62   | 20  | 150  | 23   | 16  | 29   |
| 9  | Meranti putih | Shorea javanica       | 1      | 57   | 57  | 57   | 22   | 22  | 22   |
| 10 | Merbau     | Intsia bijuga (Colebr.) | 1      | 34   | 34  | 34   | 16   | 16  | 16   |
| 11 | Pulai      | Alstonia scholaris      | 2      | 50   | 50  | 50   | 19   | 18  | 20   |
| 12 | Resak      | Vatica sp               | 245    | 43   | 20  | 145  | 20   | 13  | 47   |
|    | Total      |                          | 2030   |      |     |      | Mean |     |      |
|    |            |                          |        | 44.5 | 27.3| 91.6 | 20.5 | 14  | 28.6 |

Measurable variables such as tree height, diameter, and shape are needed to build mathematical models or functions as one of the best ways to estimate tree and stand volumes and have played an important role in forest inventories, management, and silvicultural research [7,8].
3.3. Benefit of Dipterocarpaceae species

This type of wood from the dipterocapacea family can be used for various purposes because it is an easy wood to work with and has a fine grain texture. From an economic point of view, meranti trees produce high-quality hardwood that can be used as home furnishings (such as cabinets, tables, chairs, doors, windows, etc.), souvenirs, children's games, and veneers. Various varieties of Dipterocarpaceae such as Keruing, produce oil, resin, and fruit of commercial value [3,4]. The following are the benefits that can be obtained from dipterocapacea family including [8,9,11]:

**Easy Dry**
Meranti wood has a specific gravity of about 0.3 to 0.86 at a moisture content of 15%. Meranti wood can be dried naturally by drying in the sun and using an oven system. Wood drying aims to obtain a constant size of wood.

**Durable Class**
Some types of meranti have a strong class II-IV (up to 15 years) and a durable class III-IV (up to 10 years). Meranti wood can be preserved by using a combination of diesel oil and creosote.

**Hard Structure**
Meranti wood is hard and not easy to shrink or expand. Its constant shape is suitable for building construction, especially roof trusses.

**Furniture Material**
The wood from the meranti tree is easy to process and work on by craftsmen. The selling value of furniture from the meranti tree is quite high even though it is still below teak wood.

**Building construction**

**Paper Making Material**
Meranti wood can be processed into particleboard, veneer and plywood. In addition, it can also be used as a material for making paper.

**Wood Near Prime**
Meranti wood has a round cylindrical shape with flat bark or deep and shallow grooves, gray to brown in color, a straight trunk, large diameter, branching and slight knot defects.

Wood from the dipterocarpaceae family can be recognized by its surface, which is pale pink, pinkish brown, dark red, and dark red brown. The color indicates the age of the wood, where the darker the age, the older it gets, so the quality is better.

Information measurement of tree diameter and height stand holding important role in determining volume of trees/stands concerned. By knowing the diameter, height and types of species of the family Dipterocarpaceae, it is very important to know their potential in the forest management unit in Mandailing Natal. [9-11].

4. Conclusion

There are 12 tree species from the Dipterocarpaceae family in the Mandailing Natal Forest Production Management Unit. The average diameter of the tree group of the Dipterocarpaceae family is 44.5 cm, and the average height is 20.5 m.

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References
[1] Production Forest Utilization Monitoring Center (BP2HP) Region II Medan 2015 Report on the Results of the Inventory of Timber Forest Products for the Mandailing Natal KPHP Model
[2] Saridan A and Wahyudi A 2017 *Journal of Dipterocarp Research* 3 23
[3] Saridan A 2012 *Journal of Dipterocarp Research* 5 75
[4] Saridan A and Fajri M 2014 *Journal of Dipterocarp Research* 8 7
[5] Saridan A and Soegiharto S 2012 *Journal of Research and Nature Conservation* 9 3
[6] Hadiansyah, Tirkaamiana T and Mujahidi D E 2016 *Jurnal AGRIFOR* 14 2
[7] Ozçelik R, Diamantopoulo M J, Brooks J R and Wiant Jr H V 2010 *Journal of Environmental Management* 91 742
[8] Wagle B H and Sharma R P 2011 *Banko Janakari* 21 13
[9] Mamoun E I and Osman H 2012 *Journal of Forest products and industries* 2 34
[10] Latifah S, Muhdi, Purwoko A and Tanjung E 2018 *Jurnal Biodiversitas* 19 670
[11] Abdurachman 2012 *Jurnal Penelitian Dipterokarpa* 6 121