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Characteristics of growing sites *Anisoptera thurifera* in South Manokwari West Papua

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ABSTRACT

Anisoptera thurifera is a type of Dipterocarpacea family that dominates lowland tropical forest areas. In line with the growth and development of human needs for timber forest products, the existence of this species is also diminishing in nature. For this reason, information about the characteristics of the type of growing place is very much needed, as initial information for the potential development of this type as a silviculture tree species in the future. The location where *A. thurifera* grow naturally is observed at the Manokwari Selatan protected forest. Observed data included ecological and demographic aspects of the plant by using Systematic Continuous Strip Sampling (SCSS) for the observation of *A. thurifera*. While the 17.8 m circle is used for observing the ecological habitat of *A. thurifera*. The results showed that *A. thurifera* was found in the study area was in the edaphic conditions in which *A. thurifera* grew were in slightly acidic to acidic soil conditions, even though the CEC was 45.32. The potential of this type is very worrying, it can be seen from the decline in the IVI value of the tree level to the seedling level. Although this plant is able to associate with several other types in its development, it is necessary to focus on more neutral edafic characteristics.

Keywords: *Anisoptera thurifera, Place to grow, Edaphic, Potential*

Introduction

Anisoptera thurifera is a type of Dipterocarpaceae family that spreads out from the Philippines, eastern Indonesia to Papua New Guinea (GBIF, 2017). This type has two subspecies namely *A. thurifera* subsp. Polyandra which distributes in eastern Indonesia (Sulawesi Island, Maluku island and Papua) and New Guinea. Whereas *A. thurifera* sub sp. *thurifera* distribution is found in the Philippines (Nooteboom, 2017). According to Asthon (1998) conservation status for type A. thurifera subsp. thurifera since 1998 has been included in the critically endangered (EN) category, while *A. thurifera* sub sp. *polyandra* began in 2017, included in the category of vulnerable (VU). This type has been harvested because it has many benefits including ship planking, automobile bodies, vehicle work, interior finishing, veneers, furniture making, plywood and general construction. In fact according to Nur *et al.* (2019), who revealed that some species of Dipterocarpacea family found in Papua, are often grouped into mixed jungle classes because this species is less well known by the local community, so the price per cubic sawn timber sortimen of this type is much lower than other trading wood.

A. thurifera sub sp polyandra generally grows in areas of lowland tropical rainforest which is the most complex type of land vegetation and has a large number of species (Whitmore, 1984). Even so Ashton (1982) states that the distribution of species diversity from the Dipterocarpaceae family in Indonesia is not evenly distributed on each island, where the more to the eastern part of Indonesia, the number of the species found would be less.

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Momiwaren Protection Forest located in Manokwari Regency is one of the *A. thurifera* distribution areas in Bird's Head Papua. However in line with the growth and development of the area, some areas around the Momiwaren protected forest would be opened and developed as urban areas. Thus, the existence of this species is predicted to experience significant degradation which is not only due to by growth limiting factors, but also by forest management mistakes, as well as changes in political order from policies in various fields, especially in the opening of forest areas and the transfer of land functions. In addition, there have been people who live and utilize forest resources in meeting their needs. Considering that this type is a type that has a high economic value, and has even been categorized as endangered under the IUCN criteria., as such the information on the characteristics of *A. thurifera* growing sites related to climate, soil and several other ecological characteristics is required for development and this type for its conservation and management.

Materials and Methods

The area that is the object of research is the protected forest area of Momiwaren, South Manokwari Regency. The location is situated in 133°59 '8.1276"E until 134°9'19.7712"E and 1°32 '34.098"S until 1°49' 21.9792"S. This area is in a protected area with a typical lowland tropical rain forest, with mild to steep topography (Figure 1).

As for some equipment used included 1: 10,000 scale work maps, stationery, machetes, cuttings scissors, tally sheets, meter roll, nylon ropes, bags (pocket specimens), pocket meters, measuring tape, plastic samples, hanging etiquette, altimeter, compass, haga meter, lux meter, GPS, helling meter, clinometer, thermohygrometer and other supporting equipment. The materials used in this study were compass, 70% alcohol, soil samples and red paint as markers for paths and trees.

Samples were taken using Systematic Continuous Strip Sampling for observing *A. thurifera*. While the 17.8 m circle is used for observing the ecological habitat of *A. thurifera*. The selection of observation paths will be carried out by Systematic Sampling with Random Start ie the first path is randomly determined and the next path is determined systematically (Kusmana, 1997). The variables observed in this study were:

Ecological aspects, including edafic characteristics, climatic and physiographic factors. Edafic factors (soil) included soil chemical properties, pH, organic matter, Cation Exchange Capacity (CEC), Nitrogen content (N), phosphorus (P) and potassium (Ca).

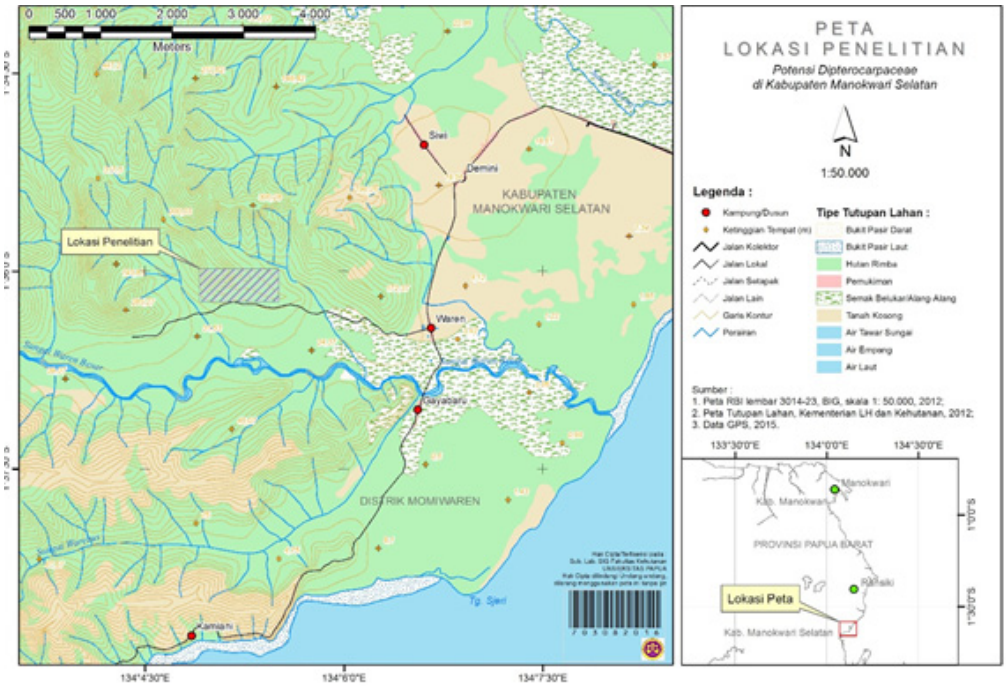

Fig. 1. Map of the Protected Forest as an observation area

Climatic factors (climate) included temperature, humidity, light intensity and rainfall. While physiographic factors include the slope of the sampling site and the height of the site above sea level (asl).

Demographic aspects, which were observed included Density, Relative Density, Frequency, Relative Frequency, Dominance, Relative Dominance and Important Value Index (IVI).

Results and Discussion

The results showed that there were several aspects that affect the growth and development of *A. thurifera* including ecological aspects and plant demographic aspects. Some ecological aspects observed in this study include:

Edafic Factor

Based on land distribution data according to Brookfield and Hart (1971), the Momiwaren protected forest area is included in the distribution of lithosol soil types. Lithosol soils are often referred to as the youngest soils, so the parent material is shallow and very often seen on the surface as solid, compact rock. This lithosol soil is a type of soil which has not been weathered for a long time and has not yet experienced development so that the level of soil fertility in this area quite varied.

A. thurifera, which was found at the study site, grows in rocky and rocky soil conditions with shallow solum (± 10 cm); on rather rocky soils with not too deep solum (± 15 cm) and on rocky soils with rather deep solum (≥ 20 cm). Besides the condition of the soil surface, many litter or organic materials are found in the process of decomposition, which results in high levels of soil moisture. This condition is found mainly in mild to severe undulating areas with a slope of 65%, while the results of soil analysis as presented in Table 1.

The results of the soil's chemical properties assessment showed that the condition of the soil where *A. thurifera* grows was classified as not very fertile soil, marked by a slightly acidic pH.soil This soil reaction is closely related to nutrient solubility, plant tolerance, nutrient absorption, microorganism activity, and ion fixation in the soil (Foth, 2010; Sufardi, 2017). The higher CEC means the base cation level in the soil would be higher as well. However, the high value of the CEC for land in this forest area was because the CEC calculated here was not an effective CEC, but a potential CEC. This showed that CEC on soils in the tropics do not always describe the number of cations absorbed by the soil but only as CEC formed from variable charge and do not describe the actual cations absorbed on colloidal surfaces (Uehara and Gilman. 1980).

Climatic Factor

Climatic factors are environmental factors that play a very important role for plant growth. Local and regional climate differences in several places would cause the formation of new communities in a particular region (Siburian, 2017). The South Manokwari protected forest area is an area that is included in a wet tropical rain forest with an average rainfall of 1500 to 2500 millimeters per year (Brookfield and Hart (1971), with optimum temperatures ranging from 27-29 ^{o}C and humidity ranging from 60-90% (Table 2).

In general, the temperature in the regions of Papua does not show much difference throughout the year. However, when related to the topographic conditions of the region (Table 3), the humidity levels in the adjacent area for the same time would show different conditions (Table 2). This is very closely related to the percentage of canopy coverage that affects the sunlight penetration in an area. Based on the results of the measurement of percent

Table 1. Results of soil assessment in the area where *A. thurifera* grows

No.	Criteria	Unit	Measurement	Category
1	pH	H_2O	5,5	Low acid
2	P tsd Olsen	ppm	7,43	Low
3	K tsd	Me/100 g	1,06	high
4	Ca tsd	Me/100 g	3,65	low
5	Na tsd	Me/100 g	0,85	High
6	Mg tsd	Me/100 g	0,83	low
7	KTK	Me/100 g	45,32	Very high

cover canopy (Table 2), *A. thurifera* plant in the seedling phase was found at 25% canopy cover, where in this phase the plants are intolerant of sunlight. This is quite different from plants in the Pole and tree phases.

Physiographic Factors

Physiographic factors are factors that caused by the composition and conditions of the earth's surface, such as; topography which includes the height and slope of the land surface where the plants grow, geodynamic processes such as siltation and erosion caused by surface runoff. This does not have a direct impact on plant growth, but it is important for the growth and the spread of vegetation (Baransano *et al.*, 2019). Wabia and Siburian (2019) revealed that the topographic location has a climatic meaning in determining the direction of the wind, humidity and the amount of precipitation, especially in the distribution of plant seeds.

The height of the site greatly affects plant growth, where *A. thurifera* observed in South Manokwari area was only at an altitude of 200 - 300 m above sea level which is a lowland forest area. Siburian et al (2017) states that Papua's lowland forests have very high levels of biodiversity because they are influenced by the very diverse forms of regional topography. The height and steep hillsides are environmental phenomena that determine the presence of a species in Papua. This condition affects the formation of different biota communities in adjacent land plots. Physiographic factors for growth of *A. thurifera* are presented in Table 3.

A. thurifera plants found in the protected forest area of South Manokwari, grow in areas with steep slopes to steep (ranged between 15-53%). This area has the potential to have a large surface run off, especially when it rains. This greatly affects the amount of organic matter content that would be absorbed by plants, then carried away by run off. It appears that in the seedling and sapling stages, A. thurifera is generally found growing in areas with a slope of 15-25% (Table 3), which causes the *A. thurifera* seeds that are physiologically ripe to generally fall and consequently move to lower areas such as on valleys and ridges.

Potential of *A.thurifera* in South Manokwari protection Forest

The potential of *A.thurifera* in Momiwaren protected forest area is very limited. This is evident from the results of the value of the inventory carried out. *A.thurifera* significance value index in all measurement classes shows very low values (Figure 2). The importance value index is a value that states the role of a plant in its community. The higher the index value of a type, the greater the role of that type in the measured community. Loveless (1989) states that if a species has a high dominant value, the species is able to utilize the environment it occupies efficiently compared to other species in the same site.

In general, the scarcity of *A. thurifera* individuals at the study site is caused by edafic, climatic and physiographic conditions which might play role as the limiting factors for *A. thurifera* growth (Figure 2). Whittaker (1974) states that if the sapling and seed-

Table 2. Climatic factor at study site for *A. thurifera*

No.	Air Temperature (ºC)	Humidity (%)	Canopy coverage (%)
1.	27 - 29	60 – 68	25
2.	28 - 29	75 – 80	45
3.	28 - 29	80 – 85	70
4.	27 - 29	83 – 90	80
5.	27 - 28	85– 90	85

Table 3. Physiographic factor of *A. thurifera* in protected forest in South Manokwari

Habitat	Above sea level (asl)	Topographic/slope (%)	Growth stage
1.	200-250	15-22	Seedling
2.	200-250	15-25	Sapling
3.	250-300	20-40	Pole
4.	250-300	15-53	Tree
5.	250-300	30-46	tree

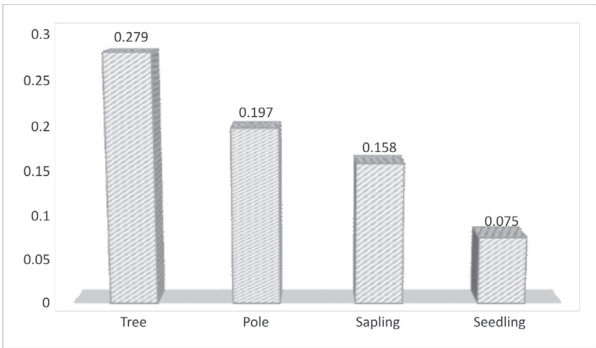

Fig. 2. Important value index for *A. thurifera* base on growth fase

ling phases are found in an area with a low density, then at a certain time the species would disappear from the stand. The value of the density of vegetation is closely related to the condition of the growing site, especially soil nutrient content, such as phosphorus and magnesium concentrations. Sist and Saridan (1998) reported that the Dipterocarpa species richness in the district of Berau was higher in well-drained soils with moderate slope than in poorly drained areas with very steep slopes. According to Asthon (1982), variations in species in wet tropical forests are mostly caused by complex interactions between physical factors and plants.

Association of *A. thurifera* with other woody plants

Association is the relationship between living things and their environment. Associations with a uniform environment tend to form communities with certain types of vegetation that are appropriate to their environment. In a relationship, an association would produce an interaction in the form of a beneficial interaction or a harmful interaction of one or more of the species that affecting each other.

The woody vegetation that was found growing with *A. thurifera* in the protected forest of South Manokwari starting from the seedling phase to the tree phase amounted to 296 tree species, where the Euphorbiacea family was the most frequently family found compared to other families in the study site. The seedling phases were found as many as 223 species, 211 saplings, pole 194 types, and 175 types of trees. The composition of plant species in lowland forests is very diverse, even some of which are endemic species. According to Whitmore (1984), wet tropical forests are the most complex type of terrestrial vegetation and the highest number of species in the world. The several types of woody plants associated with *A.thurifera* (Table 4).

Papua has a high level of flora diversity, but according to Kartika (2012) the number of families spread is relatively small. The results of this study indicated the value of the density and number of tree species contained in each plot varied greatly, this was thought to be influenced by edaphic factors and plant physiography. Johns (1986) states that the ecosystem in Papua is very unstable, where it is strongly influenced by several factors including; earthquake damage and physical damage to forests due to fallen trees, as well as El Nino related phenomena, which occur periodically every seven years, namely long drought periods of varying intensity which would have important ecological impacts on vegetation in Papua. In addition to these factors, illegal logging activities also greatly affect the stability of the forest ecosystem, where the damage caused by logging activities varies greatly depending on the size of the volume of trees harvested and species composition (Kartika, 2012).

Conclusion

The characteristics of the growing site of *A. thurifera* in the Protected Area of South Manokwari was in the form of acidic soil with low nutrient content, a rather steep gradient with different climate with all regions. The potential of this plant in the research site is diminishing as indicated by IVI value which decreases from the tree level to the seedling level, despite the plan is capable to associate with several other woody plant species.

Table 4. Woody Plants Associated with *A.thurifera* in Manokwari protected forest

No.	Growth fase	Latin name
1	Seedling	*Gnetum gnemon, Vatica rassak, Pimelodendron amboinicum*
2	Sapling	*Gymnacantera farquhariana, Pimelodendron amboinicum, homalium foetidum*
3	Pole	*Gymnacranthera farquhariana, gnetum gnemon, Pimelodendron amboinicum*
4	Tree	*Syzygium sp, Intsia palembanica, Pometia acuminata*

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