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The utilization of rosewood (*Dalbergia latifolia* Roxb.) by local community in Indonesia has opened a Pandora's box for the fate of its conservation status.

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Abstract

Dalbergia latifolia Roxb. is one species of the family Papilionaceae. It is also known as Indian rosewood, East Indian rosewood, Bombay Black wood, Palissaneder de l'Inde or d'Asie (France), or Sonokeling (Indonesia). In Indonesia, Sonokeling is often used for high-class furniture raw materials such as bookshelves, cabinets, decorative wood, wood carving and instruments cases. People also use it as shade tree, especially in agroforestry systems and government use Sonokeling for reforestation. Indonesia exports plenty of raw materials for musical instruments, sports equipment, and plywood products. The biggest source of timber trading for this species to date has been obtained from state owned concession or from community land, not from the wild. Some argues that Sonokeling has becoming rare but some claims otherwise. In 2016, *D. latifolia* Roxb. was included in the CITES Appendix II list. This may affect trading regulation in Indonesia despite the fact that Sonokeling is widely spread in Java island and easy to grow. This study was carried out to open the Pandora's box of its conservation status that so far based on limited information from their distribution elsewhere. The results revealed a massive density and its distribution in the place where it is first planted. In West Java, growth increment can reach 4-7 cm/year. However, there was a difference in heartwood size between Sonokeling growing in plantation area with those in community's land. Survey showed of farmers' less interest to grow Sonokeling intensively and indication of some illegal cutting from plantation area. So far, treatment to enlarge tree diameter is through thinning. While technology to enlarge heartwood remains unknown. The information generated from this study could be used as piece of evidence to further investigate the growth, distribution and to prevent illegal harvesting of Sonokeling in Indonesia. This will possibly help to delisting Sonokeling from CITES Appendix II.

Keywords: sonokeling, reforestation, plantation, conservation, CITES, plywood, trading

Introduction, scope and main objectives

The genus *Dalbergia* consist of about 185 species that are widely distributed in the old and world tropics. *Dalbergia latifolia* (Fam: Papilionaceae), known as Indian rosewood, East Indian rosewood, Bombay Black wood, Palissaneder de l'Inde or d'Asie (France), or Sonokelingis (Indonesia) is a native species in tropical Asia. It spreads from Nepal to India and in Java (Indonesia) and some are planted in tropical Asia and grown locally in Africa (Louppe et al. 2008). In Indonesia, Sonokeling is often used for high-class furniture raw materials such as bookshelves, cabinets and even used for decorative wood in cruise's ship and instruments cases. In the market,

this wood is suitable for high grade plywood considering its beautiful color and figure for decorative veneers. It has high strength and long lasting period of uses so that people fond of use them as constructional materials and also popularly used as a carving material and exported for musical instruments and sports equipment (Joker 20014).

People in Indonesia like this wood because it can be used as shade tree, especially in agroforestry systems. In the past, government use this species for reforestation program. Foliage can also be used as fodders for cattle. However, some anecdotal information states that Sonokeling is difficult to obtain and is on the verge of extinction in Java and West Nusa Tenggara (Rugayah et al. 2017). In fact, about 24 smallholder or community-based forest management unit in Java has received sustainable forest management certificate to sell *D. latifolia* timber. This means that timber can be traced from the liable sources that they are still many and available. Illegal logging of this species also another issue need to be tackled (Treanor 2015). The question is, where and how large is Sonokeling's potential at this time, exactly? Answering this is look like trying to open Pandora's box. Indonesia determine quota for *D. latifolia* export based on the standing stock available and not based on the growth and yield data. Information on the growth increment of this species remains lacking.

CITES notifications in November 7th 2016 and November 14th 2016 regarding Amendment to Appendices I and II Convention which were adopted at COP 17 CITES on 24 September to 4 October 2016 in Johannessburg, South Africa has mentioned that *Dalbergia latifolia* Roxb. was included in the CITES Appendix II list (CITES 2016). This has a significant consequence. The market and trade of Sonokeling must be managed properly to prevent banning of Indonesian Sonokeling by other importing countries. In fact, Sonokeling has quite a large potential for country's foreign exchange through export, thus their trade requires guidance from Ministry of Forestry and Environment.

The fact that this species is included in Appendix II of CITES along with information on its rarity in nature complements the reasons for increasing the price of wood in the market. Currently, this species is one of the most valuable timbers and the price is higher that the teak which is also known as fancy and high valuable wood in Indonesia. In this article we discuss the issue of not only the utilization of Sonokeling by local community in Java, Indonesia but also to some extent looking at the species distribution, growth and its local trading.

Methodology

1-Study Sites

The study was conducted in the two different regions in Java and West Nusa Tenggara (WNT). However, this paper only discussed data and finding from the Java which are spread in three provinces of West Java, Central Java and East Java (Figure 1). The majority of sample site were located in forest areas where Sonokeling was reportedly occurs, especially in *Perum Perhutani* plantation forest and some farmlands. *Perum Perhutani* is a state owned forest concession that operates only in Java to manage mainly teak (*Tectona grandis*), mahagony (*Swietenia mahagony*), pine (*Pinus mercurusii*), acacia (*Acacia mangium*) and sengon (*Albizia falcataria*) plantation. Sites visited in Java are West Java (Cikepuh, Majalengka, Kuningan, Cirebon, Sukabumi), Central Java (Kebumen, Sleman, Bantul, Gunung Kidul), and East Java (Madiun, Pacitan, Blitar, Trenggalek, Cepu, Tulung Agung).

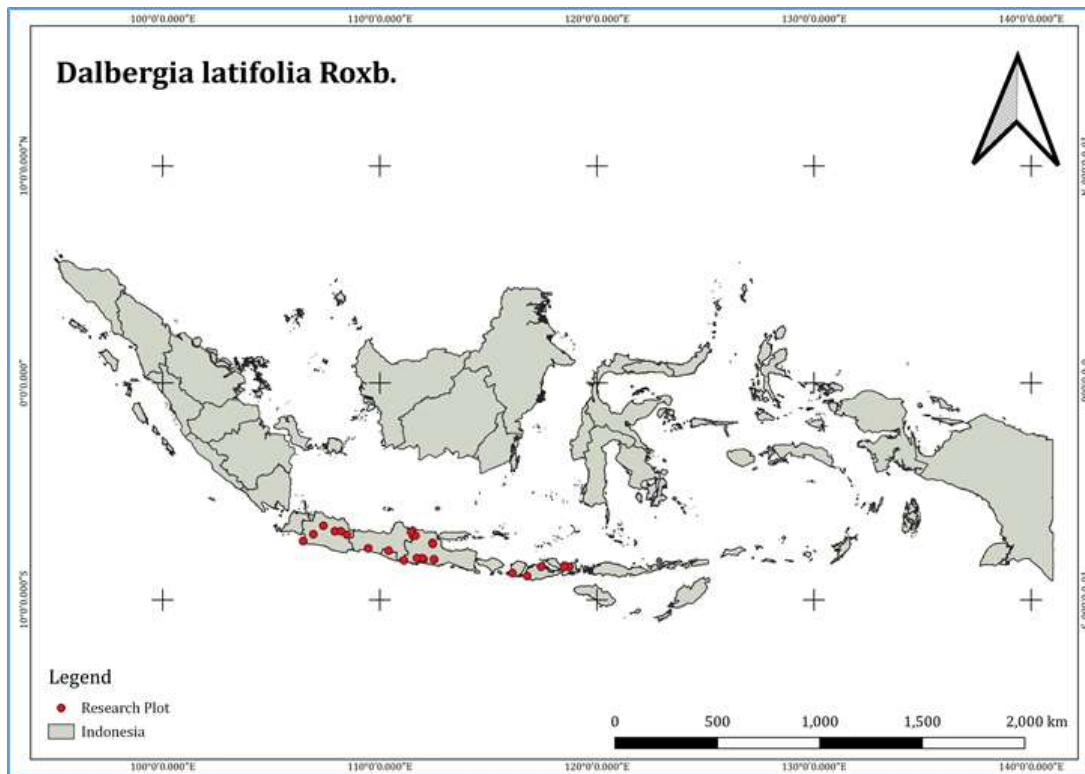


Fig. 1: Sampling site location in Java and West Nusa Tenggara (this study only analyze data from Java).

2-Data Collection and Analysis

This study involved two types of information: distribution and harvesting data in the three types of forest management and trading system applied by suppliers and buyers. The method used for data collection is secondary and primary data through interviews with the actors of sonokeling trading. There are three types of sources for producing Sonokeling timber that is studied, namely timber that comes from forests managed by the community, managed by Perum Perhutani, and protected forests managed by regional governments. Farmer's lands are characterized by the dominance of agricultural crops and often farmers raise cattle such as goats, chicken,s and cows. In a village located close to the forest, the most common tree species planted by the community are sengon (*Albizia falcataria*), jabon (*Anthocephalus cadamba*), teak (*Tectona grandis*), and mahogany (*Swietenia mahagoni*).

This study uses a semi-quantitative and qualitative method with a case study approach. The research data was obtained through in-depth interviews, observations, and documentation. Interviews were conducted with owners of land or gardens with stands of sonokeling, timber collectors, small-scale sawmill industries which also often act as collectors and industry. The data collected includes timber origin and volume of the timber and the destination of delivery. Interviews with the local community are mainly focused on their view about sonokeling compared to other species, and includes whether the local community use sonokeling for subsistence or for commercial purposes.

Results

1-Sonokeling distribution in plantation forest in Java Island

Sonokeling is one of the primary products in plantation forests managed by Perum Perhutani, a state-owned forest concession/enterprise which only manages plantation forest areas on the island of Java. Based on data obtained from Perum Perhutani, until January 2021, Sonokeling in protected forests covers an area of 917.34 hectares, while those planted in production forests are 4068.73 hectares (Figure 2). The largest areas in production forest plantations are in Central Java in Gunung Kidul and Pati, while in East Java, namely in Kediri and Saradan. Meanwhile, the largest area of protected forest is in Surakarta (859.84 ha), around 17 percent of the total area of Sonokeling in Perum Perhutani.

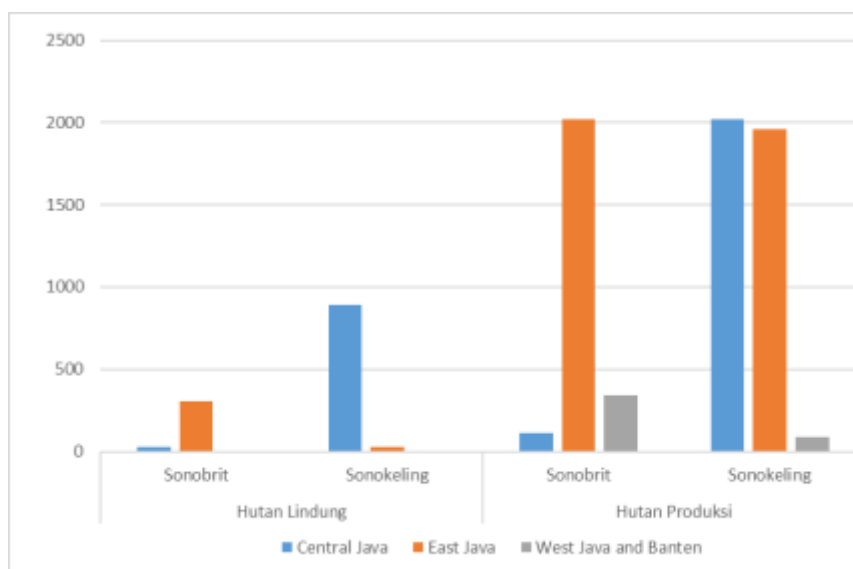


Fig 2. Sonokeling and sonobrit distribution in Perum Perhutani area in Java

In Java, Sonokeling is perceived as two different types of timber namely Sonokeling and Sonobrit. According to information from technical personnel from Perum Perhutani who comes from Central Java and East Java region, they can easily distinguish that there are two types of Sonokeling based on the shape and color of the heartwood. Standing trees is hard to differentiate but when it is cut down they can easily tell the difference. Generally, those that have clear annual rings are Sonobrit, while those that are very dark are Sonokeling. To find out whether there are anatomical and genetic differences, genetic testing is currently being carried out to determine variations in the population. Sonobrit price is lower than Sonokeling.

2- Sonokeling distribution in community land in Java Island

Rapid assessment on the four visited villages in Bantul and Imogiri (Jogyakarta), Pacitan, and Gunung Kidul shows that the density of this tree is relatively high compared to teak and sengon. In 2014, one family sold three trees of *Dalbergia* with an average diameter of 30 cm for Rp 114 million. In Imogiri, harvesting was done on trees between 25 to 45 cm in diameter. The quality of the timber in these areas is relatively higher than other sites as most of the trees have large black colored heartwood or people called it “galih” (price will depend on the heartwood color and size).

In Java, Sonokeling is only planted on sites that are not sufficiently productive for teak (*Tectona grandis* L.f.). It is generally grown in pure stands but sometimes mixed with mahogany (*Swietenia* sp.). Although pruning and thinning are normally recommended 5-10 years after planting, but local community rarely does this. Pruning will be done if they think that other fast-growing trees in their farm growing closer to Sonokeling. Sonokeling is harvestable at 20 to 50 years old. However, presently some people harvest them at the age of 5 years so that the price is cheaper as the quality cannot be equated with the tree at age 20 years.

Local community perception of Sonokeling is quite differ among the West, Central, and East Java. Some farmers interviewed informed that they prefer to grow sengon (*Albizia falcataria*) or jabon (*Anthocephalus cadamba*) because these two species are fast-growing and the price is relatively stable. In addition, most of the Sonokeling grows in the community land has a large diameter but small heartwood. While those recorded in the Perum Perhutani site have large and dark heartwood. In general, the distribution of sonokeling in Jogjakarta (Bantul, Gunung Kidul and Kulon Progo), Central Java (Kebumen) and East Java (Ponorogo and Pacitan) has the same pattern, including in West Java.

In general, Sonokeling from Cikongga, West Java, is priced cheaply due to the small heartwood size. Sonokeling trees are very easy to breed in and people even perceive them as trees that "drag the soil". Sonokeling can dominate in certain areas and saplings easily grow from the roots that stick out of the ground. This species is also very strong as they are capable to break the roadside as it is seen in Pacitan area and along the roads in Blitar and Trenggalek, East Java Province. Unfortunately, it seems that farmers usually cut the trees when they need cash.

3-Information on Sonokeling utilization and trade by local community

In almost all villages located close to the forest in the visited sites, the most common tree species planted by the community are sengon (*Albizia falcataria*), jabon (*Anthocephalus cadamba*), teak (*Tectona grandis*), and mahogany (*Swietenia mahagony*). Most respondent mentioned that they have never planted Sonokeling as this species grows naturally in their garden which they had received from their ancestor. Some respondent said that they have to plant Sonokeling and other fast growing species during Rehabilitation Movement (GERHAN) in 2000. Prolific natural regeneration of *Dalbergia* grown from its roots were observed in Jogjakarta, Central Java and East Java. Sonokeling trees in the locations visited was unevenly distributed and none of the stands found on community land were intentionally planted. Stands growing on community land are the result of natural regeneration through roots. Trading Sonokeling only if someone orders or buys it.

Sonokeling is not evenly distributes in all visited village, some have many and some have few. Even some local community having large garden do not have it. In Java, Sonokeling is one of the popular agroforestry plants in Indonesia. In general, this tree is planted in a coppice system interspersed with various food crops such as rice fields, corn, cassava, or nuts. Sonokeling is also planted mixed with mango, jackfruit, soursop, guava and others. Local community use the leaves for animal feed and green manure and its roots are used for fertilizer.

For no clear scientific reasons, the issue of the scarcity of Sonokeling widespread and *Dalbergia* has been registered as a vulnerable species by the International Union for natural conservation or IUCN since 2017. After the issuance of CITES List App II, Sonokeling becomes the most expensive wood in Central Java, East Java and West Nusa Tenggara province. The highest price of Sonokeling was recorded in December 2017 when a single Sonokeling log of 1,5 meter diameter and 10 meter length was sold for Rp. 475 million (around 3,200 USD). In Gunung Kidul, Sonokeling with 1 m³ volume ini size can reach the price at 2500 USD.

We also observed a large amount of sonokeling trees planted along the main road in Trenggalek (towards Pacitan). The trees have large diameter of more than 30 cm. This presumably planted more than 30 years ago. Sonokeling was planted alternately with Trembesi (*Samanea saman*), mahagoni (*Swietenia mahagony*) and Asam (*Tamarindus indica*). All have large diameter. In 1990 a total of 16.750 m³ of *Dalbergia* timber was harvested in Java, the larger part of which was Sonosisso (*Dalbergia sisso*). The price of sonokeling from Java is comparable with that of teak wood.

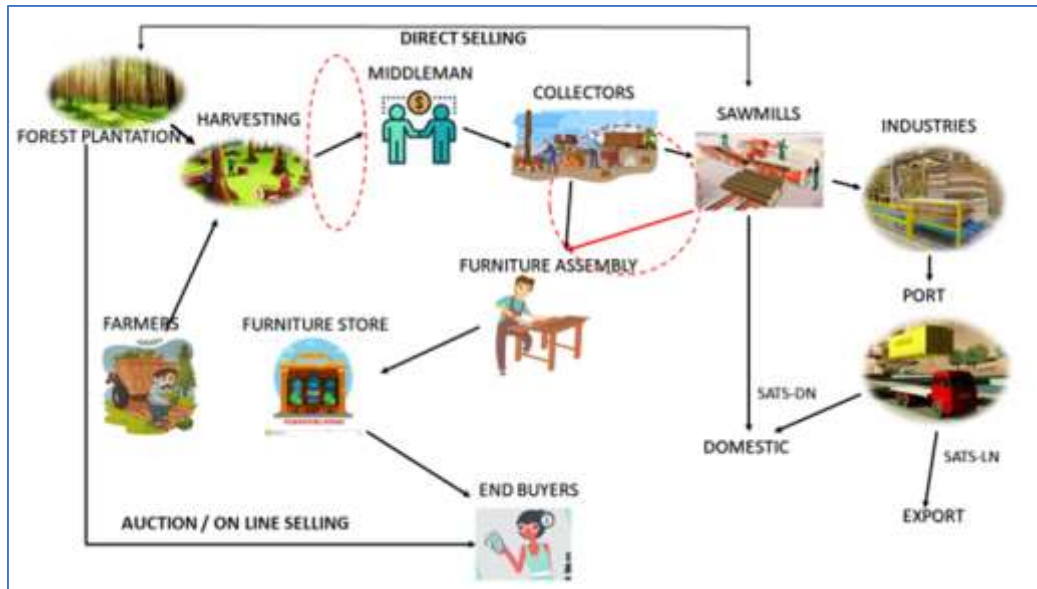


Fig 3. Diagram of sonokeling distribution in Java (red circle shows SATSDN process via BKSDA in the respected location).



Fig 4. Sonokeling stand belongs to local community in Bantul village, Jogyakarta, Central Java (left) and logs transported from farmland to the industry (right)

Discussion

Recent scientific journal describes the taxonomic status of *Dalbergia latifolia* Roxb. and found that this species is native to India and Java and it is cultivated in Java, Borneo, Phillipine (Luzon), Lombok and Sumbawa. Only one species of *D. latifolia* is currently known to be commercially valuable. Based on the result of study, Sonokeling remains widespread in Java, especially in Central and East Java. This species was massively planted during rehabilitation program in the community forest in 1978. One of the most suitable place for this species is in Bantul, Jogyakarta. They later grow wild in the state forest as well and it is easy to proliferate from its root and coppice. But cultivation is difficult although seedling is abundant but growth rate is so slow (Santoso et al. 2021). Based on information, Sonokeling in the study area has no value compared to those being traded in other

areas such as Central Java and East Java and possibly outside Java island such is reported from east and West Timor.

In general, people cut wood only to be used as building materials. However, it is surprising that it is not used as supporting pole but is used mostly for walls or possible furniture. According to respondent, Sonokeling is considered to be less strong for supporting poles because it often bending or curves. Physically, Sonokeling growing within the community land differs from those growing inside the forest or plantation previously managed by State Owned Forest Concession (Perum Perhutani). Both has a different diameter of the terrace (heartwood). Terraces belonging to tree that grow in community garden are smaller than those growing inside the forest areas (ex Perhutani's plantation). Sonokeling growing on marginal soils generally produces older and stronger heartwood than those grown in wet soils such as in West Java (Hartatianti 2013).

Community in Cirata villages only sell these wood when they need money. For example, during early pandemic, sold nine (9) rosewood tree with average diameter of 20 cm for only 2 million IDR (Indonesia rupiah). Although it has diameter of 20 cm but size of terrace (very dark color in the middle of the trunk) is very small. Respondent mentioned that it only needs three years to reach this diameter size of around 20 up to 25 cm. Some trees in the farmer's land even does not have terrace and some are very small. This is the reason behind the low timber price sourced from community land. We have not got any information yet with regard to Sonokeling price in the market surround West Java. Conversely, in Central Java, this tree has a high selling price. There is even a vast land that is especially planted with Sonokeling. Local community develop a seed orchard of Sonokeling and also nursery. It seems that the community has aware of the economic value of Sonokeling Wood (Safitri and Ashila 2019).

With regard to trading, all harvested Sonokeling was traded in small amount of volume. Often, the woods are felled upon request. Selling of wood are made available via broker. This village does not have specific place to collect wood as trading done directly with buyer without legal permit issued by KLHK (i.e SATDN). Most rosewood are used for subsistence and local community use almost all parts of the timber. Clear bole trunks are used for housing and furniture, while the remaining are used for fuelwood.

Basically, the supply chain from farmers to industry in several cities in Java is not difficult but requires a long chain as discussed previously. Only collectors or known as Trade Units (UD) have a Sonokeling wood distribution permit. Meanwhile, farmers in villages that are located far from the city will find it difficult to find markets or buyers.

A number of scientific journals and media reported that genetically, Dalbergia tree stand has becoming scarce all over the world. While the tree is still being exported mainly to Europe for furniture and interior finishing. It was reported that in Java, it is now difficult to find an old and large sonokeling tree and is only planted on a much smaller scale, in Java. This is in the contrary with our research finding.

The issue of population scarcity in nature is allegedly one of the strategies to boost prices. In fact, the population in the wild remains widely-spread. Local community in Java and Perum Perhutani has also started cultivating it. The reason why Perum Perhutani has not planted in one business block is the long harvest period and the large number of illegal loggers of rosewood trees growing in protected forest areas (Azhar 2018).

As a form of conservation measure, the government has begun to tighten the circulation of rosewood logs outside Java. Vice versa, considering that West Nusa Tenggara is also a producer of Sonokeling. The community and timber businessmen hope that their trading status will quickly change to common wood so that prices can return to normal.

Conclusions

Sonokeling is not a popular timber for utilization among the local community. Local community only sell the timber when they need cash money. Although it is not popular, but after the issuance of Sonokeling status

under CITES Appendix II, the domestic trading across province is relatively large, especially those come from farmer's land. Price is also becoming higher. For Sonokeling export, seller shall have special permit and this often discourage local community to sell the timber.

Local community prefer to grow trees that has good marketing and also more easy to obtained for replanting, except Sonokeling which normally grow by root cutting. The technique for cultivating Sonokeling need to be improved to encourage local community planting this valuable and prospecting tree.

Supply chain between central and east Java are almost similar. The biggest player in Sonokeling trading is middle-man which also often function as collectors. Sonokeling sourced from West Java is less popular in the market due to the quality of the timber as most buyer prefer to buy Sonokeling based on the quality. Almost all traded Sonokeling comes from plantation forest in Java, especially from Central Java and East Java. while those from community forest land in traded domestically. Price has becoming higher under current CITES policy due to the issue of scarcity. Finding in this study remains

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