NATURAL REGENERATION OF *Eusideroxylon zwageri* T. et B. AT GUNUNG MERATUS PROTECTION FOREST EAST KALIMANTAN - INDONESIA

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ABSTRACT

A study on the natural regeneration of *Eusideroxylon zwageri* T et B, a native and multi purpose iron wood tree species, was conducted at the Protection Forest of Gunung Meratus, East Kalimantan, Indonesia. As many as 15 mature trees with diameter more than 20 cm at breast height (1.30 m) were chosen for this study. The amount of natural regeneration found under tree crown projection, were classified into four height classes: less than 50 cm, 50 – 100 cm, 100 – 150 cm and more than 150 cm. The result showed that most of the natural regeneration were in the 50 -100 cm height class, as many as 58.7 %. Average number of natural regenerations was 69.2 wildings per tree ranging between 17 to 161. Such amount of natural regeneration will compete for their life and many of them will die in the competition for food and light. Therefore some of those natural regenerations especially the trees with more than 20 wildings may be used for planting stock procurement in the form of wildings without soil, wildings with soil, and stump.

Keywords : regeneration, *Eusideroxylon zwageri*, planting stok

I. INTRODUCTION

Indonesia has one of the most diverse and richest tropical rain forests. The well known commercial timber species include meranti (*Shorea* spp.), kapur (*Dryobalanops* spp.), bangkirai (*Shorea laevis*), keruing (*Dipterocarpus* spp.) which belong to Dipterocarpaceae family and agathis (*Agathis* spp.), ramin (*Gonyistilus* spp), medang (*Litsea* spp.), nyatoh (*Palaquium* spp.), bintangur (*Calophyllum* spp.) and ulin (*Eusideroxylon zwageri* T.et B), which are non Dipterocarps. *Eusideroxylon zwageri* T.et B. is locally known as ulin, belian, and tembelian. This heaviest and most durable native species known as Indonesian iron wood, have been used since hundred of years by community around the forest for various purposes such as wooden roof known as "sirap", doors, floors, frames of doors and windows, bridges, platform for small harbor, and ornaments in front of a house.

Clark (1990) stated that information on regeneration capability of a tree species, especially its natural regeneration is very essential in the frame of maintaining the sustainability of the species. In addition to ex situ conservation of a tree species is also important to avoid species distinction. While Sastrapradja (2001) mentioned that an integration of in situ, ex situ and on farm conservation into management system, is probably the best way in long term tree species conservation.

In order to keep the sustainability of ulin, the Government of Indonesia prohibits large forest concession holders to cut this particular species and only local people are given permission to cut the trees with diameter more than 60 cm. However due to lack of control and high demand of local market and export, many trees below allowable diameter were still cut. At present, the potency and distribution of ulin is alarmingly getting lesser. Ulin trees may be found only in

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remote areas, some national parks and protection forests. Some areas known as ulin producers in the past, now are only a history.

In addition to its very slow growth, at present, no investor is interested in establishing large scale ulin plantation even though the price is very high reaching Rp 1,000,000,- (US \$ 1,200) per m³ at local market. Only small and research scale plantations have been established in some places among others in Samboja and Sebulu by government research institutes. The objective of this study is to obtain data and information on ulin natural regeneration at Gunung Meratus Protection Forest, East Kalimantan.

II. METHODOLOGY

The location of study is Gunung Meratus Protection Forest, East Kalimantan province. This area is located close to the area of PT. ITCI, one of the largest forest concession holders in the province. Based on local government administration this protection forest belongs to Penajam District, East Kalimantan Province. The area of the forest is about 500 km².

Geographically this protection forest is situated between 0°55' - 1°09' South and between 116°07' - 116°27' East at altitude of 61- 454 m above sea level (Tata, 1999). The topography of the area is undulating and hilly. The location is also used by The Orangutan Reintroduction Project as a releasing area for rehabilitated orangutans.

Observation and measurement of natural regeneration were conducted under each observed Ulin trees. As many as 15 trees were selected for this study. The natural regenerations observed were those that found under tree crown projection. All ulin regenerations under the trees were measured and grouped into four height class namely :

- A : < 50 cm
- B : 50 – 100 cm
- C : 100 – 150 cm
- D : > 150 cm

The data were tabulated based on height. Average amount of wildings and the range were also counted.

Information about mother trees that were gathered cover diameter, tree height, clear bole height, crown quality, and crown position. Environmental condition was also observed which include soil solum, tree position, direction of slope, and altitude. Soil samples were taken under the trees. An observation was also conducted on the cause of damaged seeds on the forest floor.

III. RESULTS AND DISCUSSION

A. Mother Trees

As many as 241 mother trees were found at the study area but only 15 trees had more than 20 seeds per tree. Measurement and observation were conducted on these 15 trees. The average diameter of the trees varied from 27 to 143 cm or 78.5 cm in average. The average tree height is 24 m and ranging from 14 to 32 m while their mean clear bole is 12.2 m or ranging from 8 to 17 m. Based on their crown quality most of the trees are in category 1 namely having good crown quality and cylindrical form. The average crown diameter is 10.77 m and ranging from 6 to 18 m. The tree position is mostly in the first and second, meaning that they are in the A and B strata.

The environment where the trees are found mostly in the valley and some in the middle slope. The direction of the slope varied from North East, South East and South West. Soil column is 1 meter. Based on soil analyses data, the soil pH under ulin trees 5.2 - 5.8 (H₂O) and 4.6 - 4.9 (KCl) and the organic matter is 1.83% - 3.21%. Based on USDA classification, the soil texture belongs to sandy clay loam (SCL). The study also showed that most of ulin trees are found either at the valley or at middle slopes which means the species prefer humid areas (Appendix 1). While soil texture and pH ulin species prefer sandy clay soil and acid respectively, as shown in Appendix 2. Detailed data of each measured mother trees are presented in Appendix 1 and result of soil analysis in Appendix 2.

Collection of seeds from the 15 trees was carried out for ex-situ conservation in the future. As many as 471 seeds and wildings were collected under those mother trees. They were then

B. Natural regeneration

Study on ulin natural regeneration was carried out in the selected 15 trees. Result of natural regeneration measurement based on their height is presented in Table 1.

Table 1. Number of natural regeneration based on height class

Tree Number	Number of natural regeneration based on height class				Total
	< 50 cm	50- 100 cm	100-150 cm	> 150 cm	
1	19	38	8	3	58
2	21	67	15	1	104
3	10	23	-	-	33
4	14	70	-	-	84
5	19	24	-	-	43
6	12	88	58	3	161
7	1	25	12	10	48
8	5	66	53	-	124
9	2	30	19	-	51
10	3	22	12	-	37
11	10	42	23	-	75
12	21	31	37	-	89
13	7	16	2	-	25
14	9	7	1	-	17
15	6	61	22	-	89
Total	159	610	262	17	1,038

Table 1 indicated that the amount of natural regeneration per tree ranged from 17 to 161 or 69.2 stems on average. From those 15 trees, as many as 11 trees have more than 40 natural regenerations and even three trees have more than 100 regenerations per tree. Figure 1 shows the distribution of those natural regenerations based on their height.

Figure 1. Distribution of natural regeneration based on height classification

In that study area many of fallen fruit were eaten by porcupine while the other got rotten due to diseases and fungi. Observation was conducted to those damaged fruit as shown in the Table 2.

Table 2. Amount and percentage of good and damaged fruit.

No. of tree	Good fruit		Attacked by porcupine		Rotten		Total
	Amount	%	Amount	%	Amount	%	
1	8	15.68	20	39.21	23	45.09	51
2	4	12.5	15	46.87	13	40.625	32
Total	12	14.45	35	42.16	36	43.373	83

The fruiting season at the study area usually occurs in April. The observation of natural regeneration were conducted in December or about eight months after fruit season. Most of the fruit will become seed after several months. The data showed that the longer the seeds on the forest floor the more fruit/seeds will be damaged. It is therefore suggested to collect fruit or seeds soon after the fruit fell. However, there are still abundance of natural regenerations found under the trees as shown in Table 1.

In Lempake (East Kalimantan), the distribution of seedling stage based on diameter class, showed that 0.40 – 0.79 cm class were the highest while for sapling stage 1.5 – 1.9 cm class were the highest. At the 15-years old ex-forest fire as many as 77 seedlings and 44 saplings were found within 0.6 ha (Kusumaningsih, 1997).

The amount of natural regeneration at research forest of Mulawarman University in Samarinda (East Kalimantan) reached 270 regenerations per tree with a density of 0.3 – 0.35

individuals per m². Regarding natural regeneration distribution, the highest class was in 0.6 – 0.7 cm for seedling stage and 1.0 – 1.9 cm diameter class for sapling stage (Rusdiana, 1998).

The natural regeneration of a species is very important for its sustainability especially its quantity, quality and distribution. The relatively large amount of ulin natural regenerations may be used for planting stock procurement in the form of wildings with and without soil and stump depending on time and available skill.

IV. CONCLUSIONS AND SUGGESTION

1. Average amount of natural regeneration of *Eusideroxylon zwageri* T. et B. found under tree canopy projection is 69.2 wildings, ranging from 17 to 161 wildings per tree.
2. Most of natural regeneration belong to 50 -100 cm height class (58.7 %) followed by 100-150 cm (25.24 %), more than 150 cm (16.37 %), and less than 50 cm (16.28%).
3. The fallen fruit were eaten by porcupine and attacked by diseases and fungi. Therefore it is suggested to collect fresh fruits for planting stock procurement.
4. Those abundant natural regenerations may be used for procurement of planting stocks in the form of wildings without soil, wildings with soil, and stump.

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Appendix 1. Information on ulin mother trees and their environment.

Tree Number	Diameter (cm)	Tree Height (m)	Clear Bole Height (m)	Crown Diameter (m)	Crown Quality	Tree Position	Solum	Tree Position at Slope	Direction of Slope
01	87	32	17	15.6	1	2	1 m	Valley	Flat
02	56	26	12	7.5	1	2	1 m	Valley	North East
03	27	22	12	6	1	2	1 m	Valley	Flat
04	110	23	12	11	2	2	1 m	Valley	Flat
05	52	25	14	9	1	1	1 m	Valley	Flat
06	143	29	14	18	1	1	1 m	Valley	Flat
07	110	26	12	12	2	1	1 m	Valley	North
08	99	26	16	13	1	2	1 m	Midle	South East
09	121	24	12	15	1	1	1 m	Midle	South West
10	110	14	8	12	2	1	1 m	Midle	North East
11	67	23	9	7	3	2	1 m	Valley	Flat
12	41	24	13	8.5	1	1	1 m	Midle	North East
13	53	24	12	11.5	1	1	1 m	Valley	Flat
14	32	15	8	7.5	2	2	1 m	Valley	Flat
15	69	27	13	8	1	2	1 m	Midle	North West

Appendix 2. Result of analysis of soil taken under ulin tress.

No	pH		OM (%)	C (%)	H ⁺	Al ³⁺	CEO pH 7	CEC Effective	Tot. Cation Basse	KB Potential (%)	KB Effective (%)	Particle size distribution			Soil Texture class (USDA)
	H ₂ O	KCL										Clay (%)	Sand (%)	Ash (%)	
1.	5.3	4.9	2.75	0.05	9.15	4.50	14.06	4.91	0.41	2.93	8.40	21.72	53.28	25.00	SCL
2.	5.4	4.9	2.29	0.04	7.55	4.73	16.31	8.76	4.04	24.75	46.08	23.62	52.28	24.10	SCL
3.	5.3	4.6	1.83	0.03	6.40	4.50	16.88	10.48	5.98	35.41	57.04	17.28	58.24	24.48	SL
4.	5.6	4.7	5.04	0.09	5.50	3.00	12.09	6.59	3.59	29.72	54.50	11.72	71.28	17.00	SL
5.	5.2	4.8	3.21	0.06	8.80	6.68	19.69	10.89	4.21	21.40	38.69	20.28	55.22	24.50	SCL
6.	5.8	4.7	3.21	0.06	6.85	4.88	18.84	11.99	7.12	37.78	59.35	22.54	52.26	25.20	SCL