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A study on tree diversity in association with variability of ironwood (*Eusideroxylon zwageri* T. et B.) in Jambi, Indonesia

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1. Introduction

The lowland rain forests of Sumatra support 111 dipterocarp species, including six endemics. The emergent trees, which can reach 70 m tall, are also dipterocarps (*Dipterocarpus* spp., *Parashorea* spp., *Shorea* spp., *Dryobalanops* spp.) and, to a lesser extent, species in the Caesalpiniaceae family (*Koompasia* spp., *Sindora* spp., and *Dialium* spp.).. Other understory tree families that are common include Burseraceae, Sapotaceae, Euphorbiacae, Rubiaceae, Annonaceae, and Lauraceae. Sumatra once contained pure stands of ironwood forests (Whitten *et al.* 2000).

Jambi is situated in the southern part of Sumatra. It is geographically located between 0° 45′ and 2° 25′ latitude South and 101° 10′ and 104°55′ longitude East (Anonymous, 1997). According to Governor of Jambi's decree no. 108, 1999, the forest area in Jambi is 2,179,440 ha; 870,250 ha of this is protection forest and about 1,320,700 ha production forest. In the past ironwood grew at almost every part of Jambi forest except in Kerinci District but due to over exploitation and other disturbances, this species now can be found only in some forest areas namely Senami, Sengkati and Durian luncuk. Local people recognized four varieties of ironwood namely *daging, kapur, sirap* and *tanduk* (see fig. 1). Ecologically, it is important to study the association of these ironwood's variety with other tree species. This information is useful for future management of ironwood.

Figure 1. Variability of stem and bark of ironwood varieties: left to right: *Daging, kapur, sirap* and *tanduk* variety (Irawan and Gruber, 2002)

2. Research methods

2.1. Time and study site

The research has been conducted from October 2002 to November 2002 in Senami natural forest stand Jambi - Indonesia.

2.2. Methods

The research has been conducted using systematic plot survey. The size of sample plot is 20 m 20 m for tree observation, 10 m x 10 m for pole, 5 m x 5 m for sapling and 2 m x 2 m for seedling observation. The variety of ironwood was recognized based on knowledge of local people (see Heyne 1927; De Wit, 1949; Kostermans *et al.*, 1994, Irawan and Gruber, 2002).

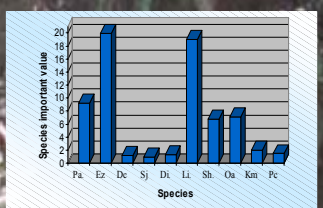
3. Results and discussions

3.1. Species richness

The field research found that ironwood grows associatively with more than a hundred tree species (see fig. 2 and 3). Species number that were recorded are 99 species of trees, 90 species of poles, 125 species of saplings and 92 species of seedlings. From those number of species some species are economically important for wood production namely *Eusideroxylon zwageri, Palaquim sp., Dyera costulata, Strombosia javanica, Litsea sp., Shorea sp., Hopea mengarawan, Tetramerista glabra, Ochanostachys amentacea, Peronema canescens, Koompassia malaccensis* (see table and graph 1). Some other are important for non-timber forest products (see fig. 3).

Table 1. Economically important tree species for wood production

Local name	Scientific name	Diameter (m)	Height (m)	SIV	Basal area (m^2/ha)	Volume (m^3/ha)
Balam	*Palaquium sp (Pa)*	0.33	21.40	9.21	0.77	12.42
Bulian	*E. zwageri (Ez)*	0.26	24.68	19.98	1.10	5.18
Jelutung	*D. costulata (Dc)*	0.33	12.00	1.16	0.09	0.72
Kacang-kacang	*S. javanica (Sj)*	0.20	8.00	0.91	0.03	0.18
Keruing	*Dipterocarpus sp. (Di)*	0.37	17.00	1.26	0.11	1.28
Medang	*Litsea sp. (Li)*	0.29	15.60	19.02	0.99	11.07
Meranti	*Shorea sp. (Sh)*	0.26	24.00	6.72	0.39	6.58
Petaling	*O. amentacea (Oa)*	0.36	19.50	7.14	0.65	8.83
Kempas	*K. malaccensis (Km)*	0.22	15.00	1.97	0.04	0.38
Sungkai	*P. canescens (Pc)*	0.22	16.00	1.46	0.08	0.85



Graph 1. Species important value (SIV) of trees

Figure 2. A giant *Eusideroxylon zwageri*

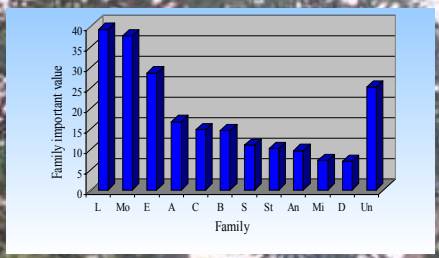
Figure 3. Species that produce NTFP; left to right: Jelutung - *Dyrea costulata* (wood and latex); Pasak bumi - *Eurycoma longifolia (traditional medicine)* and Tampui - *Baccaurea crassifolia* (edible fruit)

3.2. Family richness

The vegetation analysis revealed that in the study site could be found about 28 families of trees . The most important families at tree stage are presented in table and graph 2.

Table 2. The most important families of tree species

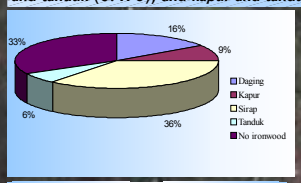
Family	Relative diversity (%)	Relative density (%)	Relative dominance (%)	FIV
Lauraceae (L)	12.50	16.26	10.42	39.18
Moraceae (Mo)	3.85	12.80	20.97	37.62
Euphorbiaceae (E)	10.58	10.03	7.93	28.54
Anarcadiaceae (A)	6.73	5.54	4.42	16.69
Caesalpinaceae(C)	4.81	4.15	5.65	14.61
Burseraceae (B)	2.89	5.89	5.75	14.50
Sapotaceae (S)	3.85	3.11	3.97	10.93
Sterculiaceae(St)	1.92	3.46	4.70	10.09
Annonaceae (An)	2.89	3.46	3.22	9.57
Mimosaceae (Mi)	2.89	2.77	1.47	7.12
Dipterocarpaceae (D)	1.92	2.77	2.32	7.00
Unidentifed Family (Un)	12.50	6.57	6.04	25.11



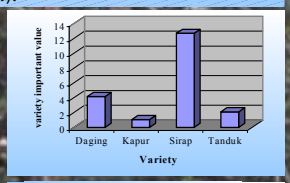
Graph 2. Family important value (FIV) of tree species

3.3. Ironwood variety and distribution

The study revealed that each ironwood variety grows in some small clusters. It can be found in about 68 % of forest area (graph 3). The variety important values of those varieties are presented in graph 4. The alternatives of cluster composition of ironwood variety are *daging, kapur* and *sirap* (4.69 %); *daging* and *sirap* (9.38%); *sirap* and *tanduk* (4.69%). Sirap is the variety that able to form cluster with any other varieties. The Sørensen coefficient index between ironwood communities obtained that the most similar communities are the communities of *daging* and *sirap* with index of 0.792, followed by *daging* and *kapur* (0.569), *sirap* and *tanduk* (0.497), *kapur* and *sirap* (0.488), *daging* and *tanduk* (0.478), and *kapur* and *tanduk* (0.364).



Graph 3. Percentage of ironwood's distribution



Graph 4. Variety important value of ironwood varieties

4. Conclusions

1. The field research found that ironwood grows associatively with more than a hundred tree species. Those species belong to 28 families. The most dominant families are Lauraceae followed by Moraceae, Euphorbiacea, Anacardiaceae, and Caesalpinaceae.
2. Ironwood variety grows in small clusters. Sirap is the variety that able to form cluster with any other varieties.

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