

Eusideroxylon zwageri (Ulin) as Key Species in Two Zones of Sangkima Rain Forest, Kutai National Park, East Kalimantan

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ABSTRACT

Aim of this research was to study trees' diversity quality in primary and intensively used forest of Sangkima area in Kutai National Park (TNK), East Kalimantan (Borneo). Field observation was carried out by vegetation analysis using 17 sampling plots of 25x25 m². Community structure of each forest was determined by calculating trees' density, basal area, frequency, important value and stratification of species. While trees diversity was estimated by taxa richness, Shannon-Wiener diversity index, and rate of endemism. Both forests were compared by Morisita community similarity index. Data were tabulated by Microsoft Excel 2007 and statistically analyzed by PCA method and supported by hierarchical cluster analysis in SPSS 15.00 for windows. The result showed that diversity quality in primary and intensively used forest of Sangkima TNK was high, indicated by similar stratification. The forests were composed by A stratum trees of > 30 m high to ground cover plants, but they were dominated by B stratum trees of 20-30m high. Primary forest's formation was *Eusideroxylon zwageri*-Mixed Dipterocarpaceae, while intensively used forest's formation was *E. zwageri*. Taxa richness of both forests was not different significantly. In the primary forest was found 34 species, 25 families and 16 orders, while intensively used forest was found 36 species, 20 families and 13 orders. Diversity Index of primary forest (H=4.57) was slightly higher than secondary forest (H=4.28). Rate of endemism of both forests reached 100%. *Eusideroxylon zwageri* and *Cananga odorata* were co-dominant in the Borneo rain forest. Tree of *E. zwageri* showed a biggest trunk and largest canopy. *Cananga odorata* showed a high density in both zones. Luxurious jungle performed A to E strata, but B stratum was dominant. Based on those five characters, trees' diversity quality in Sangkima was still high. Bi plot analysis showed that trees' community structure of both forests composed by three groups. In secondary forest, *E. zwageri* was a key species and characterized by high important value, while species *C. odorata*, *Dyospiros borneensis* and *Dillenia beccariana* found in a high distribution, otherwise other trees were classified into the 3rd group. Comparing to the secondary forest, even though *E. zwageri* was also as dominant tree, but the virgin one showed more species growing in a better density, distribution and dominance.

Keywords: Tree, Borneo, rain forest, community structure, quality diversity, Kutai National Park

INTRODUCTION

Kutai National Park (TNK) is one of representation of lowland tropical rainforest in East Kalimantan. *Ulin-meranti-kapur* forest, mixed Dipterocarpaceae, mangrove and *kerungas* were some vegetation formation in TNK. TNK

is consist of core, primary, intensively used, rehabilitation and buffer zones [1]. Natural forest was the highest carbon storage compared to agriculture landscape caused by its high trees' diversity with plenty of ground plants and manures [5]. Ecosystem service is the ability of ecosystem to directly or indirectly profit human's efforts, such as maintain hydrology cycle, climate regulation, water and air purgation, maintain atmosphere composition, pollination, soil formation and storage and nutrition cycle [6].

Aim of this research was to study trees' diversity quality in primary and intensively used forest of Sangkima area in TNK, East Kalimantan (Borneo). Database of trees'

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diversity are expected as consideration of next related environmental research and policy, especially efforts to overcome global warming such as reforestation, environmental education, wildlife conservation and green accounting.

Study Site

Geographically Sangkima Natural Resort was at 0°7'54"- 0°33'53" S and 116°58'48" - 117°35'29" E [9]. Common topography is lowland and flat and steep hills in height of 70 – 200 m asl [4]. Sangkima has tropical climate with average precipitation 1.543 mm per year and average temperature are 27° - 33°C. Sangkima's total width ± 61.641 ha or 31 % of all 198.629 ha TNK coverage. Majority of Sangkima is formed by Dipterocarpaceae forests and it is home for many of faunas [9].

MATERIALS AND METHOD

Field observation was carried out by vegetation analysis using nine (for intensively used forest) and eight (for primary forest) sampling plots of 25x25 m² (for trees with DBH ≥ 20 cm). Trees diversity was estimated by taxa richness, Shannon-Wiener diversity index and rate of endemism. Rate of endemism determined based on comparison of endemic species' density to all species' density. Endemism status determined based on literature of Malesia phytoregion.

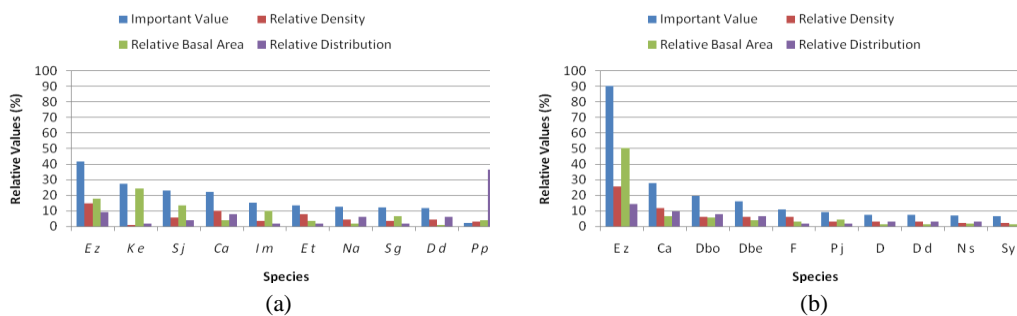
Community structure of each zone was determined by calculating trees' density, basal area, frequency (and its relative value), important

value and stratification of species. Observation on trees' stratification was descriptively analyzed related to its vertical spaces utilization [11]. Both forests were compared by Morisita community similarity index [3]. Data were tabulated by Microsoft Excel 2007 and statistically analyzed with PCA method and supported by hierarchical cluster analysis in SPSS 15.00 for windows to display the plot relationship between objects (trees) and sites based on its variables (trees' density, basal area, frequency and important value).

RESULTS AND DISCUSSIONS

Community Structure

Sort of species with the 10 highest important values in each forest showed that *Eusideroxylon zwageri* (*ulin*) and *Cananga odorata* dominated present in both forests. It was a possibility of *co-dominant* between them in Sangkima tropical rainforest. Species *E. zwageri* had a big trunk and large canopy due to its highest important value in both forests. A large canopy also showed by *Koompasia excelsa* in primary forest despite of *E. zwageri*. The highest density showed by *E. zwageri* which was presented in all sampling plots of intensively used forest as much as 26 individu and 56% sampling plots of primary forest (5 of 8) as much as 13 individu. It showed high distribution of *E. zwageri* in both forests (Fig.1). These were caused by purposely design of *E. zwageri* in secondary forest [12]. *Ulin* forest is one specific type of Kalimantan forest [7].



Description:			
<i>Ez</i>	: <i>Eusideroxylon zwageri</i>	<i>Ca</i>	: <i>Cananga odorata</i>
<i>Dbe</i>	: <i>Dillenia beccariana</i>	<i>F</i>	: <i>Ficus</i> sp.
<i>D</i>	: <i>Diospyros</i> sp.	<i>Dd</i>	: <i>Dracontomelon dao</i>
<i>Sy</i>	: <i>Syzygium</i> sp.	<i>Ke</i>	: <i>Koompasia excelsa</i>
<i>Im</i>	: <i>Irvingia malayana</i>	<i>Et</i>	: <i>Elmerillia tsiampaca</i>
<i>Sg</i>	: <i>Shorea gratissima</i>	<i>Pp</i>	: <i>Pometia pinnata</i>
		<i>Dbo</i>	: <i>Diospyros borneensis</i>
		<i>Pj</i>	: <i>Pterospermum javanicum</i>
		<i>Ns</i>	: <i>Nauclea subdita</i>
		<i>Sj</i>	: <i>Shorea joborensis</i>
		<i>Na</i>	: <i>Nauclea</i> sp.

Figure 1 Density, Basal Area and Distribution of 10 Species with Highest Important Value in Intensively Used (a) and Primary (b) Forest

Luxurious jungle performed A to E strata in both forest. Shorea in height of ± 30 dominated the hilly primary forest, while flatter area was a mixed Dipterocarpaceae forest. Overall formation of primary forest is mixed Dipterocarpaceae - *Eusideroxylon zwageri* forest. Below A stratum, continued canopy of B stratum was dominant. Similar to primary, intensively used forest also has A-E stratum, although domination of A stratum was *E. zwageri* (ulin) which is the key species of natural forest of Kalimantan [10]. Formation of secondary forest is *E. zwageri*. Ferns and trees' offspring covered ground surface layer. B stratum was dominant in both forest.

Morisita community similarity index based on trees' density showed that both zones have similar trees' density ($C_M = 0,80$). The reason were both zones stood close together and they were included as one zone before. Both forests have similar composition of trees' species density. On the contrary, Morisita community similarity index based on important value and relative basal area showed that they were different community (C_M of important value = 0,64 and C_M of relative basal area = 0,04). The differences presumably caused by human intervention in changing complexity and regeneration of trees' vegetation in intensively used forest.

Trees' Diversity

Taxa richness of intensively used forest is 36 species which is concluded in 20 family and 13 order. Annonaceae was the most family found concluded in Magnoliales order. Primary forest has 34 species which concluded in 25 families and 16 orders. Dipterocarpaceae as dominant family in this primary forest concluded in Theales order and the second dominant order is Magnoliales. Both Taxa richness in both forest was not significantly different (Fig. 2). But primary forest showed more complex taxa richness than intensively used one, in family and order number even intensively used forest has more species.

Diversity index of primary forest ($H=4.57$) was higher than intensively used one ($H=4.28$) caused by its taxa richness' complexity and density in each sampling plot. High taxa richness in family-order rates and density proportion of each tree species for each zone gave a high diversity index. Diversity index of primary forest in Sangkima was higher than diversity index of

primary forest in Barito Ulu, Middle Kalimantan, which was dominated by Dipterocarpaceae, i.e. 4,17 [2]. Both forest showed high quality diversity of natural vegetation forest, indicated by high rate of endemism that is 100%. No exotic species found in both zones. It means quality of ecological services in both zones reached maximum value as nature forest [8].

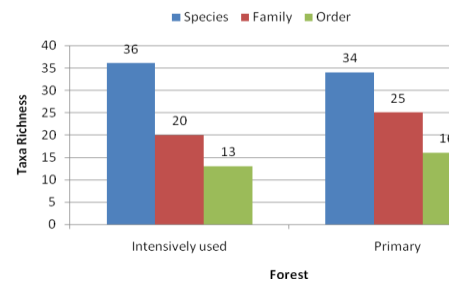


Figure 2 Trees' Taxa Richness in Intensively Used and Primary Forest

Table 3 Trees' Diversity Quality and Community Structure in Both Zones

Variables	Primary Zone	Intensively Used Zone
Stratification	A-E	A-E
Formation	<i>Eusideroxylon zwageri</i> - Dipterocarpaceae Campuran	<i>Eusideroxylon zwageri</i>
Density (ind.ha ⁻¹)	88	102
Basal area (cm ³)	229292,88	162255,47
Frequency (%)	6,18	7,00
Taxa richness:		
Species	34	36
Family	25	20
Order	16	13
Diversity Index	4,57	4,28
Rate of Endemism (%)	100	100

Bi plot Analysis

Bi plot analysis (Fig. 3) showed that tree community structures of both forests were composed by three groups (supported by hierarchical cluster analysis in SPSS). In secondary forest, *E. zwageri* was a key species and characterized by high important value, while species *C. odorata*, *Dyospiros borneensis* and *Dillenia beccariana* found in a high distribution, otherwise other trees were classified into the 3rd group. Comparing to the secondary forest, even though *E. zwageri* was also as dominant tree, but the virgin one showed more species growing in a better density, distribution and dominance.

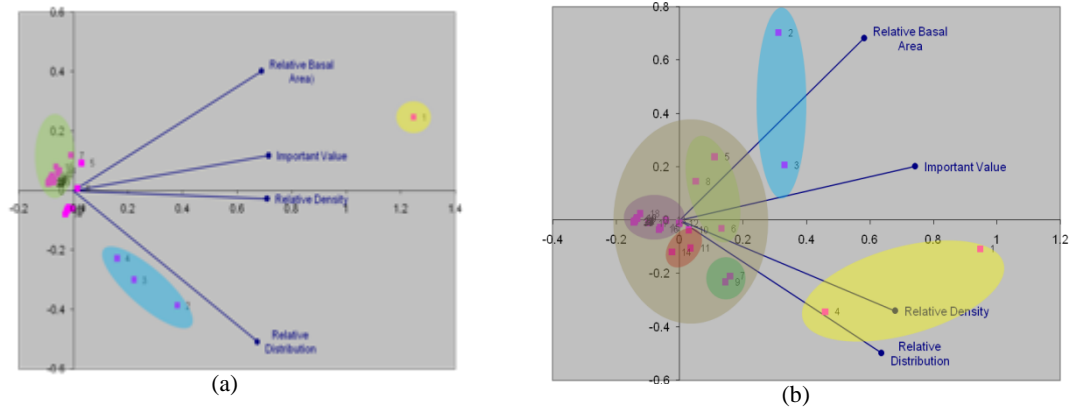


Figure 3 Bi plot Analysis in Intensively Used (a) and Primary (b) Forest

CONCLUSIONS

Primary and secondary forest of Sangkima showed a high trees diversity, richness, stratification and rate of endemism. Based on those characters, trees' diversity quality in Sangkima was still high. Taxa richness of both forests was not significantly different, but primary forest has higher diversity and more complex.

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