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THE 7TH ANNUAL BASIC SCIENCE INTERNATIONAL CONFERENCE

7-8 March 2017
Ijen Suites Resort and Convention
Malang, Indonesia

Basic Science for Improving Survival & Quality of Life

Sub Topics:
Botany
Environmental Science and Technology
Instrumentation and Measurement

BaSiC 2017 INTERNATIONAL CONFERENCE

Faculty of Science
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ABOUT BASIC

The Annual Basic Science International Conference is a scientific meeting aimed to promote mutual exchange between scientists and also experts, to discuss innovative ideas in scientific research, and to tackle contemporary problems through the application of knowledge that rise from sciences. The scope of this conference is fundamental and applied research in chemistry, biology, physics, and mathematics. The origin of this conference was initiated in year 2000, by the Faculty of Mathematics and Natural Sciences of Brawijaya University, under the name of Seminar Nasional Kemipaan (National Sciences Conference). Since then, the conference has been organized regularly on annual basis. In 2004, the conference changed its name to Basic Sciences Seminar (BSS) and started to invite international speakers and participants. The conference then expands its scope to international in 2011 and formally adopting the current name. The previous Basic Sciences International Conference was held at Atria Hotel Malang in 2016 with participants from many countries including Australia, Malaysia, Thailand, Japan, UK and Germany.

WELCOME MESSAGE

On behalf of the organizing committee, I would like to welcome you to the 7^{th} Annual Basic Science International Conference.

Firstly, I would like to thank all participants who have spent their time to come and join us for the conference. I believe that we will not be able to hold this conference successfully without participation from all of you. Secondly, I would like to thank the dean of faculty of Mathematics and Natural Sciences, Brawijaya University, because the faculty has provided us supports and facilities. I am thankful to our great keynote and invited speakers for their willingness to join the conference and share their scientific knowledge to all of us. Thanks to our reviewers who have made assessments and suggestions related to the abstracts. I also want to thank the sponsors which have made their contributions to this conference. Finally, I want to thank all members of the committee for their hard work to make this conference successful.

The Basic Science International Conference is held every year since 2010, and always organized by the Faculty of Mathematics and Natural Sciences, Brawijaya University. This conference is a forum that enables us to share our ideas among us. The participants are expected also to take their time and opportunities to know each other during the conference, in order to strengthen their networks and collaborations. In this conference, we have more than 300 participants from counties such as Indonesia, Japan, Australia, Germany, Switzerland, and Thailand. In the conference, we have plenary lectures and sessions for parallel oral presentations as well as poster presentations.

We hope that all participants enjoy all activities during the conference and this proceedings book will be useful for all of us.

Thank you very much.

Best regards,

Hari Arief Dharmawan, Ph.D.

Chairman of BaSIC 2017

WELCOME MESSAGE

On behalf of the Dean of Faculty of Mathematics and Natural Sciences, Brawijaya University, I would like to extend my warmest welcome to all delegates from all over the world. Welcome to Malang, where Malang is one of the educational city in Indonesia. Malang, which is about more than 400 meters above sea level, has many tourist destinations. Malang is like a bowl, surrounded by some volcanoes in the east (Semeru and Bromo), west (Kawi and Kelud) and north (Arjuna and Welirang Complex), and in the south are coastal areas, where we have many beautiful new opening beaches.

We are very pleased to welcome you in the proceedings book of the seventh Annual Basic Science International Conference 2017. I would like to express my gratitude to all of the participants, keynote and invited speakers as well. Many thanks also go to the reviewers and the editorial team for their big effort in supporting this book of abstracts. Last but not least my big appreciation to the steering and organizing committees, in realizing this proceedings book.

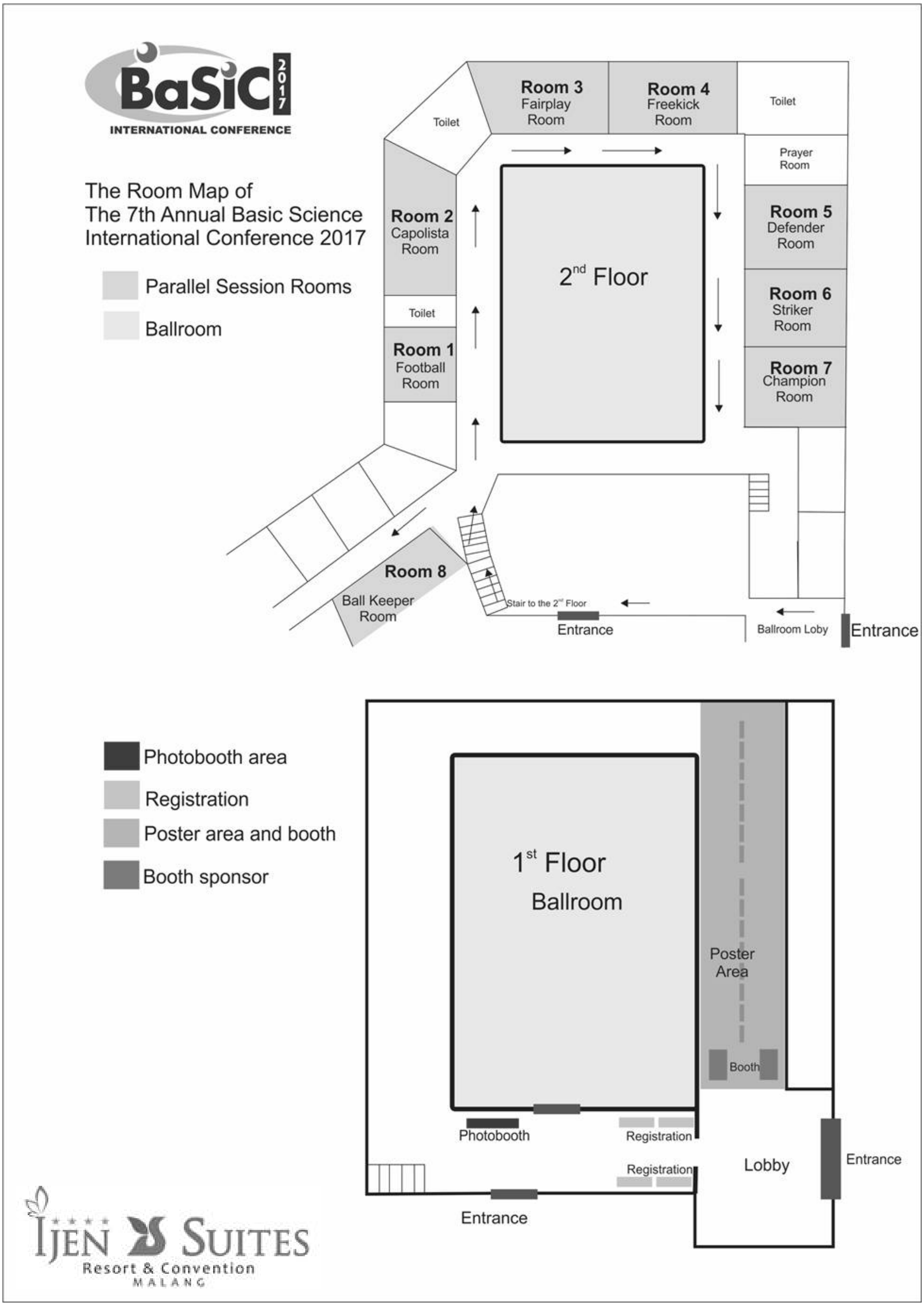
Thank you.

Faculty of Mathematics and Natural Sciences,

Dean,

Adi Susilo, Ph.D.

CONFERENCE VENUE



CONFERENCE PROGRAM

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07.30 – 08.30	Registration
08.30 – 09.00	Opening Ceremony
09.00 – 09.45	**Plenary Lecture 1**: *CRISPR/Cas9: Basics and Applications in "gene surgery".* Prof. Dr. Wolfgang Nellen, Institut fur biology, Germany
09.45 – 10.00	Coffee Break
10.00 – 10.45	**Plenary Lecture 2**: *Use of Wavelet Analyses with Potential Field Data in Exploration and Monitoring Studies* Dr. Guillaume Mauri, Neuchatel University, Switzerland
10.50 – 11.35	**Plenary Lecture 3**: *Mathematics for Solving 5G Massive Wireless IoT Networks Problems* Dr. Eng. Khoirul Anwar, S. T., M. Eng., Telkom University
11.35 – 12.30	Lunch
12.30 – 15.00	**Parallel Session 1**
15.00 – 15.30	Poster Session & Coffee Break
15.30 – 17.30	**Parallel Session 2**
17.30 – 19.00	Breaks
19.00 – 21.00	Gala Dinner

Day Two: March 8th, 2017

07.30 – 08.10	Registration
08.10 – 08.55	**Plenary Lecture 4**: *The Roles of Metal Ions in Diabetes – Metal Drugs and Supplements* Prof. Peter Andrew Lay, Sydney University, Australia
09.00 – 09.45	**Plenary Lecture 5**: *Functionalization of Stainless Steels Via Low Temperature Plasma Nitriding* Prof. Tatsuhiko Aizawa, Shibaura Institute of Technology (SIT) , Japan
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13.00 – 14.30	**Parallel Session 4**
14.30 – 15.00	Coffee Break
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BaSIC 2017

The 7th Basic Science International Conference

Basics Science for Improving Survival and Quality of Life

Botany

Diversity and Composition of Tree Species of the Secondary Tropical Lowland Forest as a Response to Structure Change of the Meranti-Dangku Landscape, South Sumatra, Indonesia

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Abstract – The diversity and composition of tree species of the tropical lowland forest will change, when there are fragmentation and changes of landscape structure of natural forest, and the dynamics of changes in the composition and diversity of trees species occur in the landscape [1]. However, there are variations among the study areas, which can be determined by tracing the linkage and interaction among indicators of changes in the composition and diversity of tree species [2]. The research objectives are to examine the the trees species diversity forest, and interactions between species on the landscape structure change in the Meranti-Dangku forest, to better understand the effects of landscape modification against individuals and groups of species. We expect that the research findings can be used to enhance the efforts on the forest restoration and biodiversity conservation.We applied a tree vegetation analysis of fragmented natural secondary forest, and conducted observations in 32 units of sample plots, whose size is 20m x 50m. Ecological analysis of all tree species with dbh $\geq$ 10 cm was conducted by identifying the local name, latin name of the tree species, and its typical characteristics, and then making the sample of herbarium. Hill's Diversity Number produced a family of number related to diversity, effective species richness, a rare species and the abundance of common species in the population [3]. We also calculated the importance value index of tree species and the Jaccard similarity index, to differentiate the level of the forest succession and the gradation among sub-landscape.The results showed significance of some parameters, which has played important roles in the detecting changes in biodiversity, namely index of species richness and species evenness, and basal area of a tree stand. Three other parameters are not significant. The changes of the tree species composition of the natural forest succession, as respond to the changes of landscape structure, and the gradation among sub-landscape, can be used as a reference on species selection in rehabilitation and restoration of the fragmented natural forest, as a part of the planning on human-modified landscape.

Keyword: Diversity indices, Importance Value Index, Similarity Index, Inter-correlation.

1. INTRODUCTION

The diversity and composition of tree species of the tropical lowland forest will change when there are fragmentation and changes of landscape structure of natural forest, and the dynamics of changes in the composition and diversity of trees species occur in the landscape [1]. However, there are variations among the study areas, which can be determined by tracing the linkage and interaction among indicators of changes in the composition and diversity of tree species [2].

The research objectives are to examine the trees species diversity forest and interactions between species on the landscape structure change in the Meranti-Dangku forest, to better understand the effects of landscape modification against individuals and groups of species. We expect that the research findings can be used to enhance the efforts on the forest restoration and biodiversity conservation.

2. METHODS

2.1 Materials

Work map of field survey in the form of an Indonesia topographical map of 1:50,000 scale, a vegetation cover type map as resulted from interpretation of Landsat TM Imagery acquisition in 2013, GPS handheld, magnetic compass, clinometer Suunto, meter types, phi band, Haga, camera, and materials needed to make herbarium.

2.2 Procedures

We applied a tree vegetation analysis of fragmented natural secondary forest and conducted observations in 32 units of sample plots, whose size 20m x 50m. We measure diameters of all tree species with dbh $\geq$ 10 cm, identified the local name, latin name of the tree species and its typical characteristics, and next made the sample of herbarium for identification in Herbarium Bogoriensis, LIPI.

To analysis of trees species diversity and composition, we use Hill's Diversity Number, which produced a family of number related to diversity, effective species richness, effective number of species, evenness of species, and the abundance of common species in the population [4; 3]). We also calculating the tree density and basal areal of tree stand [5], Importance Value Index of tree species [6], Shannon-Wienner Diversity Index, Simpson Dominance Index, and Simpson Evenness Index [7]. We also calculate the Jaccard Similarity Index [8; 7] to differentiate the structur of forest, level of the forest succession and the gradation among sub-landscape.

3. RESULTS AND DISCUSSION

Species Accumulation Curve

Within 32 sample plots, which covers 3.2 ha, we found a total of 774 species and 1,598 trees, and we processed data of species into a species - accumulation curve. We found 341 species and two unidentified species. The species-accumulation curve showed that it has reached the asymptotic number, where the addition of sample plot did not significantly increase the number of species.

Composition and Diversity of Trees Species

Indicators	Total Sample Plot	Mean	Std. Deviation	Indicators	Total Sample Plot	Mean	Std. Deviation
1. Kapas				3. Meranti Ilir			
N_0	5	27.00	14.71	N_0	7	16.57	10.34
N_1	5	22.93	12.63	N_1	7	13.82	8.99
N_2	5	19.44	11.05	N_2	7	11.76	7.90
$E_{0,1} = N_0/N_1$	5	1.15	.11	$E_{0,1} = N_0/N_1$	7	1.21	.188
N/ha	5	562	169	N/ha	7	420	198
BA (m^2/ha)	5	20.47	14.29	BA (m^2/ha)	7	15.84	13.84
2. Meranti Ulu				4. Dangku			
N_0	13	26.62	8.43	N_0	7	20.29	4.54
N_1	13	20.98	9.28	N_1	7	15.00	5.16
N_2	13	16.87	9.68	N_2	7	11.44	5.06
$E_{0,1} = N_0/N_1$	13	1.37	.296	$E_{0,1} = N_0/N_1$	7	1.47	.469
N/ha	13	588	309	N/ha	7	479	206
BA (m^2/ha)	13	22.54	7.77	BA (m^2/ha)	7	13.24	5.52

Table 1. The results of the calculation of the indices of biodiversity of forest vegetation based on Hill's Diversity Number and stands structure on each sub-landscape

We use Hill's Number of Diversity [9] to determine the richness of species, effective number of species (true diversities), abundance distribution of species, and the evenness of species, as well as the structure of the forest trees, i.e. the density of trees and basal area of trees stand (Table 1). We calculate the important value index of tree species, Jaccard's index for measuring the similarity between communities, and Shannon and Wienner Index to differentiate the level of forest succession, entropy, and gradien between the sub-landscape.

The results of the study showed that the increase in the effective number of species (true diversities) correlated with a decrease in evenness of species. This is the identifier of the process of secondary succession of forest ecosystems, which indicates the occurrence of a grouping of the new tree species population distribution (clumpiness).

Importance Value Index of Tree Species

Based on the highest order of the important value index, the main species composition in the sub-landscape of Kapas, i.e. Palaquium gutta-percha (Hook) Ball, Litsea sp, Xanthophyllum rufum, Benn, Shorea parvifolia Dyer, and Castanopsis acuminatissima DC. In the sub-landscapes of Meranti Ulu (specially of young trees class), Meranti Ilir and Dangku are dominated by secondary species or pioneers species, such as Bellucia pentamera Naudin, Bellucia axinanthera Trian, Macaranga gigantea (Rchb. f. & Zoll.) Mull. Arg., Endospermum diadenum (Miq.) Airy Shaw, and Ficus variegata Blume. The degraded natural forest has a small average of an important value index, none of dominant species, and the species composition is similar to the natural forest (old growth dipterocarp forest).

Ecological analysis showed significance of some parameters, which have played significant roles in detecting changes in biodiversity, namely index of species richness, species evenness, and basal area of a tree stand. Three other parameters are not significant. The changes of the tree species composition of the natural forest succession, as respond to the changes of landscape structure, and the gradation among sub-landscape, can be used as a indicator in species selection in rehabilitation and restoration of the fragmented natural forest, as a part of the human-modified landscape.

Tree diversity Index	Kapas		Meranti Ulu		Meranti Ilir		Dangku	
	DBH >10-30 (cm)	DBH >30 (cm)	DBH >10-30 (cm)	DBH >30 (cm)	DBH >10-30 (cm)	DBH>30 (cm)	DBH >10-30 (cm)	DBH >30 (cm)
1. Shannon's and Wienner Index	4.51	3.04	4.60	5.22	3.59	3.32	3.46	3.24
2. Simpson Dominance Index	0.01	0.06	0.02	0.03	0.10	0.04	0.04	0.07
3. Simpson Evenness Index	0.01	0.04	0.01	0.01	0.01	0.03	0.03	0.01

Table 2. Index of tree diversity of young tree (dbh ≥ 10-30 cm) and mature tree (dbh >30 cm) at four locations of the Meranti-Dangku landscape.

Barbour states [8] that the value of Shannon's and Wienner Diversity Index can range between 0-7, with criteria: 0-2 (low), 2 (medium), and > 3 (high). Thus, the level of species diversity index of young and mature trees at four locations are classified as high.

Simpson's Dominance Index of Dangku forest was the highest at both young and mature trees. However, for the forest at Dangku had Shannon's and Wienner (Table 2.)Diversity Index is lower, at both young and mature trees, compared to a third of other locations. Specifically, the young trees, with a diameter of ≥10–30 cm, at Dangku had the highest Simpson's Evennes Index., compared to an other three locations.

3.1 Discussion

Correlation between Tree Species Diversity Index

The calculation of the value of the correlation between the vegetation of the forest biodiversity indices, was conducted based on Hill's Diversity Number, and structure of the forest stand, performed in Kapas, Meranti Ulu and Meranti Ilir, indicating there is a very significant positive correlation *(p=0.01)* between the number of species in the plot or the richness of species, and the number of effective species (true diversities), and the abundance of species distribution, and as well as between the number of effective species with an abundance of species distribution.

In addition, in Kapas, there was a significant positive correlation (p = 0.01) between a richness of tree species and tree density of forest stands, as well as a highly significant positive correlation (p = 0.01) between the abundance of tree species distribution with a basal area of forest tree stands.

In Meranti Ulu, shows that the richness of species and the effective number of species (true diversities) in Meranti Ulu, both negatively correlated in a very significant *(p=0.01)* against species evenness. This means that if the total number of species in the plots and the effective number of species increased, so this is precisely indicated that species evenness will decrease. Species diversity of ensembles in undisturbed primary forest was distinctly higher than in disturbed or secondary forest. Disturbed forest with tall trees remaining appeared to represent impoverished subsets of the undisturbed primary forest community [10].

Importance Value Index of Tree Species

The analysis to the top ten IVI showed that each group of forest on each location, and a different diameter class was dominated by different species, thus the ability of species to live in a place is very depending on its ability to adapt to environmental conditions of the habitat. Therefore, the environmental conditions are very instrumental in the selection of species to be able to survive in a habitat.

There is no dominant young tree species, where the average IVI is low. This means that in the sub-landscape Kapar has a high species richness, especially for young trees. Old dipterocarp forests in Kapas and Meranti Ulu sub-landscape are managed using silviculture system of the restoration of natural forest ecosystem, the species of young trees and mature trees, have low IVI compared to IVI in secondary forest in sub-landscape of Meranti Ilir and Dangku.

The Implication against Island Biogeography Theory

Every ecologist know [11], that, Island Biogeography Theory (IBT) states that the number of species in a habitat Island is governed by a balance of dependence distance colonization and dependence of extinction area, and it predicts that the habitat of the smaller and more isolated will be supported by fewer species.

A fragmented landscape, whether in the dissection phase, dissipation or break apart, then in accordance with the IBT will happen to lose and decline in species richness, species-area curve as that hypothesized by IBT [12].

Deviations against the IBT as stated by [13] are, that, the dynamics of populations and communities are often heavily reinforced by the relatively fragmentary habitat against the natural condition. Likewise, other discoveries are that habitat fragmentation affects different species in different ways. Some species are declining sharply, or disappeared in fragments, remain stable in other area, and increases dramatically, elsewhere [14].

The results of this research also show, that, the young growth tree species in the sub-landscape of Meranti Ulu and Meranti Ilir, and the young growth and mature growth of tree species in sub-landscape of Dangku, were dominated by a secondary tree species, which controlled the growth phases of a tree in the process of forest succession. The symptoms are so common on the type of vegetation that lead to the climatic conditions and to stability. The species composition of the natural forest, that, has developed in the long run, will show physiognomy, fenologi, and low power regeneration, and tends to be steady. Thus, the new dynamics of the forest community are manifestly and less conspicuously, where the turning generations, or species regeneration, does not seem as if, as a result of certain rare species are dominant, since all species have to adapt in a prolonged period of time [15].

At the stage of forest climax, then, the IBT is likely to be re-occur [15]. It was observed during this research results that the reduction of the number of populations and species of trees occurred, when the phase of forest fragmentation is Attrition, and an increase in the number of species of trees and evenness index of tree species on the secondary growth forest, during the phase of Dissipation and Dissection [16].

4. CONCLUSIONS

The effect of the change of landscape metrics, especially on the regrowth and regeneration of the forest succession, is significantly to increase the richness of species, the evenness index of tree species, and basal area of tree stand. The increase in the effective number of species (true diversities) was followed by a decline in the evenness index of tree species, and the grouping of the new tree species population (clumpiness). This is an indicator of the occurrence of a succession process of the secondary forest ecosystems.

Dangku sub-landscape has an average value of Shannon's and Wienner entropy index, an index of tree species richness, a tree density, and basal area, which are higher than in Meranti Ilir sub-landscape. This indicates that the entropy condition for the succession process of secondary forest ecosystems in Dangku sub-landscape relatively more steady than on Meranti Ilir sub-landscape.

Secondary forest of the adjacent sub-landscape of Meranti Ilir and Dangku are experiencing the high pressure from the deforestation and forest degradation., An average value of density of trees stand is almost the same, and has a very significant positive correlation between density of trees stand and index of tree species evenness. However, the Jaccard's similarity index both sub-landscapes is very low.

The change of landscape metrics led to the decolonization of the composition and diversity of tree species in the succession of secondary natural forest, and significantly cause a rise in the index of tree species richness, and the index of tree species evenness. This phenomenon is deviation from the Island Biogeography Theory (IBT). However, it is temporal, and will follow the dynamics of the forest succession process until a climax of forest succession is achieved, as the old growth dipterocarp forest. This phenomenon occurs due to the edge effects, shade-intolerant in gap dynamics of forest canopies, connection between patches, as well as seed dispersal factors.

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