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Biodiversity as part of urban green network system planning case study: Pontianak City

Yudithya Ratih^{a*}, Jockie Zudhi Febrianto^b

Abstract

Urban ecology is a new paradigm in viewing urban area as human-dominated ecosystem. This kind of ecosystem consists of socio-cultural as well as economical aspects which play important roles. Recently, urban ecosystem had caused major ecological problems such as flood, Urban Heat Island, pollutions, and biodiversity loss. Green network system is crucial factor in urban ecology and become an alternative approach to overcome ecological problems in urban areas. Urban green space in a form of parks (patch) and corridors are integral part of green network system, therefore they are potential urban fabrics (Hough, 1989). Due to specific social and ecological function, green open space in high density settlement should integrate these functions. On the other hand, urban biodiversity serve as indicator of environment quality (Muller, 2013). The aim of this paper is to identify urban biodiversity in the city as a base for planning an urban green network system.

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Key words: urban ecology; green network system; urban biodiversity

1. Introduction

Human and nature are the two thing that can not be separated. Natural system and how human use it to their needs are the main purpose in this planet, especially in urban area where they mostly dwelled. In the former years, the science of these natural system (in term of ecology) and the knowledge of urban area are not connected. In the

*Corresponding author. Tel.: +62 811574130; fax: +0-000-000-0000 .
E-mail address: yudratih@gmail.com

former years, ecologists tend to be more interested in pristine area (Collin, 2000; Grimm, 2008) but recently they start to view urban mosaic as an ecological system.

As the human population grow and the city became major habitat for human, city became the most invasive ecosystem on earth. Due to these human expansion, nature degraded and natural resource is at risk. Urbanization has changed the landscape mosaic and this contribute to the biodiversity loss within the city.

In urban area, natural system play an important role as they support human activities (Forman, 2008). Biodiversity, on the other hand, indicates the quality of environment of these human habitat.(Muller, 2013).

Due to the need to fulfill the 30% of green area in the city, every local government urged to build more parks. A quantitative approach was made to calculate the city needs base on its habitants, the amount of vehicles and the carbon need for the 30 years a head. A masterplan of green open space was made to meet this need, mostly based on the city structure rather than ecological structure.

As a city that is located in the Borneo Island, Pontianak is surrounded by regions that rich in biodiversity. Some rare and endangered specieses, such as crocodile, Orang Utan and lots of bird species and flora were found in the area nearby. This species richness is degraded as the city developed, changing its mosaic, from natural cover to building blocks. The green open space was made, mostly to meet the human need of outdoor space with hard land covered to do their activities outdoor, rather than to feel the nature within the city. This research aim to figure out factors that influence the level of biodiversity of the green open space in Pontianak.

2. Methods

Kota Pontianak is located in the province of Kalimantan Barat ($0^{\circ} 02' 24''$ N, $0^{\circ} 05' 37''$ S, and $109^{\circ} 16' 25''$ E). It has a total area of $107,82 \text{ km}^2$. its population reached 565.456 inhabitant in 2011 with population density about 5.244 person/ km^2 (Pontianak Municipal Statistic Berau, 2011). The study area covered the public park managed by the Pontianak City Authority. There are 23 parks that being observed in this research, mostly were designed with ornamental vegetations, some are urban forests and a abandonland.

In order to investigate the relationship between biodiversity level in urban green area, a number of biodiversity level measurement were carried out over the study area. The biodiversity level was developed from Muller's biodiversity level measurement form. The parameter which were measured in the sample area were size, sealing level, linking fuction, species diversity, structural diversity and age of vegetation. Landuse, park and vegetation type were added to the assessment form to find the connection between these parameters. The collected data was presented in a map to overview the spatial pattern within urban structure. A map of spatial pattern was produced to present the connection of parameters within urban spatial pattern.

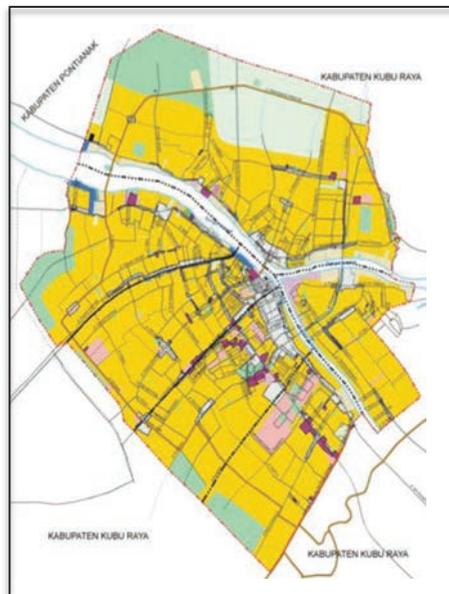


Fig. 1 Landuse Map of Pontianak

3. Result and Discussions

Base on the park’s characterisric in the Pontianak city, most of the are ornamental park, with size average less than 1 Ha. Parks are scattered within the city and most of them are located in the Pontianak Tenggara area and less in the city center. Vegetation cover are mostly ornamental, as they were designed, some are wooded forrest cover and and only a little covered with natural vegetation, as shown in the tabel 1 below.

Tabel 1. Parks Characteristic

No	Location	Green Open Space	Width (Ha)	Landuse	Vegetation Type	Biodiversity Level
1	A1	Neighbourhood Park	0,211	Tr	OA	4
2	A2	Neighbourhood Park	0,211	Tr	Or	4
3	A3	Village Park	0,305	Gp	OA	3
4	A4	Ornament Park	0,015	Tr	O	1
5	A5	City Forest	2,425	Gn	AL	3
6	B1	Ornament Park	0,082	Su	Or	1
7	B2	Village Park	0,813	Su	OA	2
8	B3	City Forest	4,669	Fe	Al	4
9	B4	City Forest	3	Fn	AL	4
10	B5	Ornament Park	0,065	Tr	Or	2
11	B6	Park	0,717	Tp	AL	3
12	B7	Ornament Park	0,111	Tp	AL	2
14	C2	Ornament Park	0,078	Tr	Or	2
15	C3	Ornament Park	0,467	Fn	AL	2
16	C4	Village Park	0,483	Gp	Or	2
18	C6	Ornament Park	0,06	Wg	AL	1
20	C8	Neighbourhood Park	0,097	Dl	OA	3
22	C10	City Forest	1,5	Gs	AL	4
23	D1	Sub District Park	4,503	Gp	Or	3

Natural vegetation seems to influence biodiversity level, as shown in data A1, A2, B3, B4 and C10. Compositon of natural vegetation and excotic species also reached a high level of biodiversity, as shown in data A3, A5, B6, C8 and D10, shown in the cart below:

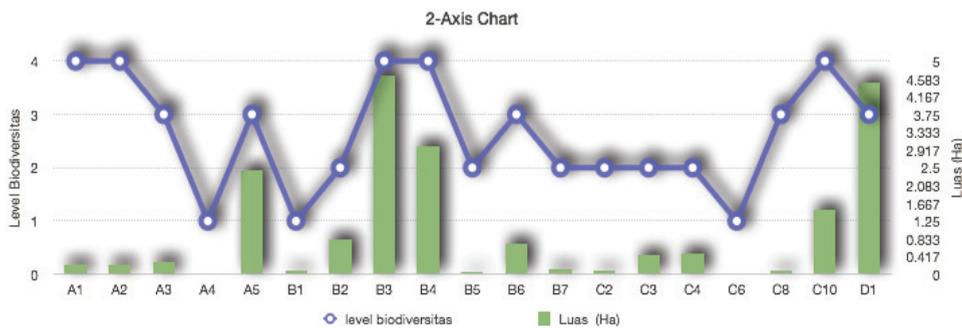


Fig. 2. Relation of Biodiversity Level and Area

As we layered the green space and the landuse map, we found that most parks with higher biodiversity level are

adjacent to the stream river corridor. When they are nearby, they tend to have more natural vegetation than other parks. Some parks that adjacent to the street corridor tend to have lower biodiversity level. This means that stream corridor play important role in increase the spread of natural vegetation, as shown in figure 3 below.



Fig. 3. Green Network System of Pontianak City

4. Conclusions

This research has found that biodiversity level of park in Pontianak City is determined by vegetation type cover. Natural vegetation cover contributed to the number of species as they rise the biodiversity level. Composition of natural and ornamental vegetation also reached a high value of biodiversity level. Parks location, as they are adjacent to the river stream, has also have a higher biodiversity level. This means that parks in the city, in order to serve as an ecological structure as well as social function, need to combine both ornamental as well as natural vegetation. This research also found that parks which interconnected with the stream riparian would maintain its species richness. And the last, more other research related to this urban biodiversity still need to be addressed.

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