

**RIVER ECOSYSTEMS WITHIN URBAN AREA
(Case Study : Palembang Metropolitan Area)**

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ABSTRACT

Town is centre of activities, where resident, infrastructure network and human being activity take place with all economic interaction, culture and social. Palembang is one of the town among some other metropolis in Indonesia having area land structure "low land". The mentioned marked with regional geomorphology structure of formed river to the some river branch from one great river which passing town, with height in area of around river less than 5 m above means sea level (msl). With this condition, existing river will is always influenced by sea water level, where high water moment, sea water tide influence will influence exit current drainage coming from its upstream region (town). So that top rain moment, water which do not be accomodated in river, because water level lest than upstream, will abundance in vinicity region, so that suffuse in low area or which is ordinary to be referred is by floods plain.

At some case, the core important at some town growth which do not in control, like inconsistency of settlement of area with environment, one of the problem to arise is degradation of quality of itself town environment. One aspect do not control growth of town is expressed with disregarding of problem of land use planning at region that having high natural and ecological value. Many method have been conducted to overcome the problem of floods that happened in urban area, what in general can be classified to becomes : approach of non structural and structural approach (Correira et all, 1999).

In that sense, the aim of this research is to develop a spatial approach that could incorporate the environmental perspective and the environmental services inside the planning process, through the application of GIS tools (knowledge-based modeling). For that purpose, concepts and theories proposed in the framework of Sustainable Development (Landscape Ecology, Ecosystem Analysis, Land Unit Concept, Ecosystem Services and Urban Ecosystem) were applied for analysing secondary data obtained from different public institutions in Palembang Metropolitan Area. As a result, a preliminary spatial approach for identified river and urban ecosystems and their interactions in spatial terms was developed. If monitoring system change of land use and capacities of analyse systems can be created by exploiting GIS technique, or Geographic Information System, hence condition of river ecosystems service to its environment can be monitored.

Keywords : low land, environmental services, GIS

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1. INTRODUCTION

Palembang is one of the town among some other metropolis in Indonesia having area land structure " low land". The mentioned marked with regional geomorphology structure of formed river to the some river branch from one great river which passing town, with height in area of around river less than 5 m above means sea level (msl). With this condition, existing river will is always influenced by sea water level, where high water moment, sea water tide influence will influence exit current drainage coming from its upstream region (town). So that top rain moment, water which do not be accomodated in river, because water level lest than upstream, will abundance in vinicity region, so that suffice in low area or which is ordinary to be referred is by floods plain.

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2. MATERIAL AND METHODS

Data which is used in research are line maps with scale 1 : 1000, result of mapping with aerial photograph year 2004, what consist of contour data, land use to obtains open space and close space data, land type, and vegetations type. Field data obtained to know region flooding areas and the duration flood and also town drainage condition and rainfall.

One of the approach of ecosystems that be able to exploited for the description of hierarchy characteristic from social condition and formation of surface of earth as system as a whole is "Landscape Ecology" (Zonneveld, 1989). This system is used to understood comprehend ecosystem function and it's interaction between town and river and to description of is condition of land with mapping natural structure and ecosystems using spatial approach.

Analysis system to be used to see the condition of Sub DAS ecology is principle "Bank Balance" (Detwyler, 1972), change and condition evaluated each part of Sub DAS from condition of Sub DAS regions as a whole at town system. This approach use one unity, where interaction process and element and is influence each other, change in one of the parameter will influence the condition of ecosystem as a whole. As a result, a preliminary spatial approach for identified river and urban ecosystems and their interactions in spatial terms was developed. If monitoring system change of land use and capacities of analyse systems can be created by exploiting GIS technique, or Geographic Information System, hence condition of river ecosystems service to its environment can be monitored.

3. RESULTS AND DISCUSSION

Metropolitan Palembang geographically lay in Latitudes are 2° 52' - 3° 5' South latitude and longitudes are 104° 37' - 104° 52' East longitude with means height is 2 until 32 meters from sea level. Boundary of Palembang Administration are north side, eastside and west side abut on Sub-Province Banyuasin, south side with Sub-Province Muara

Enim and Sub-Province Ogan Ilir. Metropolitan Palembang consist of 14 district and 103 regional sub-district with total area is 400,61 Km2.

Metropolitan Palembang have 19 DAS systems with most have estuary to Musi river (Figure 1). From 19 DAS systems , 6 DAS have estuary to in Musi river, while 3 DAS have estuary to northwards namely Sub-Province Banyuasin. Though Metropolitan Palembang have location far from sea, but existence of tide and ebb by sea, especially when tide enough bothering jetting of branch river.

Table 1. Name of DAS in Palembang City with total area

No	Name of DAS	Area (Ha)
1.	Gandus	2,394
2.	Gasing	5.211
3.	Lambidaro	5.209
4.	Boang	867
5.	Sekanak	1.139
6.	Bendung	2.259
7.	Kidul	286
8.	Buah	1.082
9.	Juaro	686
10.	Batang	559
11.	Selinca	483
12.	Borang	7.209
13.	Simpang Nyiur	2.285
14.	Sriguna	491
15.	Aur	658
16.	Kedukan	1.099
17.	Jaka Baring	3.761
18.	Kertapati	2.509
19.	Keramasan	3.288

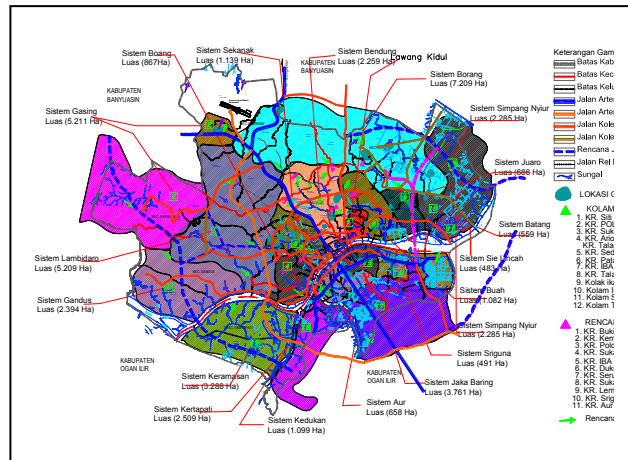
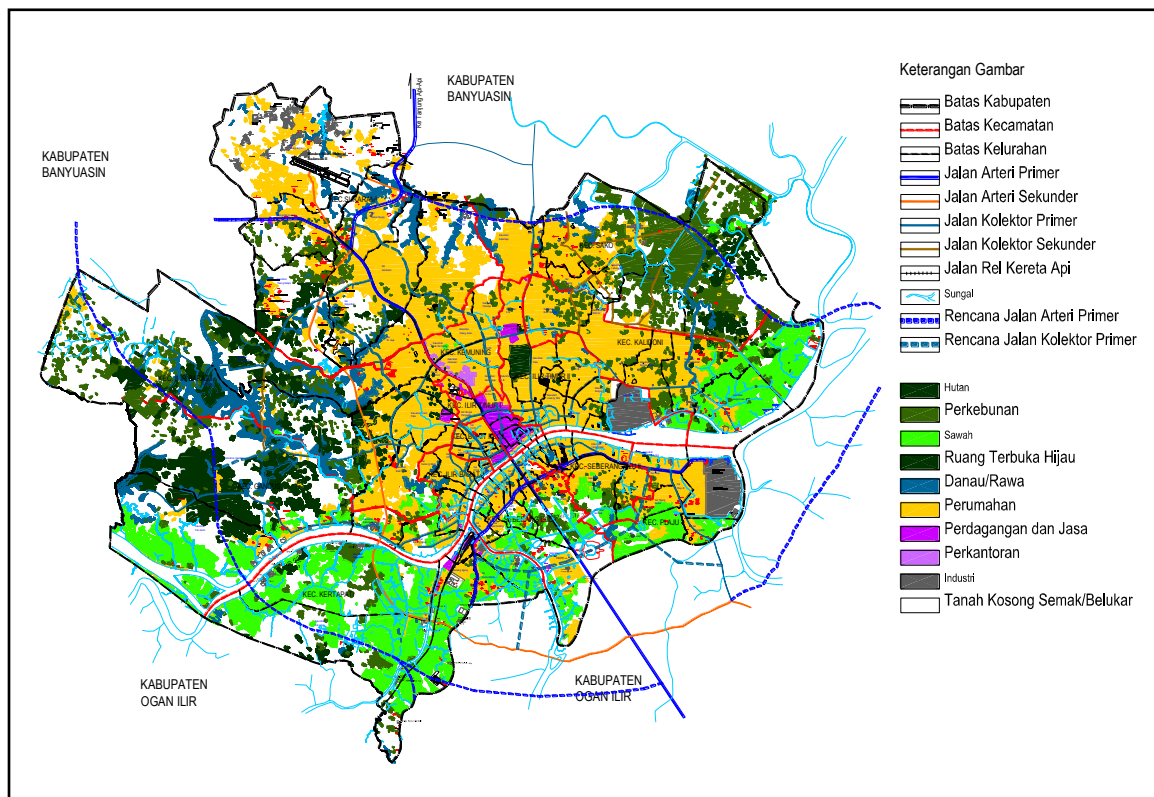


Figure 1. Split of DAS systems in Palembang

The combination of sosio-economic activities and the city's growth process gives as a result the current land use pattern of the urban area. As a spatial expression of the performance of the urban activities, this variable provides a good perspective about the city's dynamics and in some way provides a good idea of the intensity of the use of space.

The pattern distribution of the land use in Palembang Metropolitan area shows a city a high percentage of non urban land around 68,78 % of the total. The other activities, such as residential and residential with economic activities such as commerce, industry, education and other uses represents approximately 31,96 % of the total. The agricultural of dry land use represents 24,60 % of the area non urban and 14, 61 % of the total area representation agricultural of wetland. Figures 2, can see the land use pattern shows a gradual decrease of intensity of use, which start the city core with high dynamic activities such as commerce and industry and diminishes towards the periphery with residential activities. In the same way, the old parts of the city have a more intensive use than the new ones, because of the type of uses they present whilst the new parts are only use as "bedroom" areas with less intensity of use.



Figures 2. Land use distribution in Palembang urban area

Amount of population Palembang city is make-up of in range of time 1999 - 2002 with growth rate 2,1 % the growth relative mount if compared to year growth 2003 equal to 2.3 %. In the year 1999 amount of Palembang city equal to 1.433.099 head and experience of improvement become 1.560.075 head in the year 2003. In the year 2003, Palembang city have density equal to 39 head/ Ha. Big Density relative at district of Ilir Timur I (around 3.348 head/ha), District of Seberang Ulu I (around 2.894 head/ ha) and District of Ilir Barat II (around 2.732 head/ ha).

Housing with urban character (outside settlement of swamps) spread over in 8 district, broadly equal to 13.677 Ha (38,01%). Including housing which with character countryside only spread over in 4 district, that is District of Ilir Barat I (around 327 Ha), district of Sukarami (around 245 Ha), district of Sako (around 40 Ha) and district of Ilir Barat II (around 27 Ha). Settlements at swamps area spread in location for the width of 1.855 Ha, in 3 district are district of Ilir Barat II (1.225 Ha), district of Ilir Barat I (439 Ha) and district of Seberang Ulu I (191 Ha).

The combination of land use, population density and housing density for finding a preliminary recognition of the intensity of use in the city constitutes the first step in the spatial identification of the integral urban pattern of Metropolitan Palembang, which is assessed in terms of the intensity of use of the urban structure

Te identification and analysis of the interactions between the Musi River and Metropolitan Palembang ecosystems are based on he spatial identification of the first one and the determination of the urban pattern of the second one. The overlay of those results

and the use of aerial photographs as means of checking the obtained map allow the identification of the degree of disturbance (modification) that the city puts into the river ecosystem.

The four types of degrees of disturbance in the Musi river ecosystem in Palembang City, are :

Type 1 : Least modified. The areas qualified as type one can be considered as the least modified in the Musi river ecosystem. The current urban pattern does not exert high intensity of use, maintaining most of their original and natural features (physical and hydrological). The state of the environment in this area is acceptable, a condition that supports the performance of most of the ecosystem services of the Musi river ecosystem in Palembang City.

Type 2 : Moderately modified. These areas present a certain degree of urban intervention in the Musi River ecosystem, but the type of settlement on the terrain was done without major alterations. These are the areas with average intensity of use, where the urban patterns present medium densities, mostly residential uses and an acceptable presence of open green areas. The presence of uncovered areas distributed within type two assure to some extent the performance and provision of the river's functions and services.

Type 3 : Highly modified. The settlement pattern in this type was created with extensive modifications on the river ecosystem, changing the original topographic and morphologic features and removing soils and vegetation. There are high percentages of impervious area and this type presents dynamic functions with high densities, conditions that reflect high intensity of use of the area.

Type 4 : Very highly modified. These are the areas that show drastic alteration of the original conditions of the river ecosystem, where the topography, geomorphology, soils and vegetation do not conserve any traces of their original features. These areas present the highest intensity of use of urban pattern, with very dynamic uses and very high densities. The almost total pavement of these areas has resulted in scarce presence of open green areas, a condition that considerably restrict the functioning of the river ecosystem.

4. CONCLUSION

- (1) The worldwide understanding of the reasons behind the current urban and environmental deterioration has lead to the development of approaches that could incorporate the environmental perspective inside urban planning process. One of the se approaches is landscape ecology, which includes ecosystem analysis and land unit concepts in an attempt of simplify the complex interrelations between urban and natural areas, providing a comprehensive understanding about the interrelations between urban and natural ecosystems.
- (2) Metropolitan Palembang and Musi River could be considered a good example for examining the permanent interrelation between urban and natural ecosystems. This interrelation has resulted in negative consequences for Musi River and Metropolitan Palembang. The degree of deterioration of the river is changing the direction of the service provision : those services are now considered constraints instead of being considered benefits. This is the case of specific services, such as natural water purification, flood control, food supply, water supply and recreation, which are some

of the most altered services from the thirteen ecosystem services identified during the analysis.

- (3) The recognition of the relevant role that environmental, urban and socio-economic variable are playing in the current state of Metropolitan Palembang and Musi River ecosystems was done in the basis of the spatial analysis and identification of the river ecosystem. In the general terms, environmental elements (geomorphology and vegetation), urban patterns (land use, population density, housing density, road network and open spaces) and socio-economic factor (urban poverty, illegal occupation and land value) can be considered relevant variable for expressing ecosystem services to cities in spatial terms. Those elements were the inputs of a spatial approach (a raw knowledge-base model) which could allow the incorporation of the environmental perspective in different stages of the spatial analysis, providing intermediate and final output that can be used inside a planning process framework.

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