

Understanding Urban Development at Lowland Environment

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ABSTRACT

Palembang, located on the lower basin of the Musi River, has experienced of urbanization which transformed the physical environment of urban areas. Irregular and unplanned physical growth of cities has been one of the most important problems of urban development. Low-lying area is one of most rapid growing area of the city therefore the main result of land use changes process in this area that not fully controlled was decreasing natural hydrological function and ecological value of urban areas. This paper aimed to present the form and character of urban development in its geographical setting (at lowland environment). Urban morphological approach is used in this study and the results revealed that the urban morphology analysis can provide an appropriate framework for solution of the complicated urban planning issues to achieve good quality development and at the same time maintaining the natural configuration of the environment.

Key words: *urban development, lowland environment, urban morphology*

INTRODUCTION

Palembang, located on the lower basin of the Musi River, lowland and flood prone areas can be found in the city and the surrounding area. Musi River is the main drainage for the city and the river influenced by tides that have the difference 0.8 – 1.30 m (study at 2001). Fluctuation of the river also influences streams and swampy areas in the city.

Palembang has experienced of urbanization which transformed the physical environment of urban areas. In Palembang river basin area has been part of the city system. Low-lying area is one of most rapid growing area of the city therefore the main result of land use changes process in this area that not fully controlled was decreasing natural hydrological function and ecological value of urban areas.

Urban morphological approach is used in this study to understand the form and character of the city in its geographical setting. The urban morphology analysis can provide an appropriate framework for solution of the complicated issues of urban spatial planning. Moreover, urban morphological approach will be used to generate alternative urban development scenario on the basis of environmental constraints and predictions about future urbanization which are critical to the protection of ecosystems and the sustainability of communities.

With recognition of the ecological significance of lowland urban areas and their sensitivity to rapid urbanization, greater emphasis placed on the issue of sustainability to achieve good quality development. Since the city is located in a lowland environment, creating better places can improve the life of the people who live in them, and at the same time can maintain the natural configuration of the environment

STUDY AREA.

The study area is located at the densely populated and urbanized low-lying area in the heart of the city, where the growth of the city began. In accordance with the hydrological conditions, the study area belongs Sekanak sub-basin, part of the Musi river system. Streams flows in the area and functioned as the drainage network, and all rivers and swampy areas inside are influenced by fluctuation of Musi river tide. *Figure 1* shows the location of the study area in the city of Palembang.

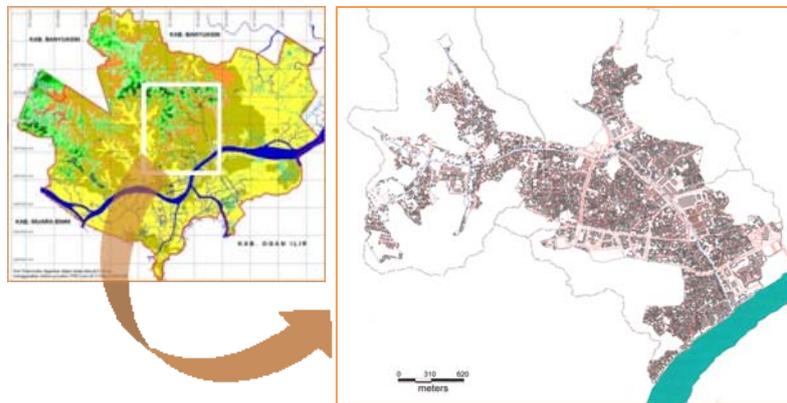


Figure 1. Study Area
Source:

The study area is the low-lying area inside the Sekanak sub-basin, DEM between 0.10 – 3.00 m above sea level has been delineated. The area has around 417.7 ha and consist of built up areas 82.83 % and another 17.17 % of non built-up areas. In general the use of low land in the study area can be classified into: greenland and reservation area; wetland (swampy area, reclamation, pond/retention pond, river); residential area (settlement and housing); commercials and services; public facilities; and infrastructure. (*Figure 2 and Table 1*).

Table 1. Land Use of The Study Area

Source: Analyses

No	Land Use	Area (Ha)	%
1	Greenland and reservation area	22.13	5.30
2	Wetland (swampy area, retention pond, river)	13.90	3.33
3	Residential area(settlement and housing)	305.47	73.13
4	Commercials and services	10.04	2.40
5	Public Facilities	30.48	7.30
6	Infrastructure	35.67	8.54
		417.69	100.00

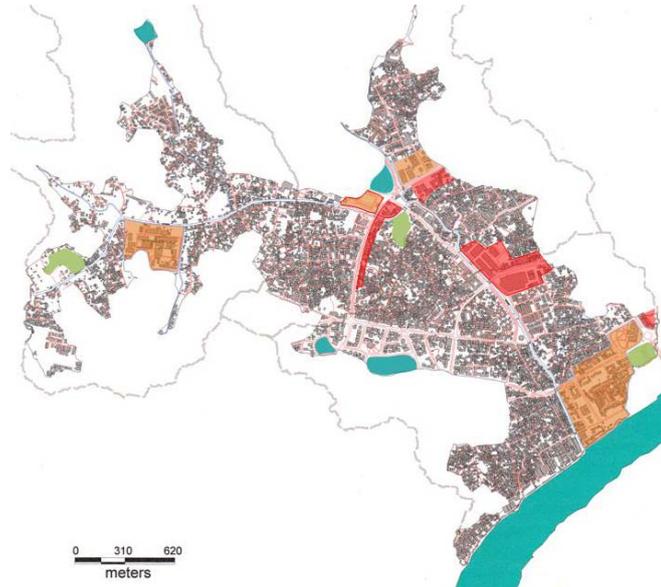


Figure 2. Landuse of the Study Area

Source: Analyses

IDENTIFYING URBAN GROWTH PROCESS AT THE STUDY AREA

As an inner city of Palembang, the study area has experienced severe urban growth since the colonial era that resulted changes in the spatial structure of the area with respect to diverse population, morphology, and the relationship to the whole city area.

In the past, urban patterns of the study area used to be tied to the logics of the watershed, with water being one of the most important factors. The built up area, mostly dwelling, was growing alongside the river banks and stretched not far inland following the watercourses, and transport was principally carried out by ship. Urban road network was first built during the colonial era and initially constructed by considering watercourses.

In the same period, the European district was built in a flat ground and some are hilly area, with good drainage system where gutters and two retention ponds have been provided. On the other hand, the tradition to live on the river banks and floodplain was remained occurred in the old part of the area.

The built of bridge over the Musi river at the 1960s gave a big influence on the area development and increasing the accessibility of study area. River is no longer functions as the transportation mode. In the 1970's a new complex of sports facilities along with the athlete village has been developed through "land reclamation" by backfilling swamps in the area, and this was followed by the growth of spontaneous settlements in the wetlands. At about the same time big fire had destroyed the dense settlements at 24 Ilir (middle part of the area), that mostly located in the floodplain and swampy areas. "Land readjustment" has done in the land of fire and new settlement has built in a planned and orderly, area for commercial and social facilities were provided.

At the present time, some part of the area grew into a part of the Central Business District of the city. Hotels, commercial centers and other urban facilities located in reclamation area, commercials and mix used buildings grew and along strategic main roads. Meanwhile, increasing urban population and activities were continuously stimulating the adjustment of the land use function in the area. On the other hand many neighborhood units with high density and irregular pattern can be found alongside the streams occupy flood prone and wetlands.

RESULT AND DISCUSSION

In order to understanding the relationship between urban land use change and its driving forces, its necessary to link the resulted changes to their driving factors. The morphological form of the study area will be identified and explored by figure ground and linked, and the area is divided into 3 zones (sub areas): Zone A (upstream area) has around 119.9 ha, Zone B (midstream) has around 133.4 ha, and Zone C (downstream) has around 164.4 ha area.

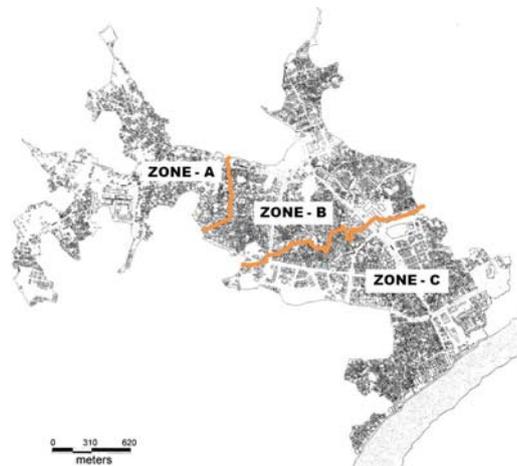


Figure 3. 3 Zones of Study area.
Source: Analyses

Figure Ground

Spatial configuration in most part of the study area on the current is influenced by the spatial intensification with random small open spaces that provides a form of densely, and the adjustment processes on land use function has associated with more informal urban development. The texture patterns of urban area will be explained by the amount of gaps in roads or by the distance between buildings.

ZONE A		ZONE B		ZONE C		Remarks		
						Building Density:		
Area	119.90 ha	Area	133.40 ha	Area	164.40 ha	Building Density		
Road	5.16 ha	Road	12.54 ha	Road	17.97 ha	ZONE	GROSS	NETT
Wetland	4.84 ha	Wetland	3.87 ha	Wetland	5.19 ha	Zone A	26.00 %	33.47 %
Building (2.755 u)	31.22 ha	Building (3.730 u)	53.67 ha	Building (4.283 u)	65.78 ha	Zone B	36.00 %	46.57 %
Greenland	16.62 ha	Greenland	1.75 ha	Greenland	3.76 ha	Zone C	40.00 %	47.84 %
Unbuilt Spaces	93.28 ha	Unbuilt Spaces	115.24 ha	Unbuilt Spaces	137.48 ha			
Non-built spaces	26.62 ha	Non-built spaces	137.48 ha	Non-built spaces	26.924 ha			
						Building Dominance:		
						<ul style="list-style-type: none"> • Big Buildings connected with roads having more clear pattern • Irregular pattern in the area tend influenced from the pattern before 		
						Orientation		
						<ul style="list-style-type: none"> • Building orientation • Area orientation 		

Diagram 1. Building Density, building dominance and building orientation
Source: Analyses

Zone A (upstream)

In general the zone is considered as an interior area since no main roads pass by the area. The area contains 2.755 buildings and the average building size is small, mostly functioned as settlements. Clustered of buildings which big in size in the area function as public, and the other buildings located along the street has commercial function for the local needs. Around 22.20% of the area is considered as non-built spaces, mostly swampy area where many small unit of neighborhoods were founded and still intensively occupying the area.

The spatial configuration of small buildings inside the area is mostly organic, no center point and a clear pattern in the setting, and group of buildings located along the roadside tend to have more obvious pattern. This indicates that the small size buildings within the area are not long ago built, and show particular urban forms associated with the more informal development.

Zone B (midstream)

The area contains 3.730 buildings. Some big buildings dominated the area, most of them are functioned as public services, and some big size buildings along

the main streets side are functioned as commercials. In some areas adjacent to the reclamation land and to the land readjustment site as well, show the well planned residencial area, grid-like street patterns.

Neighborhoods with small buildings in size have also occupying the lowland inside the area, including the land on the river bank of Sekanak and wetlands. These densely settlements has an organic character, and its non-built spaces are small. Most of the neighborhood at the riverbank show particular urban forms associated with the more informal development, and some of them are representing urban squatter types.

Zone C (downstream)

The downstream of Sekanak is considered as the core of the city. Some part of the area is well planed, and another part is dominated by old neighborhoods which have an organic character. The area contains 4.283 buildings, some big buildings in the core functioned as public services dominated the area. in the open spaces.

In the bank of Sekanak as well as Musi river neighborhoods were still intensively occupying the area. Growth and development pattern of the watershed areas are not completely follow the pattern of river flows in the area. Groups of buildings which formed away from the flow direction of rivers indicated that the river is no longer functioned as a major orientation in the development of the buildings and the area.

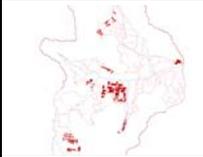
ZONE A	ZONE B	ZONE C	Remarks
			
			<p>Building Pattern:</p> <ul style="list-style-type: none"> ▪ Granary of small buildings spread out the area, mostly in irregular pattern. ▪ Irregular pattern in the area tend to be influenced from the pattern before
			<p>Building pattern:</p> <ul style="list-style-type: none"> ▪ Group of big buildings connected with roads having more clear pattern ▪ Irregular pattern in the area tend to be influenced from the pattern before
			<p>Spatial Structure:</p> <ul style="list-style-type: none"> ▪ Growth pattern of the area not related with rivers ▪ Rivers is no longer as orientation of the area buildings and built-up area

Diagram 2. Building Pattern and Spatial Structure
Source: Analyses

Linkage

The circulation system the study area included the main road, roads, and paths with a variety of patterns. Musi river in the front of the area are still have their importance, and functioned as transportation, however Sekanak river and other streams in the area are only functioned as drainage system. Some of the city's main roads across the area, especially in Zone B and Zone C, and serve as a connecting with the wider city area. In Zone A the main road just passed by some locations then they were connected with the smaller roads that spread to the inside.

Small roads and pathways are linking between buildings in the neighborhood or at the riverside settlements, however, roads network is no longer developed in line with river, as seen in the past. The roads also do not have a fixed pattern, some have a grid-like patterns, but mostly irregular. The irregular shaped pattern formed in the area is no binding patterns, both from the main road up to the hierarchy of the environment. From the road hierarchy can also be concluded that the growth / movement over the area caused or influenced by the pattern formed on the inside and outside of the area.

ZONE A	ZONE B	ZONE C	Remarks
			Hierarchy: <ul style="list-style-type: none"> ▪ No hierarchy of main road, road, pathway.. ▪ Movement of the area influenced by roads pattern outside
			Pattern: <ul style="list-style-type: none"> ▪ No fixed pattern, a grid-like patterns mostly irregular. ▪ Pattern of road development not related with river flow pattern ▪ Impact to hidrological reclamation ▪ Building dominance located the roads directed the growth of settlement inward

Diagram 3. Hierarchy and Pattern of Linkage
Source: Analyses

Impact on the wetland

Each development will result in side effects and in many cases these caused a lot of trouble. Some typical impacts on the urban river basin and flood prone area are: the development-related changes the hydrological condition, the aspect of water pollution and over exploitation.

During last many years, large areas of wetlands in the study area have been filled to create additional land for residential and commercial buildings. There are only little open water systems visible in the area, and the lowland area in the heart of the city is becoming dry. Remaining wetlands in the area are subject to increasing pressure, some wetlands have harmed due to the direct filling. Typically the lost of wetland begins with fragmentation due to road construction following by reclamation for individual construction. Land reclamations, where much of the area has been built through, can reduce the flood storage capacity due to thereby increasing the flood in many parts of the city. In addition other wetlands in the area have also been lost to dumping of solid waste.

CONCLUSION

Lowland area in the center of Palembang is already highly urbanized, the urban problems requiring innovative and more locally adapted solutions. The needs for development in flood prone urban areas are generally justified by the areas needed for living and other social economic development. However, the dynamic land use changed processes that occurred in the area may result in disordered that give some negative influences on the development of the city.

In the socio-economic perspective, the spatial structure of the study area is influenced by the sharp population in the city because of urbanization. The relationship of population and its environment have motivated a fast and disordered urban development. The consequences of the uncontrolled urban development in the area are: disorganized and intensive growth of urban inner city, and also with illegality and informality in the occupation of the area.

The results of this study indicate that the morphology of urban area in the lowland environment in the heart of Palembang was not held to the norms of water in general. People were still intensively occupying the area which prone to inundation, non-built spaces are smaller and more fragmented, and patterns of pathway and road network development show that in areas prone to inundation has led to the more densely and fragmented urban environment.

There are many considerations to develop lowland environment for urban development, therefore ignoring some of them can threat the urban sustainability. Urban development in flood prone areas are need to developed and integrated as many more components. The tool for urban growth control is master plans, in connection with urban development, the improvement regulation of land use and zone management is one of the most comprehensive solutions, and the aim is to reduce the risks involved in the present occupation of flood-prone area.

BIBLIOGRAPHY

- ADOLPHE, L. (2001). "A simplified model of urban morphology: application to an analysis of the environmental performance of cities." *Environment and Planning B: Planning and Design*, 28, 183-200.
- EGGEBRATEN, S (2007), *Sustainable General Plans*, Water-wise planning principles and polices.
- ERNAWI, Imam, S. (2005). *Morfologi – Transformasi dalam Ruang Perkotaan yang Berkelanjutan*.
- Firman, T. (2004). *Major issues in Indonesia's urban land development*, *Land Use Policy* 21, 347–355
- MOUDON, A. V. (1997): *Urban morphology as an emerging interdisciplinary field*. In: *Urban morphology*, vol 1, pp.3-10.
- NASUTION, A. D., (2005), "Prinsip dan konsep perancangan kota pada kawasan rawan bencana tsunami, Kasus: Kota-kota pantai barat daya Aceh," *Jurnal Arsitektur ATRIUM*, vol. 02 no. 01, pp. 15-22.
- SCHULTZ, B. (2006), "Flood management under rapid urbanisation and industrialisation in flood-prone areas: a need for serious consideration," *Irrigation and Drainage*, Vol.55, John Wiley & Sons, Ltd.
- Webster, C. J. (1995). *Urban morphological fingerprints*. *Environment and Planning B*, 22, 279–297.