

CITIES 2015 International Conference, Intelligent Planning Towards Smart Cities, CITIES 2015,  
3-4 November 2015, Surabaya, Indonesia

## Study on land cover change of Ciliwung downstream watershed with spatial dynamic approach

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### Abstract

Ciliwung watershed has a strategic value in Indonesia. As a watershed ecosystem, the changing of the upper stream, will affects the other part of watershed. The changing of the upper stream is closely related to flooding where the precipitation can't be absorbed by soil because the decreasing of water catchment area. The condition of land cover is important to identify the watershed condition. The land cover changes data were analyzed from LANDSAT satellite image taken in four different years of 1990, 2000, 2010 and 2014. The land cover types were divided into four areas : water body, green area, bareland and built-up area. Analysis on land cover pattern indicates that water body area decreased 1.49% in 2014 compare 1990, followed by green area (0.28%) and bareland (0.19%) in total. Spatial dynamic approach will be used as an analysis of prediction on land cover change. The concept of dynamic system is to connect all the objects that interact each other to create a trend in the future.

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Peer-review under responsibility of the organizing committee of CITIES 2015

*Keywords:* flooding, GIS, land cover change, spatial dynamic approach, system thinking, watershed.

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## 1. Introduction

Ciliwung watershed approximately has 347 km<sup>2</sup> in area and the length of its main river is 117 km. Ciliwung watershed is strategically valuable in Indonesia. Based on the toposequences, Ciliwung watershed is divided by three parts which are upstream, middlestream and downstream. As a watershed ecosystem, changes that happen in the upperstream could affect the whole area. The main city that located in the downstream area become the reason for it to be strategically valuable for the development and management of area around downstream.

Flooding are very sensitive to the changes that happen in land-use and unappropriate land management (Woube 1999, Brath et al. 2006, Weather and Evans 2009). The condition for watershed coverage area affecting the interaction between upstream and downstream area, water run-off, soil water, upstream water and hydrological system of a watershed (Molle and Mamanpoush 2012). Hence, the changes in land-use could affect on the ability of soil in water infiltration and increase on the water flow debit (Poerbandono 2009). Some of the studies shown that the reason behind flooding in ciliwung watershed are unappropriate management system in the upstream area. Irianto (2000) says that within the year 1981-1999, the landuse of upstream area has been changing 14.860 ha in wide, and Pawitan (2004) says that landuse changes create an impact in increasing the water debit in the upstream area around 65% (increase in water run-off) and increase in the flooding volume until 50%. The contribution of water run-off from the upstream and the middle stream area are predicted around 42.44%, while in the downstream area is 57.56% (BPDAS 2007).

As a hydrological system, the upstream area play the function of protecting the whole area of watershed, while the middle and downstream area is the area for utilization (Asdak, 2010). Flood is happening because of the changes and unappropriate management system for landuse, while landuse changes is dynamically flexible to the water flow debit as a respon to the total rain water (Asdak, 2010). Thus flooding management control in the watershed area and spatial planning are important factors that needed to be done.

Land cover is a fundamental variable that impacts and links many parts of the human and physical environments. Land cover change is regarded as the single most important variable of global change affecting ecological systems (Vitousek, 1994) with an impact on the environment that is at least as large as that associated with climate change (Skole et al., 1994; Chen, 2002). Land usage that could increase the environmental quality is highly recommended to prevent flooding, make sure the soil water availability and so on. Land use change is one specific area that needed some researches to be done as we see its ecological impact that significant to the environment (Fang et al. 2006; Chen et al. 2003). Thus, a study is needed to be done in order to allocating the appropriate way to utilize the space according to its condition and environmental carrying capacity.

The approaches that being used in the land coverage analysis are dynamic system approach and spatial dynamic approach. Basic concept for dynamic system approach is to introduce in a more simple way the basic elements that construct a dynamic system, which completed with the framework in constructing generic model starting from the symptom identification until producing a problem structure for policy analysis. Spatial dynamic approach is an approach that integrating the system dynamics system (SD) analysis with Geographic Information System (GIS). From the approaches above the results that is to be expected are not only in table form but also can be visualized in a spatial form.

This paper analysis land cover change processes over 1 24-year time period within the downstream of Ciliwung Watershed, in Jakarta Province. Specifically, the objectives of the paper are :

1. To analyze the land use changes pattern and land cover distribution in the downstream area of Ciliwung watershed.
2. To build the land dynamic structure of the downstream area Ciliwung watershed.
3. To construct the landscape planning of the downstream area Ciliwung watershed that optimal and appropriate with the carrying capacity.

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