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Green infrastructure development in Cisangkuy Subwatershed, Bandung Regency: potential and problems

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Abstract

Green infrastructure (GI) development is able to deliver multiple benefits to economic, social, and especially environment. Nevertheless adoption of GI measures faces some problems. The objective of this paper is to explore the potential and problems of GI development in Cisangkuy Subwatershed, Bandung Regency. The methods used in this research are modeling and stakeholder interview. The result of analysis shows that there are four kind of green infrastructure to be developed, which are infiltration basin (7,037.22 ha), vegetated filter strip (1,511.12 ha), dry pond (839.57 ha) and bioretention (418,58 ha). Based on stakeholder interview, the development of green infrastructure is limited only to bioretention (43.75 ha) and infiltration basin (5,930.58 ha) due to the problem of land ownership. Another problem is such measures have not been stated in spatial plan.

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1. Introduction

Green infrastructure (GI) is defined as a set of techniques, technologies, management approaches, and practices that can be used to eliminate or reduce amount of storm water and nonpoint source runoff including water and pollutants that run into combined sewer overflow system (CWAA, 2011). Green infrastructure mimics the natural process. This process is more difficult to take place naturally in urbanized area, hence GI is needed.

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Adoption of GI gives direct and indirect benefit. Baptiste, et al (2015) stated that application of GI can reduce the amount of storm water runoff, reduce pollution, and increase urban green spaces, thus improving microclimate, as well as neighborhood quality of life. GI provides essential ecological, social, and economic services for functioning healthy urban ecosystems (McWilliam, et al., 2015).

Idea and concept of GI are not new. However the implementation of the idea and concept is still limited (Carlet, 2015). There are some reasons for this condition, among others are institutional, technological, and perceptual (NRC Study, 2008). In order to adopt the concept, study to explore the potential and problems of GI implementation is needed.

The objective of this study is to explore the potential and problems of GI implementation in Cisangkuy Subwatershed, Bandung Regency. The region is one of regions in Indonesia that experiences flood. Adoption GI concept could be a solution for the problem. Potential and problems of GI implementation in this study is based on the perception of stakeholder, in this case the Government. Some studies related to perception of stakeholder in GI implementation are focused on perception of household or community (Baptiste, et al.(2015), Barau (2015). These studies argued that exploring perceptions, values, and preferences is fundamental in achieving desired goals and objectives.

According to Tzoulas, et al. (2007), GI are all natural, semi-natural, and artificial networks of multifunctional ecological systems within, around, and between urban areas at all spatial scales. It means that GI can be implemented in various scales which can be either household, neighborhood, or city scale. At city or county scale, green infrastructure refers to interconnected network of green space that conserves natural systems and provides assorted benefits to human populations (Benedict and McMahon, 2006). In this study, the scale of GI explored is city or county scale.

2. Method

GI is a relatively new concept in Indonesia so that the implementation of the concept is still limited. It is therefore this research cannot apply direct questions to the stakeholders in order to get information related to the potential and problems of GI implementation. In this research, at the first stage modeling is done in order to get information related to the type and location of GI measures that can be implemented in Cisangkuy Subwatershed. The modeling is done by using suitability analysis method. Suitability analysis method is done by using SUSTAIN Model. This model refers to Low Impact Development (LID) application with using Best Management Practice (BMP) Sitting Tool to choose and decide both suitable type and location for green infrastructure. There are some criteria related to land suitability that are considered in this research such as drainage area, drainage slope, imperviousness, hydrological soil group, water table depth, road buffer, stream buffer, and building buffer. Furthermore, narrative analysis method is used to analyze the perception of the government concerning potential and problems of applying the green infrastructure development in the area of study based on the model. By using those methods, the possibility to develop GI can be analyzed. Moreover, the problems as the obstacles notably in implementing green infrastructure can be identified.

The data used for analysis consist of primary and secondary data. Primary data based on interview with the Government Officers of Bandung Regency, West Java Province and the Ministry of Public Works and Public Housing. The respondents for interview were determined based on their institutions. The institutions were chosen based on the scope of works, which should have relationship with the implementation of GI.

3. Result and Discussions

3.1. Case study area

Bandung Regency, West Java Province. The area of the subwatershed is 3,3360.78 ha. As a part of Citarum River Watershed, this subwatershed is one of the main areas that supply the need of raw water for Bandung City and Bandung Regency.

The environmental condition of this area is already at a critical level which is shown by the level of erosion, sedimentation, and fluctuating discharge. The erosion level for this area has roughly reached 163 ton/ha/year. Fluctuating discharge ranged from 49 to 394 m³/second. These lead to the seasonal flood in the south part of Bandung

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