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Identification of waterbody status in Indonesia by using predictive index assessment tool

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Abstract

The relationship between land use and water quality status is complex and likely to be site-specific, and more work is needed for it to be clearly quantified. Theref National Cheng Kung University, No 1 University Road, Tainan 701ore, the main objective of this paper was thus to identify and investigate status of waterbodies (lakes and rivers) by using appropriate predictive index assessment tool coupled with the offered Adaptive Co-Management (ACM) methodology towards sustainability of water quality and ecology in Indonesia. We then present a comprehensive assessment as baseline information to describe the existing condition of waterbody status in study area. The results indicated that the basic requirements of predictive index assessment tool, expressed as indicator: criteria and attributes, are use-specific or targeted to the protection of the watershed and waterbodies uses among a number of land use policies. In some situations, even stricter requirements and policies are necessary to achieve sustainability of water quality and ecology in Indonesia.

Keywords: Adaptive Co-Management; Comprehensive assessment; Waterbody status; Watershed index; Water quality index

Introduction

With a rapidly expanding global land use development, decreasing surface water quality is an issue of growing concern around the world (Wu & Tan, 2012; Abdel-Dayem, 2011). One of the major causes of such water pollution is change of land use, which can produce various effluents in domestic, agricultural, and industrial areas. A number of studies on the effects of changes in land use on surface water conditions have been conducted (Li, Gu, Tan, & Zhang, 2009; Mouri, Takizawa, & Oki, 2011), but it seemed complex and likely to be site-specific, and more work is required to quantify this (Seeboonruang, 2012). Researchers have also shown that the various attributes of watersheds, such as morphological and geological factors, as well the local socio-economic conditions, can influence the status of surface waterbodies through physical, chemical, biological or bacteriological parameters (Herricks & Suen, 2006; Kang et al., 2010; Miserendino et al., 2011; Richardson, Flanagan, Ho, & Pahl, 2011). However, only a few have used predictive indexes to link the relationship between watershed and waterbody. Therefore, an important first step is to identify the key watershed indicators that affect the quality of waterbodies (Guimaraes & Magrini,

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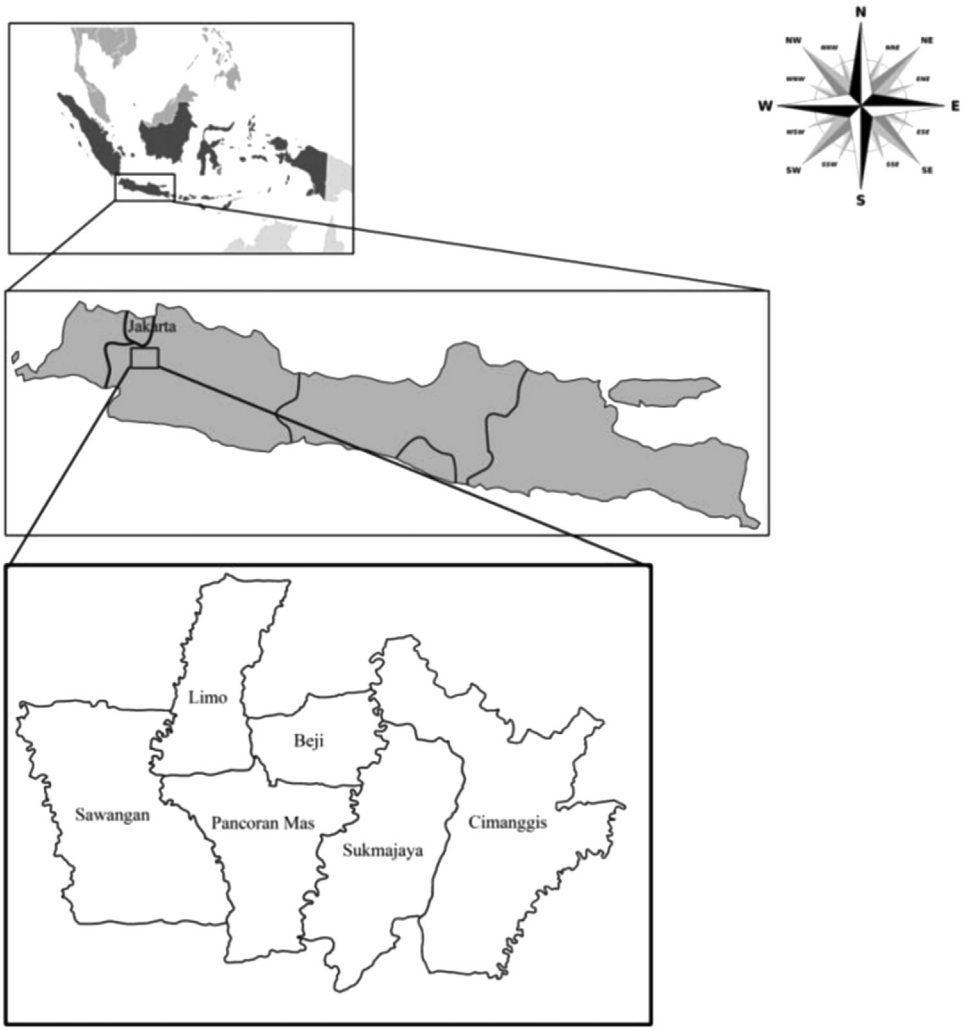

Fig. 1. Location of study area.

2008). One simple and powerful index is the Watershed Sustainability Index (WSI) that combines several watershed indicators into a single number (Chaves & Alipaz, 2007).

Moreover, it is also necessary to measure and monitor water quality by selecting certain parameters that together provide a representative picture of the status of waterbodies. Since water quality is based on a set of complex interactions, the impacts that various factors have may be impossible to isolate and study individually. Some researchers have addressed this issue by using the predictive index of water quality, which consists of certain physical, chemical, biological and bacteriological parameters that provide information above overall it. This approach has been applied in many cases and areas around the world (Cude, 2001; Liou, Lo, & Wang, 2004; Bordalo, Teixeira, & Wiebe, 2006; Shuhaimi-Othman, Lim, & Mushrifah 2007). Many government agencies have also developed different standards for various uses of water, which differ in the terminologies used and the selection of indicator parameters (Bordalo et al., 2006; Sarkar & Abbasi, 2006). Nevertheless, this approach is widely accepted by academic and practitioners in many fields, especially when the water quality data is lacking and not easily obtained.

As a developing country, Indonesia faces many water quality problems due to changes in land-use and human activities within the surface waterbodies (Verburg, Veldkamp, & Bouma 1999; Pawitan & Haryani, 2011). It has a long history of the increase of water pollution due to the unsuccessful applications of land use associated with environmental policies in many waterbodies (Djuangsih, 1993; Dsikowitzky et al., 2011; Pawitan & Haryani, 2011).