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Perceptions of urban land use and degradation of water bodies in Kumasi, Ghana

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ABSTRACT

The availability of freshwater is vital not only for the survival of the human race, but also the survival of the ecosystems upon which humans depend for a number of services. However, with rapid urbanization and associated land uses there is increasing degradation of water bodies, especially in the developing world. In sub-Saharan African cities, it is well known from the literature that the lack of appropriate land use regulations, low compliance to existing regulations, and the lack of enforcement are enhancing degradation of water bodies. However, little is known about how urban residents perceive land use and water body degradation. Relying on data collected through semi-structured interviews and transect walks, this study investigates perceptions and knowledge of land use and water body degradation in a poor community and an affluent community in Kumasi, Ghana. The study demonstrates that both communities have a good knowledge on land use and water degradation, but that of the affluent community is richer than the poor community. However, in both communities there is limited knowledge on how estate development exert impacts on water bodies. The study recommends that education and stakeholder participation (community involvement) should constitute the key components of any environmental regulations and policies aimed at protecting urban water bodies.

1. Introduction

Most cities around the world are urbanizing rapidly and the United Nations (2014) has projected that by 2050, 66 percent of the global population will reside in urban areas. Currently, a little over half (54 percent) of the world's population lives in urban areas. It is estimated that by 2050 2.5 billion persons will be added to the world's population, with the majority (90 percent) concentrated in Africa and Asia. The rapid urbanization together with population growth, increasing demand for freshwater, increasing pollution, increasing wealth, increasing demand for food and water, and climate change are contributing to diminishing freshwater supplies globally (UNEP, 2012). The speed and scale of urbanization, therefore, presents formidable challenges in most developing countries (Cohen, 2002). One of the greatest concerns is the threat to water bodies posed mainly by low compliance with limited urban land use regulations, which is seen as a systemic urban planning problem in most developing countries, especially in sub-Saharan Africa (Awuah & Hammond, 2014; Cobbinah, Erdiaw-Kwasie, & Amoateng, 2015).

In sub-Saharan Africa, uncontrolled urbanization coupled with limited land use regulation has paved the way for the increased pollution of urban water bodies. The majority of rivers in urban areas have concentrations of phosphorous and nitrogen above recommended levels and their waters are not suitable for human consumption (Haddis et al., 2014; Seanego & Moyo, 2013). A number of urban streams are used as receiving bodies for the discharge of domestic and industrial wastes (Melaku, Wondimu, Dams, & Moens, 2007). The fact is, the levels of contaminants in urban rivers in sub-Saharan Africa continue to increase year after year with urban population growth and associated land use change as the main drivers (Haddis et al., 2014).

With 17 percent of cities in developing countries experiencing an annual population growth rate of 4 percent or more, a majority of urban residents will meet their accommodation and service needs in slums (UN-Habitat, 2009); this has implications for the urban environment, including water pollution and accumulation of

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solid waste (Braimoh & Vlek, 2004). Moreover, the growing changes in land use and land cover will also impact the hydrological cycle through changes in recharge, runoff, and evapotranspiration. This is likely to affect the supply of surface waters to reservoirs and aquifer recharge and therefore affect urban water supplies (Srinivasan, Seto, Emerson, & Gorelick, 2013). In Mombasa, Kenya, one urban water supply system was abandoned due to rising treatment and maintenance costs resulting from rapid deterioration of source water quality (Hirji & Ibrekk, 2001). Currently, a number of sub-Saharan African countries have adopted the Integrated Water Resource Management (IWRM) approach and have introduced a number of measures at the catchment level for the protection and optimum use of water resources (Agynim & Gupta, 2012; Balana, Catacutan, & Makela, 2012; Funke, Oelofse, Hattingh, Ashton, & Turton, 2007). However, challenges of controlling water pollution still exist (Dungumaro & Madulu, 2003).

These issues are not different in Ghana. With more than half (50.88 percent) of the population (GSS, 2012) now inhibiting urban areas, urban environmental problems continue to grow. Gyau-Boakye and Biney (2002) indicated that degradation of water bodies in the country continues as raw wastes are discharged directly into water bodies, mostly from urban development. The degradation of urban water bodies resulting from land use activities and change in Ghana, in sub-Saharan Africa, and in other developing countries has been attributed to: a lack of environmental policies and regulations, and low levels of regulatory enforcement (Haddis et al., 2014); institutional problems, including a lack of awareness, unavailability of skilled personnel, sectorial conflict, financial constraints (Gyau-Boakye & Biney, 2002); and low compliance with existing land use regulations (UN-Habitat, 2009; Awuah & Hammond, 2014).

These studies and others, however, often concentrate on land use policies and regulations, and the causes, processes, and challenges of urban transformation, and tend to pay little attention to community perceptions and knowledge of urban land use change and its implications for water bodies. Land use planning and conservation strategies are likely to support responsible stewardship if local people are engaged, and their knowledge sought, in landscape decision making (Palmer, 2004; Valencia-Sandoval, Flenders, & Kozak, 2010; Walsh, Roy, Feminella, Cottingham, Groffman, & Morgan, 2005). This study investigates community perceptions and knowledge of land use and water body degradation in Kumasi, Ghana. The study uses interviews and transect walks to address the following questions: 1) How do communities perceive land use and its impacts on water bodies; and 2) What differences in perceptions of land use and degradation of water bodies exist between poor and more affluent residents? The objective is to provide evidence that local perceptions and knowledge of land use and degradation of water bodies should be considered in all environmental policies and regulations aimed at protecting water bodies, and also to contribute to the discourse in the literature. Moreover, the study provides evidence to policy makers and development planners that differences in perceptions of land use and degradation of water bodies between affluent community and poor community exist, and these differences should not be overlooked in the development of conservation measures. These differences have not received much emphasis in the literature, therefore this study will add to our knowledge. The reminder of the paper is organized around four sections. Section two opens a discussion on land use change and water bodies and presents issues pertaining to the degradation of water bodies in sub-Saharan Africa. Section three presents the methodology of the study, including the study area. Section four presents the study results and discussions. The conclusion of the study are drawn in section five.

2. Background

2.1. Land use change and water bodies

The impacts of land use and land use change on water bodies are complex, diverse, and wide ranging. On its transit through the landscape, water is exposed to the properties of the terrestrial surface which is an important determinant for both water quantity (sufficient supply of freshwater to support human and natural systems) and water quality (suitability of supply for an intended use). While humans use land in diverse ways to improve their quality of life, some uses have caused negative effects on the environment. In examining environmental problems associated with land use change, Solbe (1986, 22) noted that “many of the environmental problems which countries are experiencing are resulting from the increasing rapidity of land use change and one of the critical facts about changes in land use is that the effects may be long-term and sometimes irreversible”. Smol (2002) argued that some changes are due to natural processes, but the issue is that anthropogenic activities are responsible for many of the environmental problems cities are currently facing.

Urban land use produces impermeable surfaces as a result of increased development in the form of residential and commercial buildings (rooftops), highways and driveways, car parks etc.; these give rise to greater runoff, increasing the risk of channel degradation, poor water quality, and other environmental consequences. Solbe (1986) and others observe that runoff from impervious surfaces such as heavily trafficked motorways, car parks etc., has implications for the water cycle, both in terms of quantity and quality. A wide range of organic, inorganic, and metallic pollutants may be removed from the land and road surfaces by runoff, which are transported into water bodies in high concentrations. These impacts are collectively referred to as the ‘urban stream syndrome’ (Walsh et al., 2005).

In sub-Saharan Africa, increasing urban population growth, uncontrolled land use, and land use intensification are having impacts on urban surface water. Haddis et al., (2014) noted that a majority of surface waters in Ethiopia are contaminated by both solid and liquid wastes from residential, industrial, and commercial areas. The Sand River in Limpopo, South Africa receives storm water that is highly polluted by both animal and human fecal matter from urbanized areas (Seanego & Moyo, 2013). Urban water pollution is a problem in all most all cities in sub-Saharan Africa as a result of poor sanitation and other challenges (Adarkwa & Post, 2001; Simon, Nsiah-Gyabaah, Warburton, Adu-Gyamfi, & McGregor, 2001). As Cohen (2006) noted, the lack of capacity and inability of some cities in developing countries to adequately manage waste and introduce recycling policies and practices means that cities are being engulfed by their own waste. To combat environmental problems that include water pollution associated with poor sanitation, some governments in sub-Saharan Africa have adopted measures such as subsidization of on-site sanitation facilities (ECWUP, 2003) and house-to-house solid waste collection. However, this has always favored more affluent communities (Kubanza & Simatele, 2015).

Indiscriminate solid and liquid waste disposal is a common phenomenon in most cities in sub-Saharan Africa. Though there have been deliberate efforts to control this, sanitation problems still exit (Cohen, 2006; Hove, Ngwerume, & Muchemwa, 2013). Untreated household wastewater and solid waste are still disposed into open gutters to be carried by runoff water into storm water drains polluting nearby waterways (Govender, Barnes, & Pieper, 2011). Storm water pollution is further enhanced by the fact that most riparian vegetation communities have been removed due to development pressures; especially the increasing number and size