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Integrated planning for the resilience of urban riverine ecosystems: the Istanbul-Omerli Watershed case

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Abstract

Since urban areas display nonlinear and dynamic interactions within their growth patterns, a crucial question is how complex systems can be integrated into urban planning practices in relation to urban ecosystems. Natural threats and extreme weather conditions resulting from climate change will threaten social, environmental and economic assets in urban riverine ecosystems due to their cumulative vulnerabilities, especially in less developed regions. This paper will discuss an "ecosystem services based watershed management framework" to increase the resilience capacity of urban riverine systems using the case of the Omerli Watershed (Turkey), which is located in a metropolitan area characterized by rapid population growth and ecosystem change. Three research domains, i.e. ecosystem services (ESs), spatial planning and climate change (CC) mitigation, will be integrated in order to propose an analytical methodology for spatial planning of urban riverine systems. The adaptive mitigation approach is used to accommodate both mitigation and adaptation policies in its structure. The methodology used here is a part of an ongoing research effort. However, this assessment is aimed at clarifying the integration of the three research domains for use in policy development.

Key words: Climate change, ecosystem services, spatial planning, adaptive mitigation, Omerli Watershed, Istanbul.

1. Introduction

Civilizations are restricted by the quality and quantity of available safe drinking water and by climatic conditions affecting the production of food, energy, transportation and industry. Therefore, expectedly, the location of the earliest civilizations was identified mainly by the availability of water. As well-known examples, the fertile crescent of Tigris-Euphrates, and the valleys of the Jordan, Nile, Indus and the Yellow Rivers accommodated the early civilizations who had a very strong relationship with these riverine corridors (Fig. 1) (Biswas *et al.* 2008; Girardet 2008).

From the point of water quality, at the time of these early civilizations, the clusters of human populations were small, and the range of human activities were very limited (Biswas *et al.* 2008). But, as the human populations steadily increased over centuries, communities became more vulnerable to water and climate based problems. From 1900 to 2000, the global human population increased fourfold, from 1.5 to 6.2 billion, and the global urban population increased from 225 million to 2.9 billion (Girardet 2008). In this period, especially after the industrial revolution, expansion of human activities and rapid urbanization have started to affect negatively natural resources in terms of quantity and quality. Therefore, starting from water related stresses, all natural resources came under increasing stress in many parts of the world, more than ever before. Future projections show that this stress will increase gradually. According to the 2003 World Population Report of United Nations (UN), by 2030, 60% of the world population, and, by 2050, 6.3 billion of the 8 billion projected world population (78%), is expected to live in urban areas (UN 2004).

The rapid growth of urban populations has been of interest to the scientific community for many years, especially with regard to aspects of the sustainability of urban ecosystems. For instance, urban areas are influenced by diverse ecosystems, creating a complex system of interactions characterized by multidirectional flows of water, matter, pollutants and energy (Zalewski, Wagner 2005). Climate change and population increases in urban areas are two important concerns relating to sustainable development policies. Beside the impacts of rapid urbanization and agglomeration of population in urban areas, the impact of climate change has been increasing the vulnerabilities of cities and their ecosystems that will exacerbate the deteriorations in the fresh air, water and food cycles of future populations (WaterAid 2007). In this context, riverine corridors and watersheds seem to be the most vulnerable ecosystems to the effects of climate change, being the most important sources of freshwater to urban areas, agriculture, industry and energy production. Hence, the interaction between water sources and climate change has been a growing concern of the scientific community (Fig. 2).

An analysis of the keywords "climate change (CC) and planning" appearing in international scientific journals indicate that these research subjects are mainly based on energy, water or agriculture-related sectorial contents. As can be seen in figure 2, climate change (CC) and either spatial planning or urbanization related topics are the least mentioned subjects relating to these resources. Therefore, an integrative methodology is needed for formulating effective development policies, urban design guidelines and implementation measures for spatial

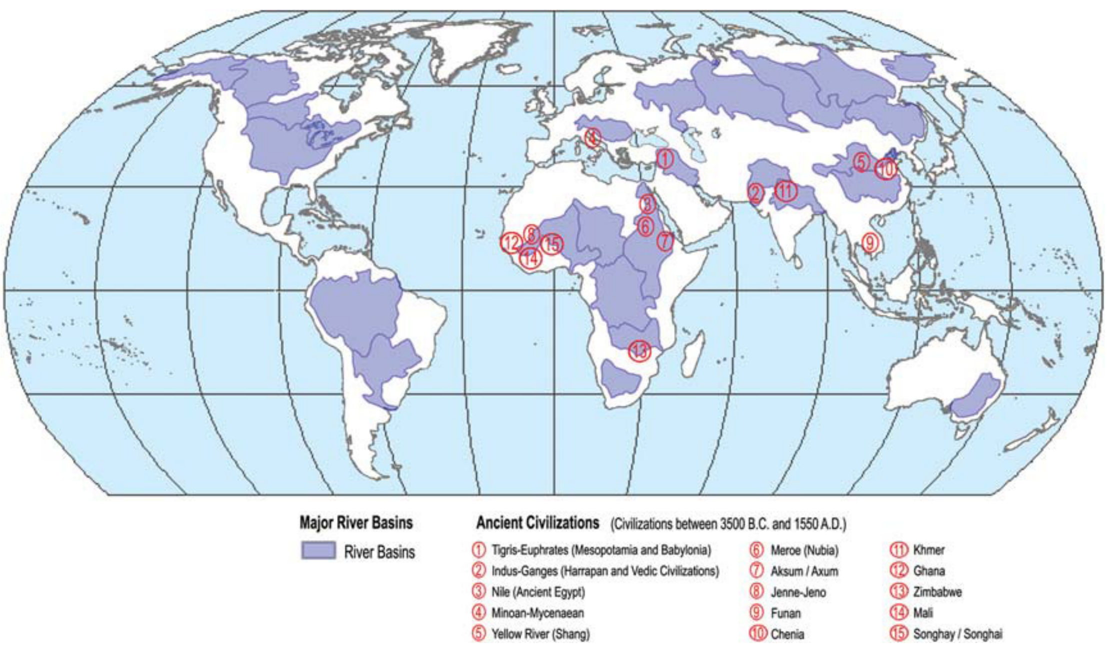

Fig. 1. Locations of the early civilizations and major river basins in the world (Source: Produced with the information from Allen, Shalinsky 2003; UNEP-WCMC 2001).