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Urbanisation and changing waterscapes: A case study of New Town, Kolkata, West Bengal, India

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ABSTRACT

Landscapes have been the product of human intervention in nature. With increasing trends of urbanisation and rapid land conversion in both developed and developing countries there has been a rapid change in the land-use land cover pattern, resulting in large scale conversion of water bodies. To understand and analyse this problem, a study was conducted in the planned township of New Town, West Bengal, India, where satellite images have been derived for the years 1990, 2004, 2010, and 2016 to show the gradual change in the urban landscape and its effect on water bodies. Using the indices such as EBBI, NDWI, and change detection technique of classified images in Arc GIS 10.2.2, the paper emphasizes on the temporal change in built up area and its subsequent effect on the water bodies. An attempt has been made in this study to suggest measures for sustainable conservation of water bodies.

1. Introduction

Urbanisation is a complex phenomenon which essentially includes the rapid conversion of rural lifestyles into a more urban one (Antrop, 2004). From the perspective of landscape ecology, this expansion results in large scale land use and land cover changes wherein the natural attributes of the landscape such as water, soil, and vegetation are replaced by built up landscape made up of concrete and metallic elements (Al-Manni, Abdu, Mohammed, & Al-Sheeb, 2007; Merlotto, Cintia & Ricardo, 2012). This phase of urbanisation evolves over time and as it gains momentum it becomes one of the major contributors of environmental pollution-a pertinent cause of concern across the globe. But as of yet the brunt of urbanisation is mainly felt in developing nations where the change from "agribusiness-based economy to urban-based industrial economy" has not been successfully completed (Azam & Khan, 2016). Such changes often affect the quality and spatial orientation of land use types, which in turn leads to the development of a completely disordered landscape. Consequently, most natural ecological cycles are adversely affected due to which a fragile ecological environment is created (Merlotto, Cintia & Ricardo, 2012; Pigeon et al., 2006; Zhou & Zhao, 2013). When landscape patterns change, the environment and the human habitats become vulnerable to degradation. Not only does urbanisation and consequent conversion encroach upon previously vegetated landscapes, fallow or agricultural areas, and water bodies, but it even pollutes the same. As the quality of the attributes of nature deteriorates, toxicities within the environment increase and ultimately it becomes difficult for fauna and human beings to thrive. Such a situation is what ecologists call environmental degradation. Once ecosystems and their exploitative use reach this point, recovery is no longer possible. Hence, adequate attention needs to be focussed on changing spatial patterns and policies also need to be implemented in such a way that the burden of urbanisation does not overcome the carrying capacity of a landscape.

Of the various components of the landscape, urbanisation affects fresh water retaining zones the most. The term 'Waterscape' primarily refers to a "landscape in which an expanse of water is a dominant feature" (Oxford Dictionary, 2017). In spite of such a connotation, ironically these expanses of water are gradually becoming insignificant over a landscape in the present century. Although, life is not possible without water, the demand for living space is such that urbanisation activities first tend to endanger these waterscapes. Previously, urban fresh water bodies had the capacity to retain a substantial amount of water for supplying to the cities, allowed the replenishment of the groundwater table, helped to regulate the temperature, and reduced the problem of water-logging since these were are all a part of the natural drainage system. But recent demands for basic necessities for human life per capita have increased in such a rate that these very reservoirs of water have been abandoned, reclaimed or used as a zone for dumping waste. Further, development processes have affected the surface water resources in such a way that previously preserved water bodies have shrunk significantly. Urban fresh water resources such as rivers, lakes and groundwater from the aquifers are overwhelmed with pollutants

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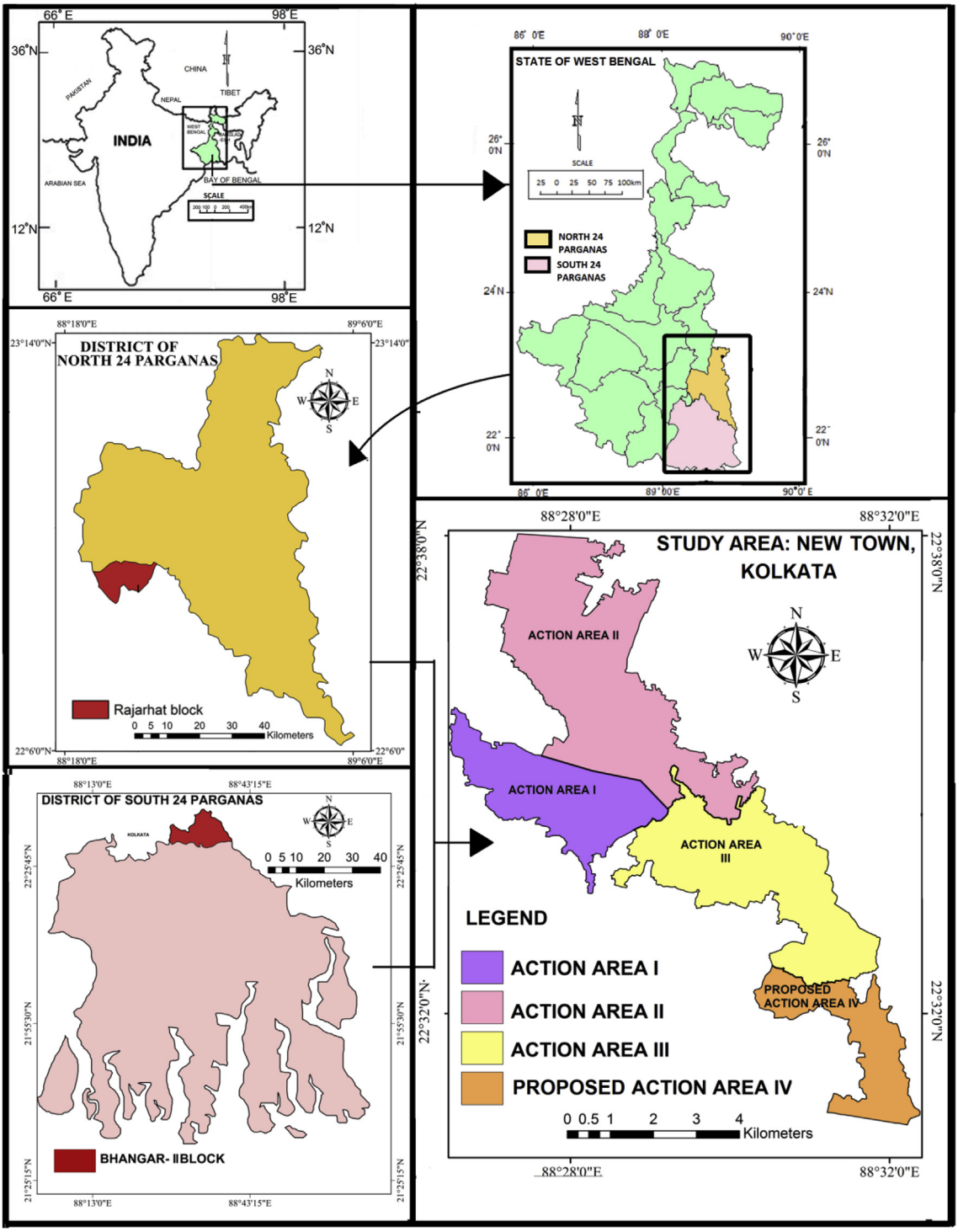

Fig. 1. Location Map of New Town, Kolkata, India; Source: Designed by Author.

due to their continuous overexploitation by people. Eventually, when local water resources are unavailable, these people are forced to draw water over greater distances, at a higher expense (Beura, 2017). But in spite of importing water from a distance, developing regions continue to suffer from intermittent water supply, deteriorating drinking water quality, while simultaneously undergoing incessant water logging problems during the rainy season, with the added trouble of chronic diseases. Some of these critical conditions, due to changing landscape patterns and consequent water body change, have already been faced by the coastal areas of China, and portions of Greece. In India, most of the states are suffering from water body reclamation activities. Its fifth-largest city Hyderabad has experienced the gradual depletion of 404 water bodies due to urban encroachment, waste dumping activities as well as eutrophication processes (Arunpandiyan, Aarthi, Vidyalakshmi, Savaridhos, & Devi, 2015; Mundhe & Jaybhaye, 2014; Nandan, Sen, Harini, Sekhar, & Balaji, 2013; Prasad, Rajan, Bhole, & Dutt, 2009). Kerala has also experienced water body loss as a result of mindless urbanisation (Jacob, 2017). As a result, ecologists have begun to draw increasing attention to land use and land cover changes due to urbanisation (Valavanidis & Vlachogianni, 2011; Zhou & Zhao, 2013).