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Urban sprawl and its impact on landuse/land cover dynamics of Dehradun City, India

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Abstract

The world has seen the development and growth of urban areas at a faster pace. The rapid urban growth and development have resulted in the increase in the share of India's urban population from 79 million in 1961 that was about 17.92 percent of India's total population to 388 million in 2011 that is 31.30 percent of India's total population. This fast rate of increase in urban population is mainly due to large scale migration of people from rural and smaller towns to bigger cities in search of better employment opportunities and better quality of life. Urban sprawl has resulted in loss of productive agricultural lands, open green spaces and loss of surface water bodies. Hence, there is a dire need to study, understand and quantify the urban sprawl. In this study, an attempt has been made to monitor land use/land cover of part of Dehradun city over two periods of time i.e., from 2004 to 2014 for change detection analysis and to assess urban sprawl using IRS P-6 data and topographic sheets, in GIS environment for better decision making and sustainable urban growth. © 2017 The Gulf Organisation for Research and Development. Production and hosting by Elsevier B.V.

Keywords: Development; Metropolitan; Change detection; Sustainable; Urban growth

1. Introduction

Throughout the human history, urban areas have played a significant role in transforming the society. They have been the scene and setting of major social, economic and political change. Urbanization has been an important social and economic phenomenon taking place at an unprecedented scale and rate all over the world (Sun et al., 2013). Although, urban areas cover a very small fraction of the world's land surface, their rapid expansion has

significantly altered the natural landscape and created enormous environmental, ecosystem, and social impacts (Berling-Wolff & Wu, 2004; Grimm et al., 2000; Mundia and Murayama, 2010; Pickett et al., 2001; Weber & Puissant, 2003). The inevitable outcomes from this process are the spatial expansion of towns and cities beyond their juridical limits and into their hinterlands and peripheries in order to accommodate the growing urban population (Mosammam, et al., 2016) Due to the acceleration of the global urbanization in both intensity and area, there is a growing interest in understanding its implications with respect to a broad set of environmental factors including loss of arable land (Lopez et al., 2001), decline in natural vegetation cover and climate at local, regional, and global

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scales (Grimm et al., 2000). The unplanned and uncontrolled rapid growth has resulted in serious negative effects on the urban dwellers and their environment (Chadchan and Shankar, 2012). It is also associated with health risks including air pollution, occupational hazards and traffic injury, and risks caused by dietary and social changes (Li et al., 2012). Primary causes of urbanization are population eruption, migration from other places, industries, economy and proximity to resources and basic amenities. The built-up is generally considered as the parameter for quantifying urban sprawl (Torrens and Alberti, 2000; Barnes et al., 2001; Epstein et al., 2002).

As population increases in an area or a city, the boundary of the city expands to accommodate the growth; this expansion is deemed as sprawl. The study on urban sprawl (The Regionalist, 1997; Sierra Club, 1998) is attempted in the developed countries (Batty et al., 1999; Torrens and Alberti, 2000; Barnes et al., 2001; Epstein et al., 2002) and recently in developing countries such as China (Yeh and Li, 2001; Cheng and Masser, 2003) and India (Jothimani, 1997; Lata et al., 2001; Sudhira et al., 2003). Today, we live in a built environment which suffers from the spatial side-effects of technological overdose that has been administered in hurry. These technological innovations and large scale exodus of rural people towards the urban areas has led to urban environmental degradation. Part of the process of environmental degradation is the tremendous amount of land being grappled up by sprawl of cities. Land use and land cover is changing rapidly due

to several driving forces (Rasool et al., 2016). Moreover, since the rich agriculture land was commonly the sitting factor for many of the cities it is being eaten away. Once lost, these prime agricultural lands are lost forever and the marginal ones being reclaimed for agriculture do not compensate in terms of productivity.

The land use/ Land cover pattern of a region is an outcome of natural and socio-economic factors and their utilisation by man in time and space (Mir & Ahmed, 2014). Land use activity is a major issue and challenge for town and country planners as well as environmentalists to design an eco-friendly and sustainable economic growth. Research on Land-Use and Land-Cover Change (LUCC) using remote sensing technology has a long history and has made progress (Singh, 1989; Jensen, 1996; Coppin et al., 2004; Lu et al., 2004; Liu et al., 2008; Dewan and Yamaguchi, 2009a, 2009b; Dewan et al., 2012; Wei et al., 2015; Sun et al., 2016). LUCC is an important indicator in understanding the interactions between human activities and the environment (Dewan et al., 2012). The rapid changes of land cover are often characterized by urban sprawl (Mundia and Aniya, 2006; Jat et al., 2008; Dewan and Yamaguchi, 2009b; Dewan et al., 2012; Dewan et al., 2012; Byomkesh et al., 2012; Liu et al., 2014), farmland displacement (Ali, 2006; Du et al., 2013), and deforestation (Zhang and Song, 2006), leading to the loss of arable land (Lopez et al., 2001), habitat destruction (Alphan, 2003), and the decline of the natural greenery areas (Swanwick et al., 2003; Kong and Nakagoshi, 2006). These losses have a

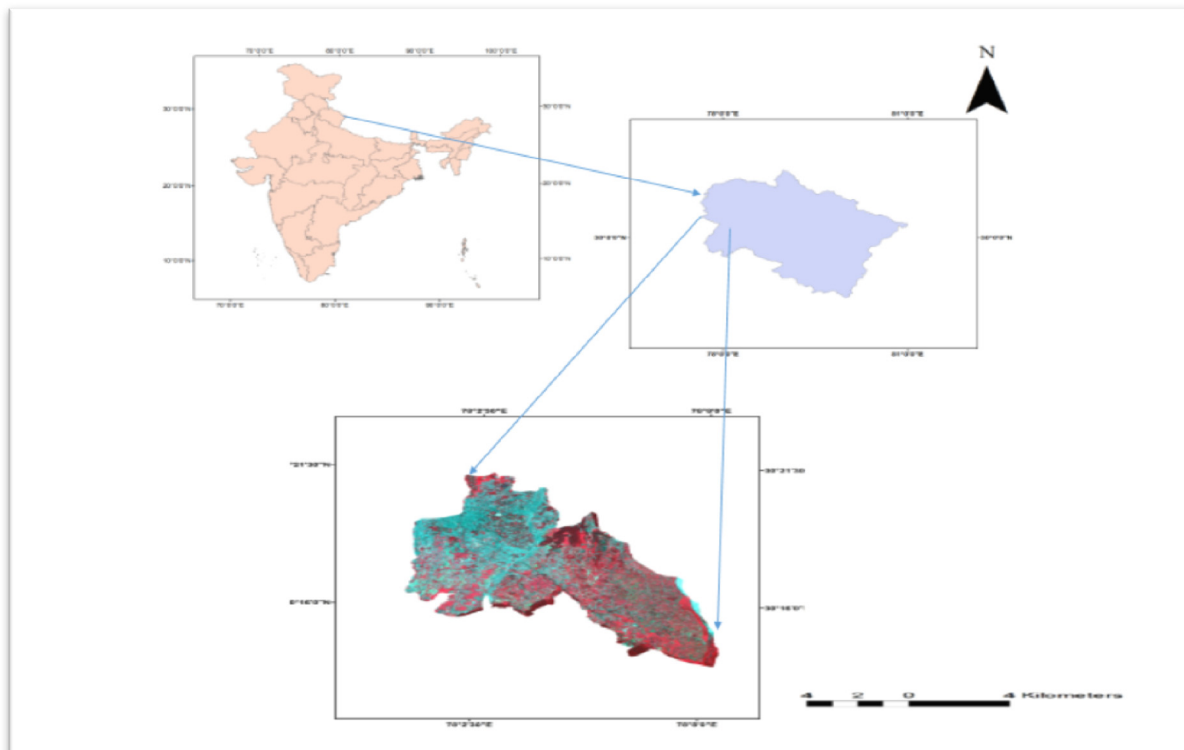


Fig. 1.1. Location of study Area.

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