# Urbanization in the Himalayas?

## DETECTING LOSS OF AGRICULTURAL LAND DUE TO URBAN GROWTH IN THE KATHMANDU VALLEY, NEPAL


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## BACKGROUND

- The entire Himalayan region has been undergoing significant socio-economic changes in the last five decades. The Kathmandu valley (KV) epitomizes this extraordinary urban growth occurring in the Himalayas.
- Kathmandu is the capital city of Nepal, and it combines with Lalitpur and Bhaktapur metropolitan areas, along with several other smaller cities and towns to form the Kathmandu Valley--a cosmopolitan and sprawling valley.
- Despite such rapid growth in population and urban area, only a few LULC change studies have been conducted on KV to date.
- While these studies highlighted the land change trajectories of the KV from the 1980s to the 2000s, much of the new conversions of agricultural land to housing development is left for speculation.
- Considering the massive expansion of urban areas and simultaneous diminution of agricultural lands that occurred especially during the first decade of 21st century, a systematic assessment of the LULC change patterns is crucial

## METHODOLOGY

- We used four Landsat images of the year 1989, 1999, 2009 and 2016 in this study. Atmospheric and Topographic CORrection (ATCOR) feature in ERDAS Imagine for haze removal and topographic normalization has been used.
- In this study, we used hybrid classification approach to derive five major land use classes: urban, agriculture, forest, bare ground, river.
- Post-classification algorithm was used to perform change detection.

## RESULTS

- The overall accuracy for 1989, 1999, 2009, and 2016 is 88, 88, 86, 89 percent respectively.
- Until the 1980s, the urban areas of KV were limited within the confines of the historic settlements of the five municipalities. The outward expansion of urban area began in the early 1990s and accelerated at the turn of the 20th century. In the 2000s, the built-up areas continued to expand further along the major roads that link the outskirts of the five municipalities.
- During the ten years between 1989-1999, the built-up area increased by about 120%, whereby significant expansion took place along the major roads such as local roads, service roads and access roads that link the outlying towns with the five municipalities (Fig 1).
- During the period of 1999 – 2009 the KV saw 117% growth in built-up areas. This expansion came at the expense of 18% agricultural lands.
- For the period between 2009 to 2016, two major LULC changes are worth noting: 1) forest area has been in a relatively stable condition in the central KV and is slowly beginning to expand in the outer margins, and 2) the aggressive urban growth of the 1999-2009 period has somewhat slowed down in the last ten years. The further expansion of forest areas in the KV outskirts, particularly in the northwestern part is notable (Fig. 2).
- Between 2009 and 2016, the built-up area increased only about 8%.

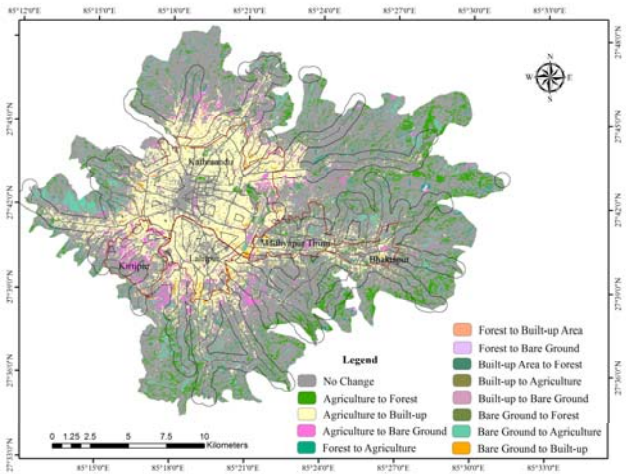


**Figure 1.** Land use land cover change analysis of Kathmandu valley (1989–2016). The roads are buffered to 500 m to show as evidence that conversion of agricultural lands to built-up areas is particularly happening along the major roads.

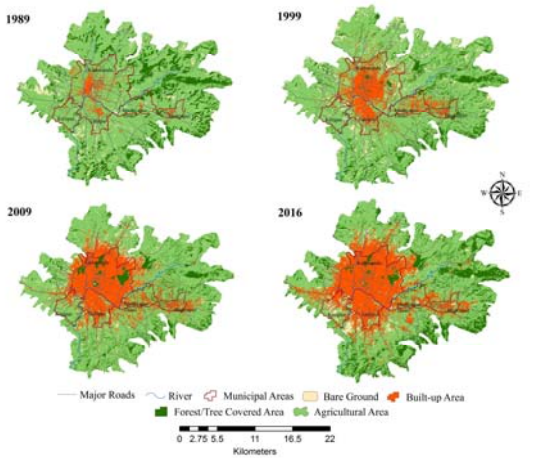


**Figure 2.** Land use land cover maps of Kathmandu Valley (for the analysis, the roads are merged into 'built-up area' category. However, in this figure the major roads are shown as a separate layer to understand the pattern of land use land cover change).