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Chapter 13

Trends of Land-Use Change in India

Geetika Rathee

Land is a crucial natural resource and an important determinant of a country's socioeconomic and ecological health. Given the finite supply of land resource, sustainable use and management of land resources is a necessity for the well-being of people of a country. Land-use change has broad lines of impact, with a potential for influencing economic growth, quality of life, management of environmental resources, and national food supply. A country's socioeconomic priorities at any given time shape the drivers of the land-use change. India, as a developing country, is pushing its industrial and service sector to create favorable conditions for production and consumption of goods and services. Urban regions, as widely recognized, are favorite spots for the consumption and production of a large number of these goods and services. Although the causal relationship of economic growth with that of urbanization is not well established, it is the backdrop for any nation's economic growth (Tolley 1987). It is the very reason for which urbanization has become a major policy guide map for India and many other developing countries¹. With rising rate of urbanization, more changes in land-use are taking place to supplement evolving demands and expectations. This chapter looks at some of the changes in land-use by looking at land-use statistics at the national level and in major metropolitan regions to assess the direction and scale of these changes that have come about as a result of refreshed urbanization focus in country's development strategy.

In the first section of the chapter, land-use changes that occurred in the period from 1950 to 2010 are mapped with the five-year plan budget priorities for differ-

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¹ Studies show that China too witnessed a sea change in land-use patterns, majorly led by government-promoted urbanization (Xu et al. 1999; Wu et al. 2001; Su et al. 2011; Siciliano 2012).

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ent sectors. A regression is run to establish an empirical relationship among different land-use categories. The analysis helped in deducing the direction of these changes. This is followed by an analysis of land-use changes for six metropolitan regions of the country for the last decade, which shed light on the extent of land-use changes due to urbanization. Section 3 highlights the issues and concerns that have emerged as a result of the current land-use trends. The chapter concludes with some tentative policy options that could facilitate in addressing the issues and concerns that have cropped up.

Land-Use Trend at National Level

In order to study the trends for land-use, classification of land area under different categories is necessary. Directorate of Economics and Statistics, Ministry of Agriculture, Government of India classifies land-use under nine categories². They are as follows:

- Forest area (this includes all land classified either as forest under any legal enactment or administered as forest, whether state-owned or private, whether wooded or maintained as potential forestland. The area crops raised in the forest and grazing lands or areas open for grazing within the forests remain included under the “forest area”);
- Area under nonagricultural uses (this includes all land occupied by buildings, road, and railways or under water, e.g., rivers and canals, and other land put to uses other than agriculture);
- Barren and nonarable land (this includes all land covered by mountains, deserts, etc. and land that cannot be brought under cultivation except at an exorbitant cost whether such land is in isolated blocks or within cultivated holdings);
- Permanent pasture and other grazing land (this includes all grazing land whether it is permanent pasture/meadows or not. The commons of the village is included under this category);
- Land under miscellaneous tree crops, etc. (this includes all cultivable land that is not included in ‘net area sown’ but is put to some agricultural use. Land under Casuring trees, thatching grasses, bamboo bushes, and other groves for fuel, etc., which are not included under “orchards” are classified under this category);
- Arable waste land (this includes land available for cultivation, whether taken up or not taken up for cultivation once, but not cultivated during last 5 years or more in succession including the current year for some reasons);
- Fallow land other than current fallow (this includes all land which was taken up for cultivation but is temporarily out of cultivation for a period of not less than 1 year and not more than 5 years);

² The Directorate of Economics and Statistics (DES), an attached office of the Department of Agriculture and Cooperation, collects, disseminates, and publishes statistics on diverse facets of agriculture and related sectors required for policy formulation by the government.

- Current fallow (this represents cropped area, which is kept during the current year); and
- Net sown area (this represents the total area sown with crops and orchards. Area sown more than once in the same year is counted only once.)

I have however focused on land-use changes under four different categories namely forest area, land under nonagricultural uses, barren and nonarable land, and arable land area³. These mutually exclusive and exhaustive categories of land-use endorse economic activities (*area under nonagricultural uses*), ecological system (*forest area*), and national food supply (*arable area*). The barren and nonarable land category reflects the constraints on land resource development which could be topographic, economic, or biophysical in nature. The source of land-use-related data for the study is time series land-use statistic tables from the Directorate of Economics and Statistics (DES), Ministry of Agriculture, Government of India.

Land-use trends are continually shaped by the changing nature of economic activity and the public policy of a country. Over time, each land-use category except forests experienced its share of growth or declining rates (summarized under Table 13.1) that mirrored the socioeconomic priorities of the country during the period. Land area under forests increased throughout the period of study. The increase was substantial for the first decade as it marks the very first development of land management after independence, Forest Act 1952 under which a sizable share of arable land was classified as forestland which is reflected in the high percentage rise in forestland area complemented by huge decline in arable land area. In subsequent decades, Forest Act 1976 and 1988 had further promoted afforestation in barren and fallow land area through programs like Joint Forest Management and Social Forestry. The total forest area of the country sustained growth (although marginal in last decade) owing to the pressure for environment sustainability from all over the world⁴.

History of Socioeconomic Policy Guiding Land-Use Change

As for other categories, the changes in land-use trends happened in tandem with investment trends and development strategies laid under five-year plans for the related sector⁵. Five-year plan is a useful tool for mapping the socioeconomic priori-

³ Arable land area was calculated from the sum total of land under miscellaneous tree crops, arable wasteland, total fallow land (summation of fallow land other than current fallow and current fallow) and net sown area. Note: Permanent pasture and other grazing land which are also known as commons are not studied in this chapter. Therefore, the total sum of the percentages of land area under four studied categories will be less than or equal to 100.

⁴ Despite economic benefits of the forests, it is usually acknowledged for its socioecological importance.

⁵ The country marked the inception of 12th five-year plan in 2012. Timeline for the 11 five-year plans: first (1951–1956), second (1956–1961), third (1961–1966), fourth (1969–1974), fifth

Table 13.1 Decadal percentage change under different land-use classifications. (Source: Computed by the author using land-use data from DES)

Decade	Arable land area	Area under nonagricultural activities	Barren and non-arable land area	Forest land area
1950–1960	–3.027	1.668	–0.684	4.128
1960–1970	0.720	0.498	–2.368	2.975
1970–1980	0.943	0.949	–2.485	1.104
1980–1990	0.006	0.454	–0.173	0.105
1990–2000	–0.524	0.811	–0.580	0.620
2000–2009	–0.301	0.736	–0.213	0.061

ties of a country. For the first few five-year plans, government was the sole investor in various economic and social projects. The budget outlay allocation for different sectors became the dominating driver of land-use change. However, for the latter five-year plans, when the country had begun making economic development marks, the investments started to roll in from other sources as well. The country's development strategies then took stronger hold in directing programs and legislations having implications on land resource management.

Under the first and second five-year plan, over 30 % of the total budget outlay was allocated for agriculture and community development (which includes agriculture, animal husbandry, fishery, and forestry) and irrigation (agriculture and allied sectors (AASs)), and over 25 % was allocated to transport and communication sectors. The land area under nonagricultural uses thus grew due to increasing uses of land under transport sector and infrastructure projects to support services for agriculture sector.⁶

The third and fourth five-year plan continued to allocate substantial share (over 30%) of budget outlay spending for the AASs. The industrial and transport sectors were starting to catch up with the AAS investments and accounted for about 20 % share in budget outlay during the period. The second decade also marked Green revolution. During fifth five-year plan, industrial sector also privileged government attention, as around 20% of budget outlay was allocated to this sector. Among varied industries, fertilizer industry bagged close to 10 % share in outlay, which favored agriculture sector production and land conversions to arable land during the period. The continued high importance on agricultural and allied sector growth had led to the redevelopment of barren and fallow wasteland to arable land area⁷.

The sixth five-year plan laid long-term objectives of poverty alleviation and self-reliance as development strategy for the country. As agriculture sustained the largest proportion of Indian population, agriculture sector development was priority agenda. In the course of seventh five-year plan, the government revived its strategies of development. In addition to agriculture sector, education and health sectors were

(1974–1979), sixth (1980–1985), seventh (1985–1990), eighth (1992–1997), ninth (1997–2002), tenth (2002–2007), and eleventh (2007–2012).

⁶ Three irrigation projects (Mettur Dam, Hirakud Dam, and Bhakra Dam) were started during this period.

⁷ The two major land development programs were launched during this period. Drought-prone Areas Program was launched in 1972–1973 and Desert Development Program in 1977–1978.

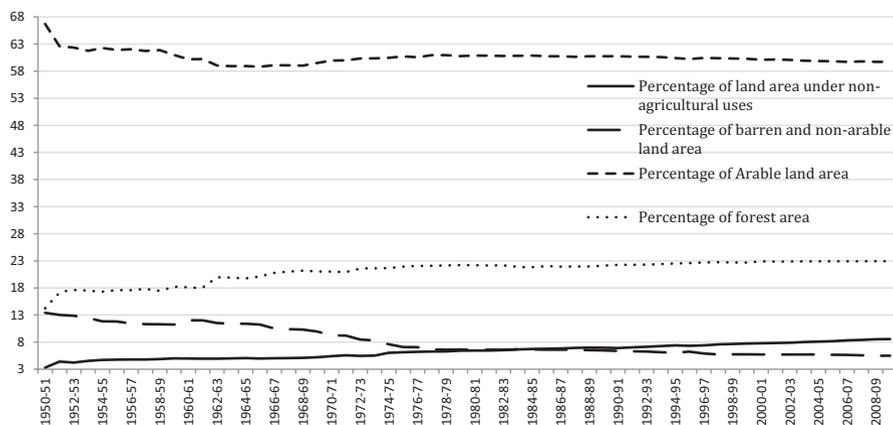


Fig. 13.1 Land-use trends for the time period of over five decades. (Source: Data tables from DES)

also focused. Growth was to be achieved by providing favorable investment options. There was, however, not much change in land-use during this decade except for a rise in land area under nonagricultural uses.

Eighth five-year plan marked the launch of economic reforms in India. India opened up its investment to competition and adopted both domestic and liberalization policies. A significant rise in industrial and service sector investments implied reshuffling of resources to meet the changing components of national growth strategy. “A largely agrarian feudal economy at the time of independence has been transformed into one based on a well developed and a highly diversified infrastructure with immense potential for industrialization” (8th Five Year Plan Report). Consequently, infrastructural growth and land development for industrial, commercial, and residential purposes fueled the steady increase in the land under nonagricultural activities. As service sector boomed, urban regions became the hot spots for the production and consumption of goods and services. The tenth and eleventh five-year plans consistently raised concerns about *India being relatively less urbanized for a country on such steep developmental path*. Understandably, urbanization became a priority on the policy agenda for the country in the most recent decade, and as a result it became a major determinant for changing land-use pattern in the country. Jawaharlal Nehru National Urban Renewal Mission (JNNURM) was launched in 2005 with significant funds to manage and address the issues that cropped up due to rapid urbanization (Fig. 13.1).

Direction of Land-Use Change

As country evolves economically, more land is diverted to nonagricultural uses. For the last two decades, urbanization has become priority in the country’s development strategy which in part resulted in greater than average decadal increase in land area

Table 13.2 Regression results

Direction of land-use change			
Variable	Coefficient	Standard error	<i>p</i> -value
Barren and nonarable land area (X_1)	-0.142	0.0459	0.003
Arable land area (X_2)	-0.0689	0.0217	0.002
Constant (β_0)	192.9306	37.65449	0.00
Number of observations			58

under nonagricultural activities as reflected in the figure. The percentage of land area under non-agricultural uses increased from 3.3% in 1950–1951 to 8.6% in 2008–2009. During the same period, barren and nonarable land fell from 13% to 5.5%. Arable land area has had ever-increasing trend except for the last two decades resulting in its decline from 66.7% in 1950–1951 to 59.7% in 2008–2009. The arable land area decline has made the direction of land-use change an interesting exercise. In order to understand how relationships among different land-use categories are placed in a given time framework, a simple time series regression model is run⁸.

Time series regression is run for 58 years (from 1950–1951 to 2009–2010). To begin, a null hypothesis that any changes in land area under nonagricultural uses do not relate to the changes in barren and nonarable land area or arable land area is established ($\beta_i=0$; for $i=0,1,2$). As the *p*-value is less than 0.05 at 5% for all variables the null hypothesis is rejected implying that changes in land area under nonagricultural uses has bearing on the changes in arable land and barren and nonarable land area (Table 13.2). The sign of the coefficient will point to the direction of the relationship among the variables. The regression result gives

$$y_{(t-2)} = 192.93 - 0.142X_{1(t-1)} - 0.0689X_{2(t-2)}$$

Y = land under nonagriculture uses

X_1 = barren and nonarable land area

X_2 = arable land area

The results indicate that any increase in land area under nonagricultural uses at present time will accompany 6.8% decrease in arable land area and 14.2% decrease in barren and nonarable land area tomorrow. It points to the fact that arable land is affected immediately as land under nonagricultural uses increase. In order to bolster the argument that current policy focus prioritizing urbanization has partially resulted in greater increase in land area under nonagriculture activities that has immediate bearing on arable land area, six metropolitan regions are analyzed for the changes in land-use category for the latest decade, that is from 1998 to 2009. The analysis also helped to quantify the scale of these changes.

⁸ Refer appendix.

Land-Use Change in Selected Metropolitan Regions

The six metropolitan agglomerations namely Greater Mumbai, Kolkata, Delhi, Chennai, Bangalore, and Hyderabad constitute for over 50% of the total urban population of the country, which is expected to increase at faster rate in the following decade. Shaw (1999) pointed out that the six metropolitan cities have attracted more population growth and investment than any other city in the country. The six metropolitan cities were unique in the sense that they attracted investments for the adjoining districts in addition to their own urban cores⁹. Being prime sites of investments land-use conversions to nonagricultural uses are expected to yield most economic returns. In addition, the increase in land area under nonagricultural uses at these locations is driven by urbanization. Indeed, these are the most favorable sites to measure the scale of land conversion taking place due to urbanization momentum. Moreover, such an analysis becomes important for country which is showing preferences for urbanization discourse for development.

Land-use change is documented and analyzed for each metropolitan urban agglomeration (UA). As UA also encompasses regions from adjoining districts of a metropolitan city, the data from the metropolitan district and the adjoining districts are used to get fuller image of the land-use changes. Comparisons of the urbanization data for census years of 2001 and 2010 are made for quantifying the scale of urbanization-led land-use change. Due to limitation of data availability, the slight difference in the time frame of the analysis for urbanization data and land-use data is overlooked.

For National Capital Territory (NCT), there was an increase in the percentage of land area under nonagricultural uses and forestland. At the same time, there was substantial rise in the percentage of barren and nonarable land area at the expense of a decline in the percentage of arable land from 42.44 to 36.18%. Somewhat similar changes took place in five districts of the national capital region (NCR) except for the barren and nonarable land areas, which did not rise¹⁰ (Fig. 13.2).

For Sonipat, the land under nonagricultural uses increased by 308% from 1998–1999 to 2009–2010, Faridabad had 155.3% increase in land area under nonagricultural uses, for Gautam Buddha Nagar (Noida) this land area increased by 74.2%, Gurgaon 63.9%, and Ghaziabad witnessed 21.3% increase in the proportion of land area under nonagricultural uses. For NCT as a whole, the land area under nonagricultural uses increased by 40.7%, which was accompanied by 4.7% growth in urbanization from 2001 to 2011 for Delhi metropolitan regions. Land-use changes of enormous magnitude in the adjoining districts accompanying comparative meager increase in urbanization of the whole metropolitan region reflect high-scale land-use changes due to urbanization in NCR. With the rise in land area under nonagricultural uses the five districts had witnessed fall in arable land area. Faridabad

⁹ The adjoining districts of Kochi also received investments.

¹⁰ NCR conceptualization is discussed in detail at the end of this section.

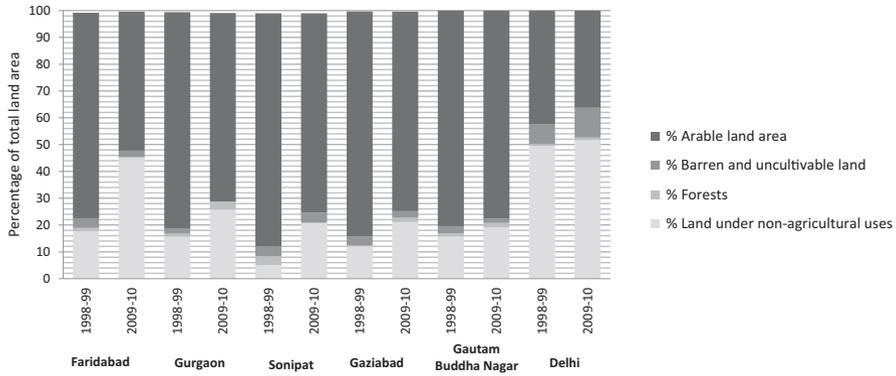


Fig. 13.2 Land-use trends for the time period of over five decades. (Source: Data from DES)

experienced the highest dip of 24.5% in a decade. The arable land area was lost by all the districts by varied degrees.

The data for land-use for Mumbai metropolitan regions were only available for half of the decade, that is, from 1998–1999 to 2005–2006. It could however be argued that changes in land-use for half a decade are enough to project the figures for the next half of the decade as they follow the general trend of increasing land area under nonagricultural activities and fall of arable land area.

The two adjoining districts of Mumbai had witnessed rise in land area under nonagricultural uses with sharp fall in arable land area. The urbanization growth for Mumbai UA was 1.25% from 2001 to 2011, which was complemented by 14.4% increase in proportion of land area for nonagricultural uses for Raigad district from which Navi Mumbai was carved out. Thane had 4.4% rise in land under nonagricultural uses.

There has been rise in the percentage of barren and nonarable land area for both districts and this rise is fairly large considering that the change happened over a period of only half a decade (Fig. 13.3).

Chennai Metropolitan Agglomeration (CMA) adjoins the boundaries of two districts, Kancheepuram and Thiruvallur. District Thiruvallur (north) had 11% rise in the land under nonagriculture use while Kancheepuram had 4.2% rise with a proportionate fall in arable land. Chennai metropolitan has been urban city since long ago. The complementary decadal urbanization growth was 3.55% (Fig. 13.4).

For Bangalore on the other hand, the increase in land area under nonagriculture uses has been profound, 77.9% for rural and 45.3% for urban Bangalore district. During the period, Bangalore had 4.96% growth in urbanization. The barren and nonarable land area for the two declined marginally. Much of the increase in land area under nonagricultural uses has been compensated by the loss of forests land for rural Bangalore and loss of arable land area for urban Bangalore (Fig. 13.5).

In case of the Kolkata metropolitan regions, there is no barren and nonarable land area for any of its three districts. The increase in land area under nonagricultural activities could only have been accompanied by loss of arable land area (Fig. 13.6).

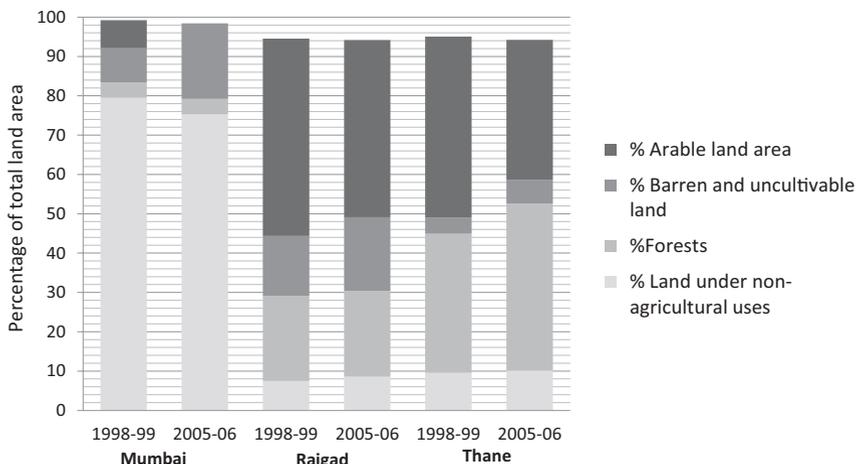
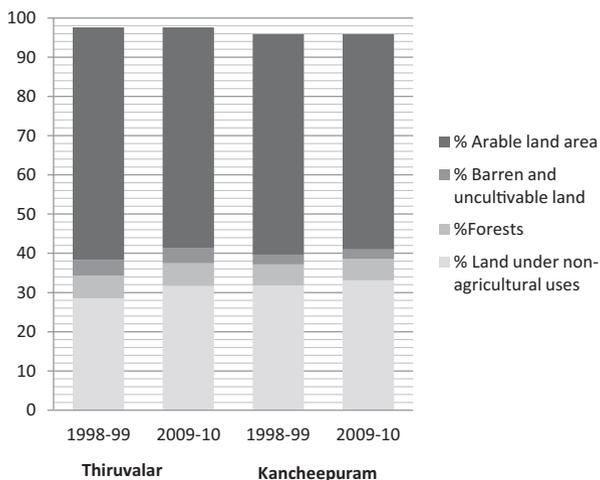


Fig. 13.3 Percentage distribution of the land-use categories for Mumbai metropolitan region. (Source: Data from DES)

Fig. 13.4 Percentage distribution of the land-use categories for Chennai metropolitan region. (Source: Data from DES)



Land area under nonagricultural uses for Howrah increased by 17, 13.5, and 2.3% for 24 North and South Paraganas districts, respectively, through a corresponding reduction in arable land area. The complementary urbanization growth was meager 0.68%.

The study of the six metropolitan cities points to proportionately large land-use changes in land area under nonagricultural uses achieved by the complementary reduction in arable land area accompanied by smaller growth in urbanization. Delhi metropolitan region had most disproportionate combination of urbanization and land-use change, while Chennai metropolitan region had modest land-use change in complementing to decent urbanization growth. In order to understand how such

Fig. 13.5 Percentage distribution of the land-use categories for Hyderabad metropolitan region. (Source: DES)

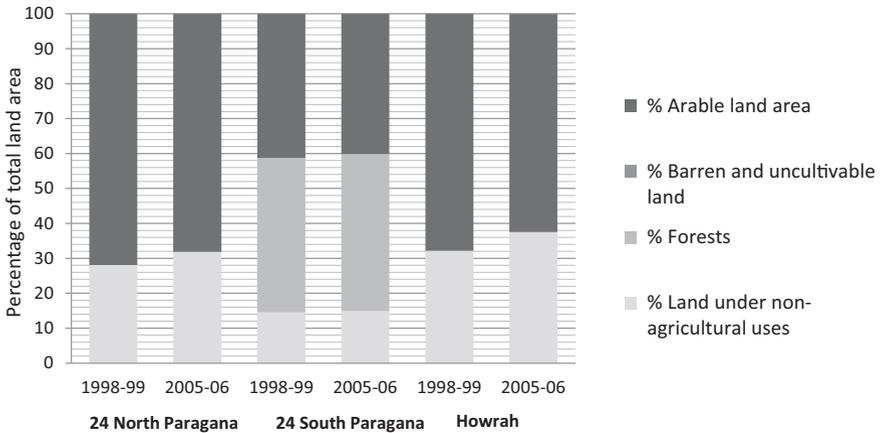
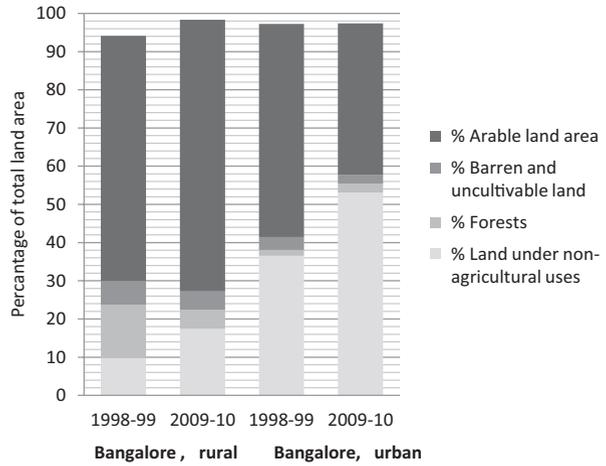


Fig. 13.6 Percentage distribution of the land-use categories for Kolkata metropolitan region. (Source: Data from DES)

high magnitude of land-use change has come about in these metropolitan regions it is useful to look at the anatomy of UA growth.

Starting with Kolkata metropolitan region, the suburbs of Kolkata witnessed higher growth than the core city and currently Kolkata metropolitan region constitutes three municipal corporations, 38 municipalities, and many nonmunicipal towns as well as villages at its fringes. Shaw and Satish (2007) discusses the profound real estate activity of the metropolitan area under which more than 30 large private housing projects are coming up. Many of these are located along the eastern periphery that connects the city to the international airport. The strategic positioning of infrastructure project by the government, here airport, caused the surrounding town to witness suburbanization at the periphery.

In case of Delhi, the city has expanded its reach into towns and cities of districts of the surrounding states. In the process, a new UA has emerged. The Delhi government promoted interlinking of the surrounding towns and urban regions to create the NCR. The main objective of the creation of NCR Delhi region was to decongest Delhi by diffusing the population pressure toward its ring towns. The biggest share of land area under non-agricultural uses from these districts was allocated for residential development as the part of decongestion drive and the next biggest share of land was allotted for industrial development following the decision of relocating polluting industries from NCT to the surrounding peripheries (Delhi Metropolitan Area Report ND). Some of the NCR towns have expanded to the extent that the peripheral boundaries of the ring towns and NCT region appear blurred. As Delhi expanded into NCR, Mumbai yielded Navi Mumbai and Greater Mumbai city extended its territory into Thane and Raigad districts of Maharashtra. Shaw discusses in her book 'The Making of Navi Mumbai', the vision of planners in creating Navi Mumbai as a counter-magnet of Mumbai for investment and population pressure diffusion on mainland at its eastern side similar to the one adopted by Delhi government.

For Chennai, the master plan 2021 expands Chennai metropolitan agglomeration (CMA) boundaries into the neighboring districts of Kancheepuram and Thiruvallur. The expansion is brought into execution by merging 13 panchayat unions in Thiruvallur district and two municipalities, five towns, and 12 panchayat unions in Kancheepuram district, where airport location has been proposed under master plan 2026. Hyderabad UA expanded its boundaries into 12 peripheral municipalities, Secunderabad Cantoment, Osmania University, and other areas. In case of Bangalore, rural Bangalore is witnessing enormous increase in land area under non-agricultural uses. Land-use changes in rural Bangalore were triggered by the positioning of airport there which has also catalyzed suburbanization at the periphery of urban Bangalore. Nevertheless, each UA has expanded into adjoining districts for want of land for infrastructure development and real estate projects (Joshi 2009).

As the population movement into these cities was higher than other cities, resultant there was congestion and crisis of adequate infrastructure for all of these metropolitan cities (Shaw 2003). The government promoted the concept of satellite towns closer to these metropolises in an attempt to decongest (Wang et al. 2010). In addition, the strategic placements of varied infrastructure projects in the peripheral regions of metropolitan cities made suburbs viable for varied economic activities that favored lateral expansion of metropolitan cities in adjacent rural regions. The farmers facing this opportunity of being able to make handsome money through selling of their land have begun to participate in this transition gladly and enthusiastically off recently¹¹. This has led to land conversions at rapid pace which is in fact altering socioeconomic balances of the economy, affecting local ecology and living patterns at the same time. Sridhar (2004) and Sridhar (2007) examine in detail the extent of suburbanization in India's UAs and conclude that the suburbanization is occurring continually and the larger UAs are suburbanizing at greater magnitude.

¹¹ Paupers & Princes of Realty Deals. The Economics Times Magazine, February 17–23, 2013.

Apart from metropolitan master plan contribution to land conversions, certain urban land-use regulations which importantly include land development and redevelopment policies such as land distribution in metro master plans and floor area ratio/floor space index (FAR/FSI) ratio regulations are also partly responsible for the current land-use changes¹². Presently, in most of these metropolitan cities FAR/FSI ratios are low at the core of the city, while higher FAR/FSI ratios are often permitted in the suburbs (Sridhar 2010; Brueckner and Sridhar 2012). Due to strict land development rules within the city, the city's capacity to support the migrating/moving population began to saturate early and the spilling over of population from the city into suburbs started to take place (Sridhar 2010).

Issues and Concerns from Current Land-Use Change

There are several other issues and concerns that these trends throw up. The first relates to the type of land acquired by the government for urban development. As evident from the graphs and foregone analysis, most of the urbanization has invaded agricultural land. Indeed, the loss of arable land to urban development has become a nationwide phenomenon. This loss of arable land due to urbanization has implications on agro-economy of the country. Following this, another issue relates to the compensation for land acquisition. The initial acquisitions were performed by government under which farmer compensations were limited especially when compared to subsequent transactions. Many researchers have documented the resentment and dissatisfaction among farmers owing to the delayed and insufficient compensatory amounts for land acquired for infrastructure development. This has triggered the need for amendments and modification of Land Acquisition and Rehabilitation and Resettlement (LARR) Act.

There are two major constraints that hold back our agro-economy of which the primary factor is the nonavailability of adequate resources especially for irrigation (Sridhar 2012). Much of the land under agriculture still depends upon monsoon for irrigation. The second constraint is the size of population that agriculture sector sustains. Delhi metropolitan region is expanding into the heart land of Indian food grain supply belt with ample irrigation resources and has been expanding into the vast agriculture land. The loss of such fertile and irrigated land may become a threat to future agriculture security of the country. Kumar (2009) and Madan (2005) criticized government's pro-land-use-change policy for urban development.¹³ India's food self-sufficiency takes care of the need of about 18 % of human population and plays an eminent role against high food grain price volatility in international

¹² Alan Bertaud has critiqued Indian metropolitan cities' low FAR/FSI ratios (2010).

¹³ Madan (2005) discusses the government strategy to provide sustainable urban and economic growth at the prospect of the availability of cheap agricultural land availability for building around NCR. Kumar (2009) highlights that despite being aware of the fact that the agriculture land around NCR is fertile and productive, much land has been acquired for urban construction purposes.

market (Swaminathan and Vepa (2012)).¹⁴ Anything that has potential of altering the current status of India with respect to the international food market could make the latter highly volatile. M.S. Swaminathan in his recent article enlists the threats of global warming and climate change on yields of food grain, which are only worsened by diversion of farmland to other uses¹⁵. Although India has achieved laudable progress in food grain production and yield statistics, it still remains susceptible to food scarcity in the event of a natural calamity. Another outcome of the diversion of arable land area to nonagricultural uses could be the shift in grain production from traditional grain-producing areas to other regions¹⁶. In addition, the arable land conversions to land under nonagricultural uses have become a cause of the displacement of agrarian population who are now exploring job opportunities in other sectors, putting the pressure of the need of greater employment growth in these urban regions.

A major consequence of the lateral expansion is further weakening of already inadequate urban service delivery. As witnessed for all the six metropolitan regions, their boundaries have expanded into adjacent municipal regions. Many towns and village settlements have been engulfed under urbanization expansion. The lateral expansion of cities without ensuring adequate administration body in place for its governance has led to the transformation of most of these settlements into unplanned housing dwellings with minimal basic infrastructure¹⁷. One of the key reasons for inadequate service delivery outcomes in these regions is the overlapping administrative boundaries or the absence of any arrangement in function, roles, and responsibilities of the institutions resulting in poor accountability¹⁸. The absence of an effective coordination mechanism among municipal-, metropolitan-, and state-level agencies has implication for orderly spatial development, coordinated infrastructure provision, local economic growth, development management, service delivery, and expenditure effectiveness (JnNURM Report No Date).

Besides the socioeconomic aspects, there are also many ecological implications of the land-use conversions. As urbanization takes off, more land area is built; the sudden increase in builtup areas around the metropolitan region causes severe drainage problems, which is an everyday story of all the six metropolitan regions¹⁹.

¹⁴ The paper comments that international wheat prices swelled up when India entered the market as importer.

¹⁵ Chen (2007) studies threats upon soil protection and food security due to urbanization in China.

¹⁶ China has witnessed that urbanization led to an overall shift in grain production from traditional “grain bowls” to other regions (You et al. 2011).

¹⁷ The scale of unauthorized dwellings is so high in Delhi that a notice dispatched by the government of Delhi in 2011 declared regularization of 733 unauthorized colonies. There are 72 nonmunicipal areas within Kolkata metropolitan region. Shaw in her book “Making of Navi Mumbai” also discusses unauthorized colonies with shamed administrative law and order in Mumbai metropolitan region.

¹⁸ Shaw presents two case studies (from Bangalore and Kolkata) that discuss the issue of administration conflict resulting in poor service delivery.

¹⁹ This points to failure of urban service delivery (in this case drainage system) in keeping pace with lateral expansion rate.

Urbanization also increases the risk of pollution through unsafe waste disposition and land degradation because of excessive land quarrying and waste that is released from the construction sites. The consequences increase in the barren and nonarable land area as seen in the case of Delhi, Mumbai, and Bangalore.

The Way Forward

There are several policy choices that follow from the analysis undertaken in this paper. It is also obvious that policy correctives may have to be taken on multiple fronts and may require synchronization and specific sequencing. Some of these issues that merit attention are as follows.

First, the LARR bill should incorporate amendments to check the scale of land that can be acquired for nonagricultural activities. In addition, resourceful arable land diversion to the nonagricultural uses should be monitored. At the same time, there is also a need for adequate and timely compensations for those whose property has been acquired under the various land development processes by the government and other parties. This will help in an orderly management of urban land supply.

Second, it is required at urban town planning level to adjust FAR/FSI ratios for the cities so as to utilize the land resource to its optimum. It turns out that the land-use regulations could have a pronounced impact on the direction of urban region growth²⁰. Land value continuously rose with ever-strict land-use laws and the real estate pricing in these metropolitan regions further fueled the lateral expansion. The residential value has risen faster than the agriculture value of land. For states like West Bengal that barely contains any barren and nonarable land area for urban development, the only alternative to address rising housing demands is to encroach upon the arable land area. The higher FAR/FSI ratios for such regions make all the more sense, so that arable land area is only encroached when the existing land is utilized to its optimum. However, creating more floor space via relaxation in FAR/FSI regulations will not be enough to address these issues and it is required to be acted upon differently in different metropolitan regions although, it could be a viable alternative for metropolitan cities with comparatively lesser density²¹.

Third, the strategic placement of certain infrastructure project (while carving out the metropolitan master plans) could also guide future land-use changes in its surroundings; therefore, it is required that before exercising a decision for current

²⁰ Unlike any other metropolitan city in the country, Mumbai had vertical growth at the urban core region apart from the lateral expansion. Mumbai had topographical constraints of being an island that provided it a thrust for vertical growth. This growth was further favored by higher FAR/FSI ratio permits at the core of the city. However, soon enough while charting the master plan for Navi Mumbai the land-use regulation was revisited and reduced to match other metropolitan city regulations. Since then it has been laterally expanding like all other metropolitan cities. Mumbai has started sprawling toward the east under the master plan for building Navi Mumbai region.

²¹ For example, Delhi could bear higher FAR/FSI ratio regulation; however, Mumbai faces issue of higher density that crosses benefits yielded of higher FAR/FSI ratios.

need of an infrastructure project, its capacity to influence future land-use changes be kept in mind and tools to address those changes and requirements be put in place well in time. The urban municipal structure has failed to keep up with the current urbanization pace. Resultantly, incoherency between municipal services demand and supply is greater than it was ever before. There is urgent need to ensure spatial and functional integration of service delivery process through innovative institutional arrangements including creative use of public–private partnership for achieving better service outcomes. The already stressed service delivery system of metropolitan cities is facing great inconveniences in keeping up the pace with increasing areal space of the metropolitan region. The lateral expansion has widened the area of administration under metropolitan municipal committees. Often the rhetoric argument put against low FAR/FSI ratio relates to the inadequate infrastructure of the cities, which would crowd up already crowded and chaotic living conditions for the existing residents if more floor spacing is created within the city. Therefore, “a widespread reform in governance and service delivery framework with a focus on metropolitan integration and co-ordination” (JnNURM Report [No Date](#)) is required.

As the lateral expansion has added a new segment to the local metropolitan economy that is villagers, who lost their agricultural land for the development of the metropolitan region, and who are now potential seekers of employment in non-agricultural sector, there is urgent need for growing metropolitan regions to generate enough economic opportunities in the nonagriculture sectors for the incoming population²². The per capita gross domestic product (GDP) of workers employed in the nonagriculture sectors is five times of those engaged in agriculture sector (Sen 2003; Bhalla 2005); urbanization, if planned systematically, could therefore become a golden opportunity for reducing this gap by decreasing the population dependence upon agriculture sectors. In summary, as country develops economically, more land will be utilized for nonagricultural uses. However, the direction and extent of these changes need to be closely monitored and checked such that it remains sustainable and benefit society at large.

Appendix

The Fig. 13.8 shows scatterplot of land area under nonagricultural uses (Y) shows an upward trend and is nonstationary data series. Further, the scatter plot of barren and nonarable land area (X_1) shows a declining trend over time and thus is a nonstationary series. Scatter plot for arable land area (X_2) is also nonstationary. Therefore, the series is converted from nonstationary series to a stationary series through differencing.

²² The failure to predict and act in tandem with shift in employment demand from agrarian to service sector among farmers participating in urban policy-driven land-use changes has led to much distress in these transient regions (Paupers & Princes of Realty Deals. The Economics Times Magazine, February 17–23, 2013).

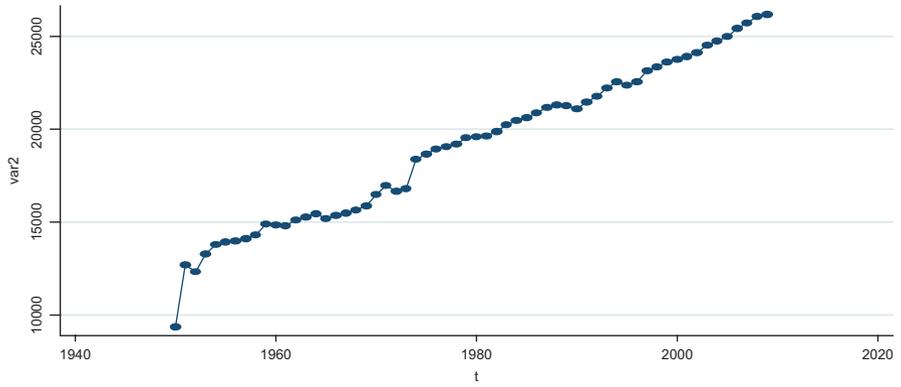


Fig. 13.7 Time series data plot land area under nonagricultural uses (Y)

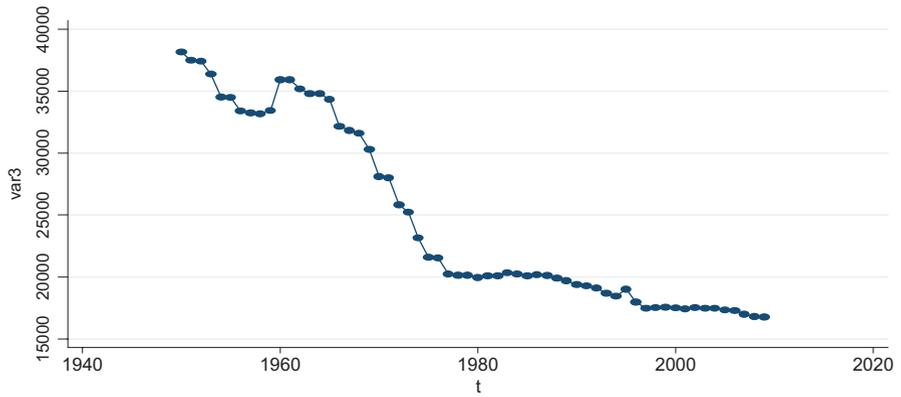


Fig. 13.8 Time series data plot barren and nonarable land area (X_1)

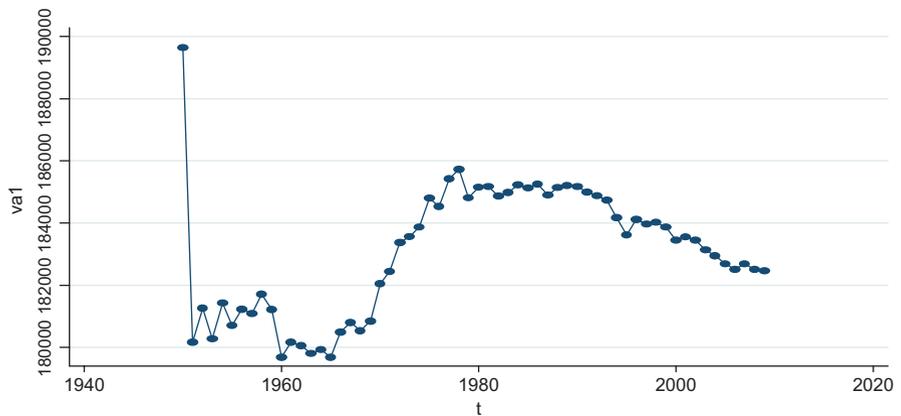


Fig. 13.9 Time series data plot arable land area (X_2)

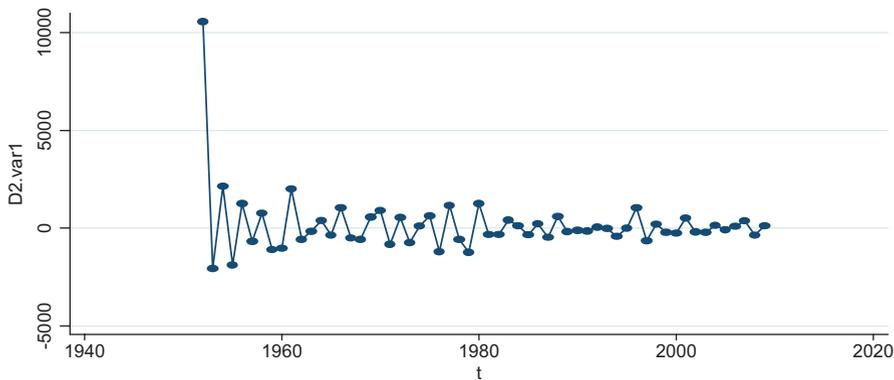


Fig. 13.10 Scatterplot of first difference of land area under nonagriculture uses

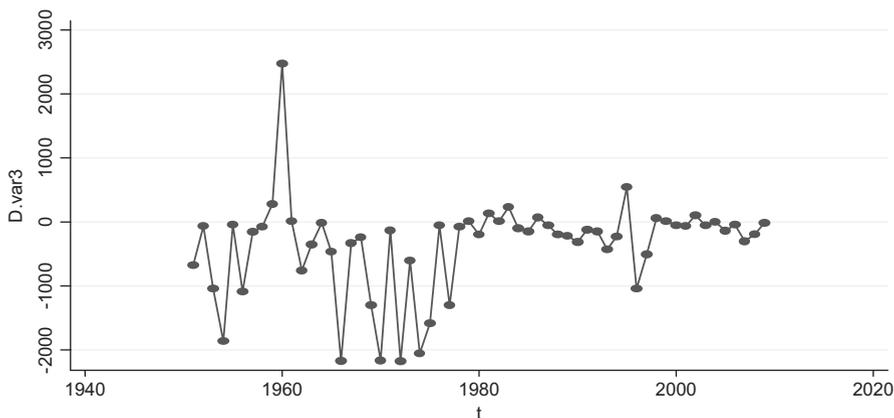


Fig. 13.11 Scatterplot of first difference of barren and nonarable land

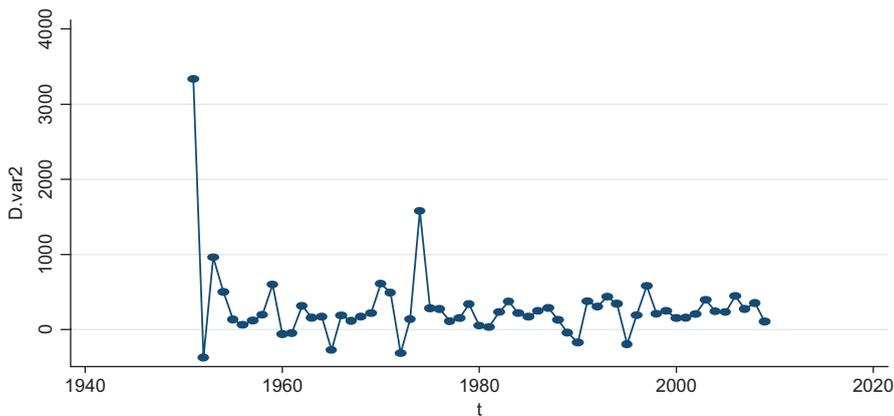


Fig. 13.12 Scatterplot of second difference of arable land

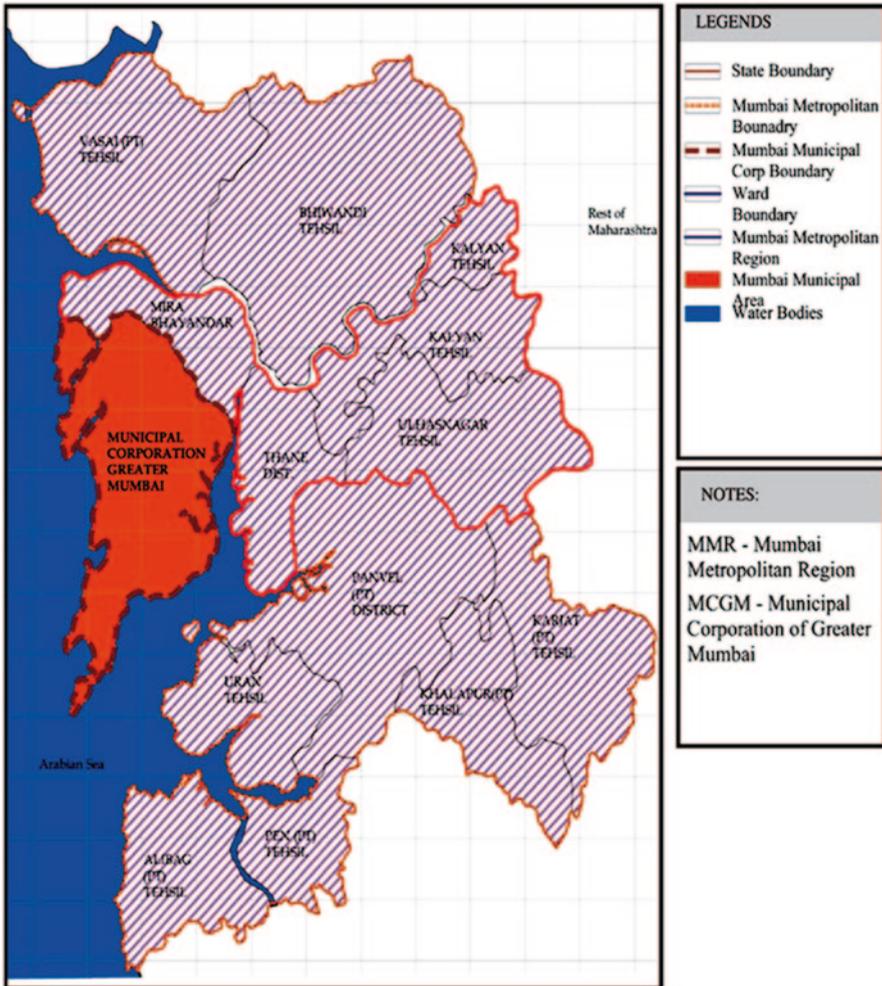


Fig. 13.13 Map depicting Mumbai urban sprawl. (Source: School of Planning and Architecture, New Delhi)

The figures below are scatterplots of first difference of land area under non-agricultural uses (Y) which is constant in mean and variance, making it stationary. Similar second difference operation is applied for arable land area (X_2) and, first difference for barren and nonarable land area (X_1) that made second difference scatter plot a stationary series. Regression for $D_1 \cdot X_1$ and $D_2 \cdot X_2$ on $D_1 \cdot Y$ and the results are shown in Table 13.2.

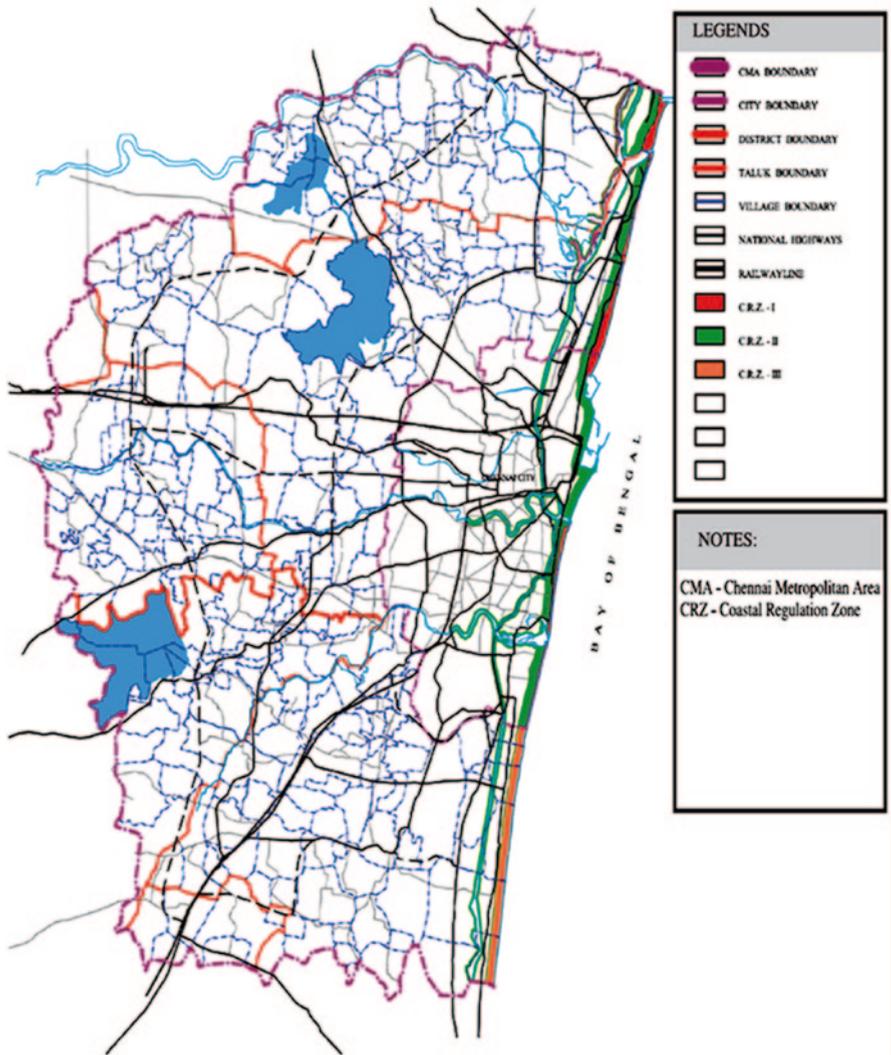


Fig. 13.14 Map highlighting Chennai conurbation. (Source: Chennai Metropolitan Development Authority)

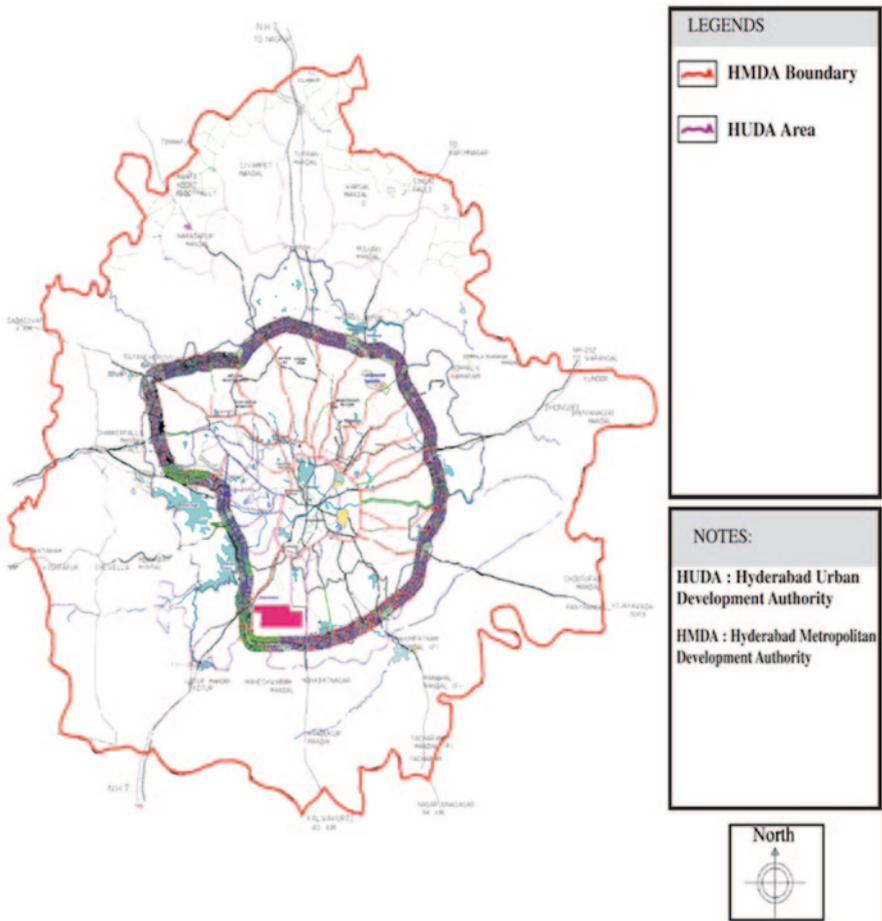


Fig. 13.15 Map depicting Hyderabad urban sprawl. (Source: Hyderabad Urban Development Authority)

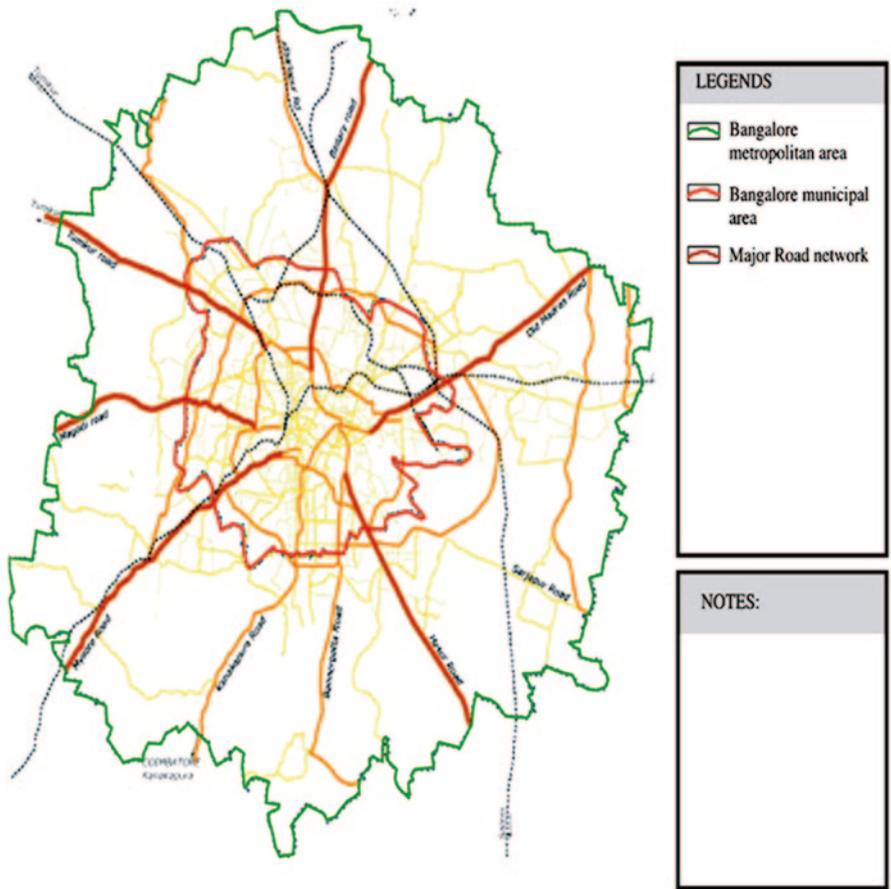


Fig. 13.16 Map highlighting Bangalore conurbation. (Source: School of Planning and Architecture, New Delhi)

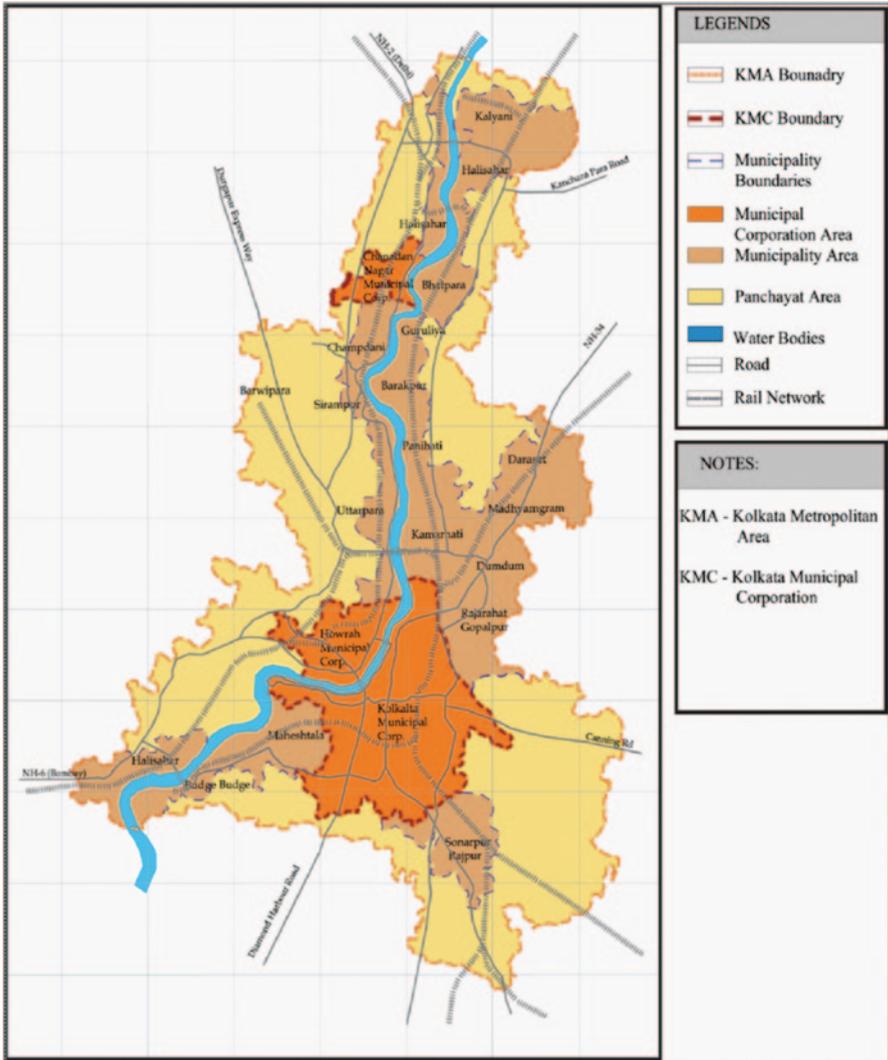


Fig. 13.17 Map highlighting Kolkata conurbation. (Source: School of Planning and Architecture, New Delhi)

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