# Dynamics of land use in India: A review

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## Abstract

**The land use pattern of an area is an outcome of demographic, environmental, technical, and institutional factors. Information on land use changes is necessary for understanding the relationships between humans and the natural environment. The purpose of this article is to review the previous studies on the spatio-temporal changes on land use in India. Drawing upon the enormous information of forty two studies conducted between 1979 and 2019, this article aimed to study the changes in land use pattern and different factors affecting land use using different methods across space and time. The findings show that compound growth rate and percentages were mostly employed to study these changes and regression analysis was used to determine the factors affecting the land use. Moreover, these articles concluded that land use changes occurred as a result of both natural and man-made factors which lead to increase in one category of land use and decrease in another. Therefore, proper monitoring of these land use changes when applied will help the government agencies and environmental managers in managing the use of most scarce natural resource on this planet.**

## Introduction

Land and water are the essential natural resources for sustaining human beings and their management is the basis for food security and rural economy of the nation (Wani *et al.* 2009, Naidu *et al.* 2014, Ramasamy *et al.* 2005, Sinha *et al.* 2017a and Najmuddin, 2018). The way and the extent to which the land is utilized set the pace of country's development (Laxmi *et al.* 2015). Land is the most important natural resource of a country like India where agriculture sector is relatively more prominent than the manufacturing sector (Laxmi *et al.* 2015, Chaplot 2017 and Pandey and Ranganathan, 2018). Like any other resource land has two dimensions viz, quality and quantity and both of these vital aspects are under serious threat due to intensive and extensive use of land both for agricultural and non-agricultural purposes (Ramasamy *et al.* 2005 and Sinha *et al.* 2017b). Land use change is a highly dynamic process or a complex phenomenon (Laxmi *et al.* 2015, Ahmad *et al.* 2018 and Ahlawat, 2017). Land use changes are broadly defined as the conversion of land from one utilization pattern to another. Different factors and mechanisms

drive land use and its change (Vaidya *et al.* 2017). Land has the characteristics of its fixity in supply and scarcity. Therefore, land use pattern is directly concerned with the problem arising in the process of deciding upon and carrying out into action for the optimum use. In a dynamic world, certain modifications can occur in the existing pattern of land utilization (Chaplot 2017). The land use pattern of a country at any particular time is determined by physical, climatic, economic and institutional factors (Laxmi *et al.* 2015 and Bairagi 2019). Considerable shifts in land use may have tremendous implications towards future agricultural and industrial growth, urban expansion and the ecological balance in different parts of the country. While some land use shifts might have occurred in the desirable direction, some others might have been in the undesirable direction (Sharma and Pandey 1992). Information on land use changes is the key factor for sustainable land use management and development and therefore, it is necessary to examine the past studies in order to understand the present status on land use. A literature search on changes in land use pattern was undertaken and all the titles and abstracts were read and assessed.

A total of 42 studies were separated having some potential relevance to changing land use scenario in the country. The criteria of including these papers was the relevance of the studies or reports, and below is a selection of the key results that helps to answer the main questions concerning the changes in land use pattern.

**Empirical literature review**

Land records information provides a geographically referenced inventory of use, ownership and value of real property. It is the basis for all the activities and thus the importance of land is indispensable. According to Ministry of Statistics and Programme Implementation, data on land use are collected in the form of a nine-fold classification i.e. Forest, Barren, Non-agricultural uses, Permanent pastures, Miscellaneous tree crops, Culturable waste, Current fallows, fallow land other than current fallows and Net sown area. Out of a geographical area of 329 million hectares statistics are available only from 305 million hectares, which implies that some areas are still not covered or classified under the nine-fold classification. It is of utmost importance to study the land use which keeps changing and is degraded continuously. Also, literature reviews are important for future policy making and taking decisions to save environmental degradation.

**Spatio-temporal changes in land use pattern**

Nandkarni and Deshpande (1979) studied the magnitude of under-utilization of land in India. They reported that the level of under-utilization of land declined from 24 to 20 per cent in the country between 1960-61 and 1970-71, which increased again to 23.4 per cent in the drought year of 1972-73. Pandey and Ranganathan (2018) examined the inter-sectoral changes in land-use at all India level during 1950–51 to 2011–12. The study revealed significant shift in the land-use in favour of non-agricultural activities throughout the period, but at varying rates over time. The shift in land-use to agriculture was favourable until the period of wider technological dissemination (1975-88) but at the cost of undesirable ecological sector. From then onwards, the net change in land for agriculture was negative, showing a shift in the land-use towards ecological or non-agricultural sectors or both. They also noted that there was no significant shift in the land-use from non-agriculture to agricultural activities.

A study by Bhandari (2007) on the changing land use pattern in district Kangra of Himachal Pradesh for the period between 1990-91 to 2003-04 revealed that area under forests and net sown area declined by 6.66 per cent and 5.40 per cent whereas, area under non-agricultural uses and barren area increased by 4.24 per cent and 9.34 per cent at the state level. At district level, the result showed that culturable waste land and barren area decreased by 4.15 per cent and 3.40 per cent while pasture land increased by 7.07 per cent. Moreover, Gupta (2007) revealed that area under forest, non-agricultural uses, barren land and other fallow land observed an increase of 2.34, 9.51, 4.22 and 0.25 per cent whereas in case of other categories of land uses decrease in percentage was observed in Himachal Pradesh. Further, Kumar *et al.* (2012) studied the land use pattern in district Solan of Himachal Pradesh from the year 1993-94 to 2007-08. The findings revealed that there were some notable variations in area under permanent pastures and net sown area. Moreover, other land categories had not shown significant change under their area. Also, Kumar and Najibullah (2013) studied the growth rates of different land use categories in Himachal Pradesh. The results clearly brought out that the growth rate of net sown area was negative during the study period (1972-2004) with decline being quite strong in 1990 period. The area put to non-agricultural uses registered very high growth rates, more so after the early1990s. Likewise, Lata *et al.* (2014) studied the land use pattern in Kinnaur district of Himachal Pradesh for the years 2003 and 2013. The findings revealed that there was an increase in barren and un-culturable land (0.38%), permanent pastures and other grazing land (0.72%), current fallows (0.007%), total cropped area (0.13%) and area sown more than once (0.07%) in the year 2012 as compared to the year 2003.

According to Takle *et al.* (2007), temporal changes in land use in Maharashtra for 30 years period from 1970-71 to 1999-2000 showed a positive and significant growth rate in land under non-agricultural uses (1.46%), miscellaneous tree crop (1.65%) and both the fallows (3.24%) while negative and significant growth was observed in forest (-0.16%), barren and uncultivable land (-0.49%) and permanent pasture land (-1.47%) over time. The dynamics of shift indicated that area from ecological sector shifted towards agriculture sector and non- agriculture sector in Maharashtra. Likewise, Gharke *et al.* (2013) used

compound growth rate to analyze the land use data in Maharashtra state for the period of 20 years from 1990-91 to 2009-10. It was observed that area under non-agricultural use, barren land, permanent pastures, current fallow, area sown more than once and gross cropped area increased significantly. Similarly, Sule and Barakade (2016) computed the percentage share of different land use categories in Satara district of Maharashtra for last 35 years from 1975-76 to 2010-11. The findings revealed that area under forest, land put to non-agricultural uses, barren area and cultivable waste land declined whereas current fallow land increased during the period.

Also, a study by Nagabhushan (1994) revealed that the growth rate of area under forest, land put to non-agricultural uses, current fallows, net sown area, total cropped area and area sown more than once were significantly positive in Dharwad district of Karnataka. Similarly, Gairhe (2011) computed the growth rates to study the land use dynamics in Karnataka using 28 years data from 1980-81 to 2007-08. The results revealed that forest area increased marginally and a considerable growth was observed in land put to non-agricultural uses and area sown more than once. Barren and uncultivated land, permanent pastures, cultivable wastes and miscellaneous tree crops showed significantly negative growth over study periods. Furthermore, Premakumara and Seema (2013) revealed that the net sown area has increased from 54.49 per cent to 55.22 per cent in Karnataka and decreased from 46.90 per cent to 46.27 per cent in India during 1990-91 to 2010-11. Likewise, Laxmi et al. (2015) analyzed the land use using markov chain analysis in Dharwad district of Karnataka. The findings revealed that forest area retained its share of 71.5 per cent and lost remaining 28.5 per cent to agriculture land (13.6 %), cultivable waste land (7.70%), fallow land (2.80 %), Cultivable waste land lost its share to land not available for cultivation (54.60 %) and forest (45.40 %). Agriculture land lost its share to forest land (53.20 %), cultivable waste land (20.30 %) and land not available for cultivation (16.90%).

Malik (2012) studied the changes in land use pattern in Haryana from 1995-98 to 2002-05. The findings revealed that proportion of area under forests and net sown area declined while area under non-agricultural uses has recorded positive change which increased from 8.69 per cent in 1995-98 to 10.14 per cent in 2002-05. Also, Bairagi (2019) calculated the percentage share of land use categories in Haryana for period 1991-92 to 2011-12. The results revealed that area under forests, fallow land and net sown area declined in the state while land put to non-agricultural uses, barren and uncultivated land increased during the period. Similarly, Rani (2019) revealed that area under forests declined drastically while net sown area initially increased then remained constant. The area under non-agricultural uses registered a positive change during the period from 1966-69 to 2010-13 in Haryana.

Furthermore, Adhikari and Sekhon (2014) studied the trends in land use in Punjab using compound growth rate for 30 years from 1980-81 to 2009-10. Findings revealed that the area under forests increased significantly by 1.43 per cent per annum, while area under barren and uncultivable land and cultural waste significantly decreased by 4.92 per cent, and 9.07 per cent per annum, respectively. Also, Singh and Singh (2019) revealed that the area under non-agricultural uses continued to increase at an increasing rate since 1990 in Punjab. But this shift towards non-agricultural uses was more than eight thousand ha (8.20 thousand ha) annually, during TE 2003-04 and TE 2013-14. Also, Pandey and Tewari (1987) examined the land use dynamics in Uttar Pradesh using compound growth rate from 1967-68 to 1983-84. The findings revealed that the area under non-agricultural uses has increased by 1.10 per cent while, forest area in the state increased at a very slow rate of 0.7 per cent. Furthermore, budgeting the land use changes within the agricultural sector indicated a consistent increase in fallow land in all the regions despite almost a constant net cultivated area. The culturable wastes were also decreasing consistently, except in the hills. Similarly, Sharma and Pandey (1992) observed declining trend in the area under non-agricultural uses, cultivable wastes and fallow land showed a positive growth in most of the states in India. Further, inter-sectoral budgeting analysis revealed that area shift occurred from both desirable and undesirable ecology sectors towards agricultural as well as non-agricultural sectors. Also, Pandey and Tewari (1996) detected the land use changes using compound growth rates in various land use classes in fourteen agriculturally important states namely Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal for the period from 1970-70 to 1990-91. The

findings revealed that only two states of Gujarat and Rajasthan had more than 10 per cent, while all other states have less than 5 per cent of their reporting area as cultivable waste. Also budgeting of land use classes revealed that there has been net addition of land to agricultural sector in the states of Kerala, Madhya Pradesh and Punjab. Similarly, Ramasamy *et al*. (2005) studied the trends in land use pattern in Tamil Nadu and found that area under cultivable wastes and barren and uncultivable waste declined significantly because of diversion of these lands for non-agricultural purposes whereas other fallow land registered the sharp increase in the state. Also, Rejula and Singh (2015) analyzed the changing land use pattern in Kerala for time period 2001 to 2012. The study observed that cultivable waste land, fallow other than current fallow and current fallow recorded a positive growth in area. Further, Deka *et al*. (2018) examined the changes in land use in Assam for the period from 1990- 91 to 2015-16. The compound growth rate analysis revealed that net area sown, total cropped area and area sown more than once had increased whereas significant negative growth was registered for forest area, barren and un-culturable land, permanent pastures and other grazing land, land under miscellaneous trees, groves and fallow land.

To summarize this, it can be concluded that the area under forest and net sown area declined in almost all the agriculturally important states namely Maharashtra, Himachal Pradesh, Haryana, Uttar Pradesh except in hilly state Assam and Karnataka while land put to non-agricultural uses experienced an increase in all the states over a period of time. States namely Maharashtra, Karnataka, Kerala and Himachal Pradesh registered a positive growth in area under current fallows and fallows other than current fallows. Area under land categories of permanent pastures, miscellaneous tree crops and culturable waste registered the declining trend in almost all the states. Dynamics of shift indicated that shift in area has occurred from both desirable as well as undesirable ecology sectors to agricultural and non-agricultural sectors in all the states of India.

**Factors affecting land use change**

Bergeron and Pender (1999) found that land use changes were influenced by plot level variables such as altitude, slope and tenure; by farm level variables such as human capital, farm size, and ownership of productive implements; and by community variables such as technical assistance, roads and population

growth in Honduras region of central America. Also, Rasul *et al*. (2004) revealed that the institutional support, productive resource base and distance to the market and service center were the main factors responsible for land use change in areas where such support and facilities were favorable in Bangladesh. While in other areas with insecure land tenure, difficult access to market centers, and unavailability of credit and extension services shifting cultivation was the dominant type of land use. Farajollahi *et al*. (2017) also revealed that the low income of rural household, the high cost of living, unemployment in rural area and increasing the price of farm land were the most effective factors of land use change in Iran. Nandkarni and Deshpande (1979) highlighted the importance of institutional factors leading to under-utilization of agricultural lands especially when people employed in urban areas keep lands idle for using it after retirement or for speculative purposes in the country. Furthermore, Bardhan and Tewari (2010) used linear regression method to analyze the factors affecting other fallows and cultivable wastes. Findings revealed that cultivable wastes increased with an increase in the area under large holdings and decreased with increase in the proportion of leased-in land in the country.

Furthermore, Reddy (1991) revealed that the land use pattern was mainly influenced by the extent of adoption of modern technology such as irrigation, tractors, commercialization, etc. in Andhra Pradesh. Likewise, Wani *et al.* (2009) revealed that increase in rural population in relation with cultivated area had considerably contributed to the increase of area under current fallows in Jammu & Kashmir. Moreover, De *et al.* (2014) revealed that due to extension of irrigation, cultivation of multiple crops and mechanized agricultural techniques, the fallow lands had been decreasing day by day and more and more land resource were coming under intensive human practice of economic consideration in West Bengal. Also, Pushpa and Akashraj (2014) found that urbanization has influenced on land shift towards non-agriculture in Karnataka. Furthermore, Azharuddin (2015) concluded that humans are the major force of change around the globe, transforming land to provide food, shelter, and products for use in Uttar Pradesh. Moreover, Vaidya *et al.* (2017) found that increased economic returns from highly remunerative cash crops emerged as the major drivers for the land use changes as perceived by 58 per cent of the respondents, followed by climate change. Similarly,

Sinha *et al.* (2017b) concluded that land use pattern was change due to increasing population, urbanization, fragmentation of land holdings and declining water table in the region of Bihar. Also, Sinha *et al.* (2017a) and Ahmad *et al.* (2018) revealed that rainfall and road length had significant impact on the level of current fallows. Erratic monsoon and scarcity of labour during the study period resulted into accumulation of current fallow lands in Bihar. It was also observed that the non-agricultural uses of land was identified as the dominant factor for changes in common lands as it negatively affected the current fallows.

To sum it up, it can be concluded that major driving forces causing land use change were socio-economic factors (urbanization, low income of rural household, high cost of living, rural unemployment, fragmentation of land holding, decreasing water table etc.), technical factors (mechanized agricultural technique, number of tractors, extension of irrigation facilities, cultivation of multiple crops, etc.), environmental factors (erratic rainfall, temperature, altitude, etc.) and institutional factors (size of farm, land tenure, road length, distance to the market, etc.).

## Conclusion

The main aim of this paper was to review the past studies conducted on the spatio-temporal changes in land use using percentage method, compound growth rate and inter-sectoral budgeting analysis. It was found that compound growth rate was the most dominant method used for detecting the changes in land use and regression analysis was used to determine the different driving forces of land use change. Also, most of the studies have shown that land use is classified in nine categories i.e. Forest, Barren, Non-agricultural uses, Permanent pastures, Miscellaneous tree crops, Culturable waste, Current fallows, Fallow lands other than current fallows and Net sown area. Majority of the studies revealed that the net sown area in the country is decreasing day by day while area under non-agricultural uses and fallow lands increased. It was also found that data on different land use categories across the country is not updated properly. Hence, disparities are often noted in land records. Therefore, in several cases, the property documents do not match the position on the ground. In conclusion, the study of dynamics of land use changes provides more detailed information on the type of changes and driving forces causing these changes. This can help the policy makers in designing appropriate short and long term development strategies for the proper use of land resource.

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