Impact of Urbanisation on Land Use Pattern in Tamil Nadu – An Economic Analysis

Abstract

Changes in land use that eventually resulted in less land being used for agriculture and more space being used for housing in most metropolitan populations. Land use changes have a variety of ecological effects on both urban and rural locations. One of the most notable land use dynamics is the conversion of land that occurs around the periphery of large cities due to a variety of economic and demographic causes. As thespecific objectives set forth for the study are, to analyse the temporal changesin the land use pattern of the study area and also to estimate the dynamic changes of land use categories and the loss of agricultural land in the study area.The changes in the land use pattern was estimated for the period from 2000-01 to 2019-2020 and further discussed as two decadal periods. The results revealed that there had been a significant decline in the net area sown, while the area under land put to non-agricultural uses and fallow lands, had a sharp increase. Thisshift in the land use categories might be due to the increasing demand for urbanization and infrastructure development, as a result of population pressure.

Keywords: Land use pattern, dynamic changes, urbanization, population pressure.

1. Introduction

Changes in land use subsequently leading to decreased agricultural land in favour of the provision of residential accommodation in most urban settlements. Land use is referred as the reflection of human activities, such as the use of the land like industrial zones, residential zones, agricultural fields, etc [1] (Ahmed *et al.*, 2015).

Dynamics of land use is a complex phenomenon, which is affected by several socio-economic, agro-climatic and ecological variables. Both climatic and institutional factors are crucial in determining land use pattern. The extent of land use is also influenced by technological changes over a period of time. The technological changes in agriculture ignited intensive cultivation resulting in conversion of marginal lands into productive agricultural lands through capital intensive cultivation. (Ramsamy *et al.*, 2005) and (Anupama *et al.*, 2020).

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Consequently, the pattern of land use in urban areas characterize the collective effects of innumerable decisions and procedures by individuals and institutions. Changes in land uses have a number of ecological impacts affecting both urban and rural areas. Most prominent land use dynamics are the land conversion that happens in the urban fringe of big cities under various economic and demographic factors (Oduwaye, 2015).

The land use transformation has a direct and indirect effect on urbanization. Land use change is the result of complex interactions between the physical, socio-economic and legal setting within a geographical context. The phenomenon has led to a gradual change of rural landscape to urban landscape due to the population pressure and demand for conversion of agricultural lands to non-agricultural lands. The increasing demand for non-agricultural land has driven up the land values and it has been significantly higher than the value of the agricultural land.

With the above backdrop, the specific objectives set forth for the study are,

1. To analyse the temporal changesin the land use pattern of the study area
2. To estimate the dynamic changes of land use categories and the loss of agricultural land in the study area.

2. Materials and Methods

2.1 Methodology

The nine-fold land use classifications considered for the analysis were forest area, barren and uncultivable land, land put to non-agricultural uses, land under permanent pastures and other grazing land, cultivable waste, land put to miscellaneous tree crops and groves, current fallows, other fallows and net area sown. The secondary data on land use pattern was collected from the Directorate of Economics and Statistics, Tamil Nadu. The changes in the land use pattern was estimated for the period from 2000-01 to 2019-2020 and further discussed under two decadal periods, namely, Decade I (2000-01 to 2009-10) and Decade II (2010-11 to 2019-2020)

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2.2 Tools of Analysis

2.2.1 Descriptive Analysis

Descriptive statistical analysis was undertaken using percentage, mean etc.

2.2.2 Growth Rate Analysis

Compound growth rates of land use pattern was estimated to capture the trend in these variables. Exponential function of the following form was used to estimate the growth rates

$$Y_t = Y_o (1+r)^t \qquad \text{------- (1)}$$

Where,

Y_t = Area under the land use category at time t (ha)

r = Compound rate of growth of Y

Y_o = Initial year area under the land use category (ha)

By taking natural logarithm,

$$\text{In } Y_t = \text{In } Y_o + t \text{ In } (1+r) \quad \text{------- (2)}$$

Now letting,

$\beta_1 = \text{In } Y_o$

$\beta_2 = \text{In } (1+r)$

Equation (2) can be written as

$$\text{In } Y_t = \beta_1 + \beta_2 t \quad \text{------- (3)}$$

Adding the disturbance term to (3), it can be written as

$$\text{In } Y_t = \beta_1 + \beta_2 t + U_i \quad \text{------- (4)}$$

Y_t = Area under crop / land use category at time't' (ha)

t = time in years

β_1 = constant term

β_2 = regression co-efficient

This log linear function was fitted by using Ordinary Least Square (OLS) method. The compound growth rate (r) was obtained using the formula.

$$r = (\text{Antilog of } \beta_2 - 1) \times 100 \quad \text{------- (5)}$$

The growth rates were estimated for the different land use categories, viz., forest area, barren and uncultivable land, land put to non-agricultural uses, land under permanent pastures and other grazing land, cultivable wastes, land put to miscellaneous tree crops and groves, current fallows, other fallows and net area sown.

2.2.3 Markov Chain Analysis

The dynamism in the direction of area under land use categories were analyzed using the first order Markov chain approach using LINGO software. Central to Markov chain analysis is the estimation of the transitional probability matrix 'P' whose elements, P_{ij} indicate the probability (share) of land use categories switching from i^{th} land use category to j^{th} land use category over time. The diagonal element P_{ij}, where i=j, represents the retention share of respective land use category in terms of area under land use categories.

This can be denoted algebraically as

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$$E_{jt} = \sum_{i=1}^{n} (E_{it-1})$$

Where,

E_{jt} = Area under land use category to the j^{th} land use in the year t

E_{it-1} = Area under i^{th} land usecategory during the year t-1

P_{ij} = The probability of shift in area under i^{th} land use category to j^{th} land use category

e_{jt} = The error term which is statistically independent of E_{it-1}

n = Number of land use categories

The transitional probabilities P_{ij}, which can be arranged in a (m x n) matrix, have the following properties:

$$\sum_{i=1}^{n} P_{ij}) \leq P_{ij} \leq 1$$

Thus, the expected share of each land use category during the period 't' is obtained by multiplying the share of these land use categories in the previous period (t-1) with the transitional probability matrix.

The transitional probability matrix is estimated using linear programming (LP) framework by a method referred to as minimization of Mean Absolute Deviation (MAD), the formulation is stated as

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Min, OP* + I e

Subject to,

X P* + V = Y

GP* = 1

P* ≥ 0

Where,

P* is a vector of the transitional probabilities P_{ij} to be estimated

O is the vector of zeros

I is an appropriately dimensional vector of areas

e is the vector of absolute errors

Y is the proportion of area to each land use category

X is a block diagonal matrix of lagged values of Y

V is the vector of errors

G is a grouping matrix to add the row elements of P arranged in P* to unity.

2.2.4 Instability Index

Instability index in area under land use categories is expected to hamper the process of economic development. To study the variation in land use pattern, Coppock's Instability Index (Coppock, 1962) was used, which is algebraically expressed in the following form:

$$V = \frac{1}{N}\left[\log\frac{X_{t+1}}{X_t} - m\right]^2$$

The instability index is = (Antilog of$\sqrt{V} - 1$) × 100

Where,

X_t = Area under land use category in time't'

n = Number of years

N = n - 1

$$m = \frac{1}{N}\text{og } X_{t+1} \quad - \quad \log X_t)$$

Steps in Construction of Instability Index

1. Logarithms are obtained for each annual value of variable: for example for year 1, year 2 etc.
2. In order to get the first difference of logarithms, the logarithm for the value for year 2 is subtracted from logarithm of the value for year 1 etc.,
3. The arithmetic mean of the logarithmic first difference is obtained.
4. The logarithmic mean is then subtracted from each year to year logarithmic first differences, in order obtain logarithmic differences, the actual and average year to year logarithmic differences.
5. Logarithmic differences from the trend- some positive and some negative are then squared, summed up and divided by the number of years minus one. The resulting number is referred to as the "log variance".

The next step is to take the square root of the log variance and obtain the antilog of the square root value. Unity is then subtracted from antilog and decimal moved two places to the right. The resulting instability index is a close approximation of the average year to year percentage variation, adjusted for trend.

2.2.5 Land Consumption Rate and Land Absorption Rate÷

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The land consumption rate measures the compactness which indicates the level of the spatial expansion of a city while the land absorption coefficient measures the amount of changes in consumption of new urban land per unit increase in urban population (Amin & Fazal, 2012).

Land Consumption Rate (LCR) = A / P

Where, A is the area in hectares and P the population.

Land Absorption Rate (LAC) = $(A_2 - A_1) / (P_2 - P_1)$

Where, A_1 and A_2 = area extents for the early and later years.

P_1 and P_2 = population figures for the early and later years.

3. Result and Discussion

3.1 Changes in the Land Use Categories

The nine-fold land use classifications considered for the analysis were forest area, barren and uncultivable land, land put to non-agricultural uses, land under permanent pastures and other grazing land, cultivable waste, land put to miscellaneous tree crops and groves, current fallows, other fallows and net area sown. The average area under different land use categories of Tamil Nadu state have been analysed for a period of 20 years from 2000-01 to 2019-20 and further discussed under two decadal periods, as Decade I (2000-01 to 2009-10) and Decade II (2010-11 to 2019-2020), along with the changes in the land use pattern between the two decades and the results are presented in Table 1.

The average area under different land use categories of Tamil Nadu and the decadal growths revealed that the net area sown occupied the highest share of 38.58 per cent in Decade I and 35.79 per cent in Decade II, followed by forest area, land put to non-agricultural uses, other fallows, current fallows, barren and uncultivable land, land under permanent pastures, miscellaneous tree crops and cultivable waste.

It is seen from Table 1 that the area under other fallows exhibited the highest decadal growth of 16.54 per cent, followed by the land put to non-agricultural uses with a decadal growth of 10.74 per cent, the current fallows has increased by 6.14 per cent and the forest area has increased only by 0.99 per cent between Decade I and Decade II.

On the contrary, the area under miscellaneous tree crops and groves has declined sharply by 11.89 per cent, the area under permanent pastures and other grazing lands by 9.97 per cent between Decade I and Decade II. The net area sown has also declined by 6.09 per

cent and the cultivable waste and barren and uncultivable land have decreased by 5.26 per cent and 4.06 per cent, respectively, over the two decades.

It is also seen that, the gross cropped area has declined by 1.43 per cent, while area sown more than once and cropping intensity have increased by 28.61 per cent and 4.97 per cent, respectively, between the two decades. The results are in line with Harishkumar and Reddy (2017).

The results on the changes in the area under land use categories of Tamil Nadu revealed that the land put to non-agricultural uses and fallow lands have increased significantly over the decadal periods and there was a considerable decline in the cultivable wastes, miscellaneous tree crops and groves, net area sown and permanent pastures and other grazing land during these periods. This shift in land towards non-agricultural uses could be attributed to the development of infrastructure, increase in demand of land for industrial purposes, housing and urban growth. The decrease in cultivable waste lands might be due to the fact that the land was being utilised for industrial purposes. The area under forest had also increased over the decades, might be due to the favourable impacts of afforestation and Forest policy measures. Also, the area sown more than once and cropping intensity have increased between the two decades, implying the farmers' awareness on the strategies to cope up with the land conversions prevailing in the rural areas, due to the effect of urbanization.

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Table 1. Average Area and Decadal Growth in Land Use Categories of the Study area, 2000-01 to 2019-20 (in lakh hectares)

S. No	Land Use Categories	Tamil Nadu State		
		Decade I (2000-01 to 2009-10)	Decade II (2010-11 to 2019-20)	Decadal Growth
1.	Forest area	21.20 (16.28)	21.41 (16.25)	0.99
2.	Barren and uncultivable land	4.93 (3.79)	4.73 (3.59)	-4.06
3.	Land put to non-agricultural uses	21.05 (16.17)	23.31 (17.69)	10.74
4.	Land under permanent pastures and other grazing land	3.61 (2.77)	3.25 (2.47)	-9.97
5.	Cultivable wastes	1.14 (0.87)	1.08 (0.82)	-5.26
6.	Land put to miscellaneous tree crops and groves	2.69 (2.07)	2.37 (1.80)	-11.89
7.	Current fallows	10.09 (7.75)	10.71 (8.13)	6.14
8.	Other fallows	15.24 (11.72)	17.76 (13.46)	16.54
9	Net area sown	50.22 (38.58)	47.16 (35.79)	-6.09
	Area sown more than once	7.83	10.07	28.61
	Gross cropped area	58.05	57.22	-1.43
	Cropping intensity	115.59	121.34	4.97
	Total area	130.17 (100)	131.78 (100)	

Note: Figures in the parentheses indicate percentage to the respective total area

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3.2 Growth Rates of Land Use Categories

The growth in the area under different categories of land use in Tamil Nadu state have been analysed for a period of 20 years (2000-01 to 2019-2020) and a disaggregated analysis for the two Decades as Decade I (2000-01 to 2009-10) and Decade II (2010-11 to 2019-2020) was done using compound growth rate analysis. The results are presented in Table 2, Figure 1 and 2.

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It could be seen that in Tamil Nadu state, the land put to non-agricultural uses increased over the two decades, at the rate of 1.13 per cent in Decade I, 2.57 per cent in Decade II and registered a positive growth in the overall period by 1.20 per cent. The other fallow lands have also increased at the rate of 1.05 per cent in Decade I, 2.39 per cent in Decade II and recorded an overall positive growth of 1.57 per cent. Also, the area under forest and current

fallows have registered a positive growth of 0.09 per cent and 0.29 per cent, respectively in the overall period, though it had negative trends in the decades.

However, the net area sown exhibited a declining trend over the decades, *viz.*, -0.07 per cent in Decade I, -0.68 per cent in Decade II and -0.56 per cent in the overall period. Also, the cultivable wasteland has decreased by 1.00 per cent in Decade I and by 0.24 per cent in Decade II and has registered an overall negative growth of -0.53 per cent.

The same pattern has been exhibited by land under permanent pastures and miscellaneous tree crops also, which have registered a declining trend in these decadal periods with -1.17 per cent and -0.57 per cent in Decade I and -0.33 per cent and -1.56 per cent in Decade II, respectively, for these land use categories. Consequently, the overall growth rates of these categories of land were -1.00 per cent and -1.20 per cent, respectively. However, the barren and uncultivable land has shown a declining trend of -0.99 per cent in Decade II and increasing trend of 0.34 per cent in Decade I, with an overall negative growth of -0.39 per cent.

An overall declining trend has been noted for the gross cropped area with -0.15 per cent and an increasing growth trend for area more than once and cropping intensity, *viz.*, 2.03 per cent and 0.42 per cent, respectively.

Table 2. Growth Rates of Land Use Categories in the Study Area, 2000-01 to 2019-20

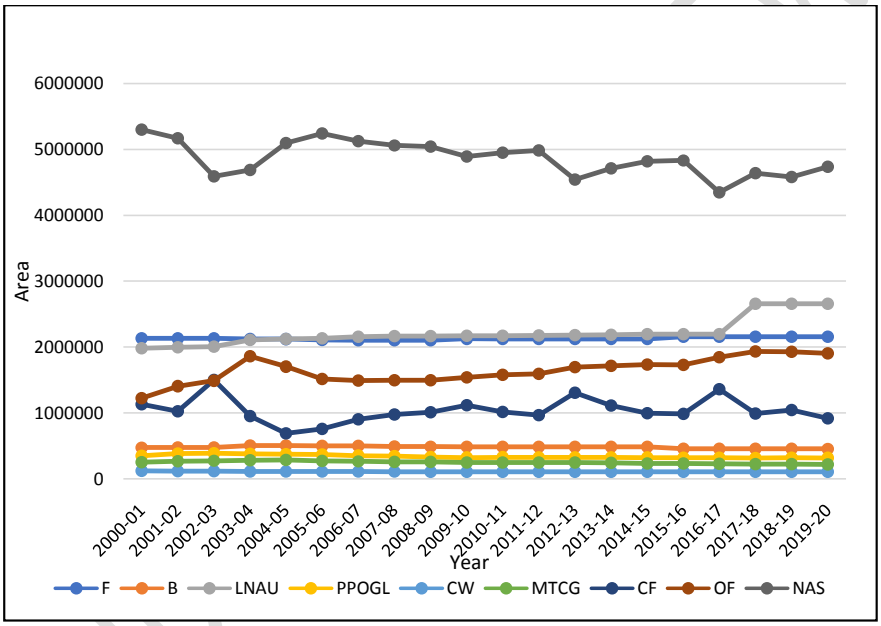
S.No	Land Use Categories	Tamil Nadu State		
		Decade I (2000-01 to 2009-10)	**Decade II (2010-11 to 2019-20)**	**Overall Period**
1.	Forest area	-0.12	0.22***	0.09
2.	Barren and uncultivable land	0.34	-0.99***	-0.39***
3.	Land put to non- agricultural uses	1.13***	2.57***	1.20
4.	Land under permanent pastures and other grazing land	-1.17	-0.33***	-1.00
5.	Cultivable wastes	-1.00***	-0.24***	-0.53
6.	Land put to miscellaneous tree crops and groves	-0.57**	-1.56	-1.20
7.	Current fallows	-1.45	-0.67	0.29**
8.	Other fallows	1.05	2.39	1.57

9	Net area sown	-0.07**	-0.68	-0.56**
	Area sown more than once	-0.45	4.22**	2.03**
	Gross cropped area	-0.38	0.10**	-0.15
	Cropping intensity	0.03	0.79	0.42***
	Total area	-2.60	0.44	0.15***

*(** and *** indicate significance at 5 per cent and 1 per cent levels, respectively)*

(Note: Compound Growth Rate Analysis)

Fig. 1. Trends in the Land Use Categories in Tamil Nadu



Data Source: Statistical Handbook, 2020

It could also be seen from Figure 1 that the trend lines for land put to non-agricultural uses, other fallows and current fallows have been increasing over the decades and the net area sown had shown a declining trend over the decades in Tamil Nadu state, while the other land use categories have not shown much variation over the decades.

The results on the growth rates of land use categories revealed that in the forest area, no significant growth has been observed both in Tamil Nadu state. There has been a continuous increase in land put to non-agricultural uses, which was the major competitor to the agricultural sector for the demand of land; and within agricultural sector, both other fallows and current fallows showed a significant positive growth in the state, for the overall period of

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the study. However, the other categories of land use, *viz*., net area sown, barren and uncultivable land, permanent pastures and other grazing land, cultivable wastes, miscellaneous tree crops and gross cropped area have registered negative growth rates over the period of 20 years in the study area, implying the diversion of the area from these categories to non-agriculture activities. The declining trend in these categories might be due to the increasing demand for urbanization and infrastructure development, as a result of population pressure. The decline in the cultivable wastes might be due to land reclamation measures adopted by the farmers for agricultural uses. Hence, it could be concluded that the common lands (permanent pastures and other grazing land, land under miscellaneous tree crops and groves and cultivable wastes) are more prone to encroachment and privatization.

The results also revealed that there has been a positive growth in the cropping intensity, which might be due to the advancements in the crop production and improvement technologies over the period, such as, adoption of improved and short duration varieties, expansion in irrigation, intensification in the use of fertilizers, mechanization and developments in other agricultural services.

3.3 Instability Indices of Land Use Categories

Instability index is a measure of extent of variability or the absence of stability in time series data and hence the instability indices for various land use categories were worked out for the overall period (2000-01 to 2019-2020) and also separately for Decade I and Decade II and the results are presented in Table 3.

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It could be seen that in Tamil Nadu, the instability indices for current fallow lands were of high order at 11.028 in Decade I, 8.968 in Decade II and 7.870 in the overall period, which implies the absence of stability in the data on the area under this land use category over the years. The area under other fallows have also registered a high instability index of 4.396 in Decade I and comparatively lower index of 1.203 in Decade II and 2.541 in the overall period. The instability index for the net area sown was also high in the two decades, with indices of 2.267 in Decade I, 2.405 in Decade II and 1.847 in the overall period, which indicates the variability in the data over the 20 years period.

All the other land use categories in the state had very low instability indices, implying a stability in the time series data on the area under these categories. Of this, the forest area has recorded the lowest instability indices, as there was no much variation in the area under forest over years, which was reflected from the growth rate analysis. The instability indices of area sown more than once, gross cropped area and cropping intensity were also of high order

in the state, indicating the absence of stability in the data. This might be due to the fluctuations in the rainfall distribution.

Table 3. Instability Indices of Land Use Categories in the Study area, 2000-01to 2019-20

S.No	Land Use Categories	Tamil Nadu State		
		Decade I (2000-01 to 2009-10)	**Decade II (2010-11 to 2019-20)**	**Overall Period**
1.	Forest area	0.177	0.198	0.153
2.	Barren and uncultivable land	0.972	0.899	0.761
3.	Land put to non- agricultural uses	0.610	2.593	1.512
4.	Land under permanent pastures and other grazing land	1.685	0.251	0.965
5.	Cultivable wastes	0.739	0.203	0.474
6.	Land put to miscellaneous tree crops and groves	1.473	0.501	0.901
7.	Current fallows	11.028	8.968	7.870
8.	Other fallows	4.396	1.203	2.541
9	Net area sown	2.267	2.405	1.847
	Area sown more than once	9.407	15.412	0.272
	Gross cropped area	3.160	4.129	10.123
	Cropping intensity	0.970	1.968	2.956
	Total area	0.037	0.472	1.251

———From the above results on the instability indices, it could be concluded that that the highest instability was observed in respect of current fallows, followed by other fallows and net area sown and the lowest index was noticed in case of forest area in the state.The highest instability indices for current fallow, indicated the high year to year fluctuations in the area under this category, due to the variations in rainfall, since more than 50 per cent of the net area sown was under rainfed cultivation.

3.4 Dynamic Changes in the Land Use Pattern

———The Markov chain analysis has been widely used in studying agricultural problems in recent years. In the present study, Markov chain analysis has been employed to study the dynamics of land use pattern in the study area using secondary data on area under different categories of land use for a period of 20 years (from 2000-01 to 2019-2020), by estimating the transitional probability matrices. The probability of retaining the particular land use category and shifting pattern was interpreted by studying the diagonal and off diagonal elements of the transitional matrix.

Table 4. Transitional Probability Matrix for Dynamic Changes in the Land Use Pattern in Tamil Nadu, 2000-01 to 2019-2020

Land Use Categories	Forest area	Barren and uncultivable lands	Land put to non-agricultural uses	Permanent pastures and other grazing lands	Cultivable wastes	Land put to miscellaneous tree crops & groves	Current fallows	Other fallows	Net area sown
Forest area	**0.2742**	0.0241	0.0000	0.0786	0.0056	0.0117	0.0538	0.0000	0.5520
Barren and uncultivable lands	0.5051	**0.0000**	0.0000	0.1556	0.0000	0.0000	0.0000	0.0000	0.3393
Land put to non-agricultural uses	0.1050	0.0170	**0.5296**	0.0200	0.0034	0.0096	0.0398	0.2320	0.0436
Permanent pastures and other grazing lands	0.0560	0.0711	0.0000	**0.0000**	0.0167	0.0344	0.1587	0.0000	0.6631
Cultivable waste	0.0562	0.0711	0.0000	0.0000	**0.0166**	0.0344	0.1587	0.0000	0.6630
Land put to miscellaneous tree crops and groves	0.0562	0.0711	0.0000	0.0000	0.0166	**0.0344**	0.1586	0.0000	0.6631
Current fallows	0.1340	0.0000	0.7642	0.0000	0.0000	0.0000	**0.0000**	0.0000	0.1018
Other fallows	0.1283	0.0000	0.3127	0.0000	0.0000	0.0000	0.1272	**0.4318**	0.0000
Net area sown	0.1367	0.0684	0.0000	0.0087	0.0152	0.0347	0.1052	0.1213	**0.5098**
Steady state probability	**0.1574**	**0.0316**	**0.2291**	**0.0245**	**0.0070**	**0.0161**	**0.0767**	**0.1576**	**0.3000**
Current Year Share (in percentage)	**15.99**	**3.39**	**19.72**	**0.79**	**2.39**	**1.64**	**6.82**	**14.13**	**35.13**

The transitional probability matrices for the dynamic changes in the land use pattern of Tamil Nadu are presented in Table 4.

It could be seen from Table 4 that the diagonal elements represent the probability of retention of existing area under the land use category. The probability of retention of land put to non-agricultural uses was estimated at 52.96 per cent, which was the highest, followed by net area sown (50.98 per cent), other fallows (43.18 per cent), forest area (27.42 per cent), miscellaneous tree crops and groves (3.44 per cent) and cultivable waste (1.66 per cent). The barren and uncultivable land, permanent pastures and other grazing land and current fallows were estimated at zero probability.

The probability of shift in land put to non-agricultural uses was estimated at 23.20 per cent to other fallows, 10.50 per cent to forest, 4.36 per cent to net area sown, 3.98 per cent to current fallow, 2.00 per cent to permanent pastures and other grazing land, 1.70 per cent to barren and uncultivable land, 0.96 per cent to miscellaneous tree crops and groves and only 0.34 per cent to cultivable waste. However, it gained around 76 per cent from current fallows and 31 per cent from other fallows.

The estimated steady state probability reveals that if this land use pattern continues, in future around 30 per cent will be under net area sown, 22.91 per cent of area will be under non-agricultural uses, 15.76 per cent will be under other fallows, 15.74 per cent will be under forest, 7.67 per cent will be under current fallows, 3.16 per cent will be under barren and uncultivable land, 2.45 per cent will be under permanent pastures and other grazing lands, 1.61 per cent will be under miscellaneous tree crops and groves and only 0.70 per cent will be under cultivable wastes. The results are in line with Adhikari and Sekhlon (2014).

A comparison between the future forecasted share of area under different land use categories estimated vide steady state probabilities and the current share of area under the respective land use category, indicated that the share of land put to non-agricultural uses would likely to increase its share in future, while that of net area sown and cultivable waste would likely to lose its share in future.

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The predicted share of different land use categories revealed that cultivable wastes and net area sown would likely to lose its share in the future, while land put to non-agricultural uses would likely to gain its share.

The results of Markov chain analysis indicated that land put to non-agricultural uses was found to be highly stable in the state, followed by net area sown and other fallows. The forest area was also highly stable in the district, might be due to the afforestation programmes implemented in the district. However, the common lands (miscellaneous tree crops and groves and permanent pastures and other grazing lands, barren and uncultivable land) were highly unstable in the state as well as in the district.

3.5 Spatial Distribution of Land Use

The land consumption rate measures the compactness, which indicates the level of the spatial expansion of a city, while the land absorption coefficient measures the changes in the consumption of new urban land per unit increase in urban population (Amin and Fazal, 2012). These measures have been calculated for the state as well as the district. The results are presented in Table 5.

It could be noted from Table 5 that in Tamil Nadu, the land consumption rate has been decreased from 0.21 in Decade I to 0.18 in Decade II, indicating the compactness of the land. Also, the land absorption rate of 1.07 revealed that for every one unit increase in population, the town compactness would increase by 1.07 times, confirming the high demand for land both within the city and suburbs. The results are in line with Oloukoi *et al.*, (2014).

Table 5. Spatial Distribution of Land Use in the Study Area

S. No	Spatial Distribution	Tamil Nadu State
1.	Land Consumption Rate	
	Decade I (2000-01 to 2009-10)	0.21
	Decade II (2010-11 to 2019-20)	0.18
2.	Land Absorption Rate	1.070

4. CONCLUSIONS

The results on the changes in the land use pattern in the study area over the last two decades reveals that there had been a significant decline in the net area sown, while the area under land put to non-agricultural uses and fallow lands, had a sharp increase. The highest instability was observed in respect of current fallows, followed by other fallows and net area

sown and the lowest instability was noticed in case of forest area in the state as well as in the sample district. The land under non-agricultural uses was found to be highly stable in Tamil Nadu, followed by net area sown and other fallows, while the common lands were highly unstable. The change in land use classifications may be the result of population pressure driving up demand for infrastructure development and urbanisation. In order to guarantee sustained agricultural expansion in the nation, it is recommended that appropriate land use policies be implemented for the effective management of land resources.

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