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An Analysis of Reshaping India's Landscape: Growth, Transformation, and the Evolution of Land Use

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ABSTRACT

Land is an essential resource that impacts a nation's economy, ecology, and social welfare. The restricted availability underscores the necessity for sustainable management, particularly as land-use alterations affect economic development, quality of life, and resource allocation. In India, urbanisation propels the growth of the industrial and service sectors, creating a problem in balancing land distribution between agricultural and non-agricultural purposes. Population pressures, food demand, and economic development influence land distribution. Data on land usage in India elucidates growth trends across many categories, including forests and agricultural land, illustrating the intricate dynamics of land allocation in response to developmental needs.

Keywords— *Land, Ecology, Agriculture, Food Demand, and Economic Development (vital words of the article)*

1. INTRODUCTION

Land is an essential natural resource that significantly influences a nation's socioeconomic and ecological health. The limited availability of this resource highlights the necessity of sustainable land use and management for the well-being of a nation's populace. Land-use alterations significantly affect economic development, quality of life, natural resource stewardship, and national food security. The particular priorities of a country at any moment influence the factors driving these transitions.

A developing nation like India has a focused initiative to enhance the industrial and service sectors, establishing favourable conditions for producing and consuming goods and services. The emphasis on urbanisation, as broadly acknowledged, positions urban areas as central nodes for the consumption and production of various goods and services, illustrating the changing dynamics of land use in the quest for economic advancement.

As an essential resource for agriculture, land is of utmost importance as a key source of subsistence for most of India's rural populace. The distribution of land for diverse economic and non-economic activities is closely linked to issues including population pressure from humans and cattle, variations in the demand for food, feed, and fibres, technological

progress, and the rate of economic development. The growing demand for land in non-agricultural industries intensifies competition for this limited resource.

The intricate interaction of these elements highlights the dynamic characteristics of land use in India, illustrating the persistent difficulty in reconciling agricultural needs with the demands of a burgeoning economy and an expanding population. This study analyses land-use trends, necessitating categorising land areas into distinct classifications. The “Directorate of Economics and Statistic, Ministry of Agriculture and Farmers Welfare” oversees the classification process, categorising land usage into nine categories. They are listed below:

1.1 **Forest Area:** refers to property designated as forest under legal statutes or managed as forest, regardless of ownership, (state, individuals, or group of individuals), and whether it is now tree-covered or preserved as possible forest land. The cultivation of crops and grazing activities in forests or adjacent open areas are included in the definition of "forest area."

1.2 **Area designated for Non-agricultural Uses**: This encompasses all property occupied by edifices, thoroughfares, railways, or bodies of water, including rivers and canals, and any area used for purposes besides agriculture.

1.3 **Barren and Uncultivable Territory**: This category comprises territory characterised by mountains, deserts, and similar terrains, are deemed unsuitable for cultivation due to prohibitive expenses. Land, whether found in solitary blocks or cultivated properties, is uncultivable.

1.4 **Permanent Pasture and Other Grazing Property**: This encompasses all grazing areas, regardless of designation as permanent pasture or meadows, and includes communal village grazing property.

1.5 **Land designated for Miscellaneous Tree Crops, etc**.: This encompasses all arable land not classified as 'Net area sown' but employed for various agricultural purposes. Land designated for cultivating trees for diverse purposes, including casuarina trees, thatching grasses, bamboo thickets, and fuel groves, is categorised under this classification.

1.6 **Culturable Waste Land**: This refers to appropriate land for cultivation, regardless of whether it has been cultivated in the past five consecutive years, including the current year. The land may be fallow or overrun with bushes and jungles, remaining uncultivated, and can be located in separate parcels or within agricultural holdings.

1.7 **Fallow Terrains excluding Current Fallows**: This category comprises “land that has been previously cultivated but left uncultivated for a length of one to five years”.

1.8 **Current Fallows**: This denotes cultivated regions deliberately left uncultivated during the current year.

1.9 Net Area Sown: This category denotes the area cultivated with crops and orchards, accounting for land sown often within the same year only once.

There are vast works of literature available in the field. The researchers like Sharma & Pandey, (1902) attempt to analyse the trends and dynamics of various land use patterns in India. A general decline was seen in the area designated for permanent pasture, grazing fields, and barren or unculturable terrain. The expanse designated for non-agricultural use and cultivable wastelands indicates positive expansion in most states.

The studied region for the research was the Chota Nagpur Region. They discovered that agricultural production is not keeping up with the rising population. The potential for an expansion in the area under cultivation is minimal (Karan, 1957).

Kerala's primary land use issues are the conversion of rice land, migration, deforestation, and urban expansion. Kerala's agricultural lands have experienced significant alterations in cropping patterns, notably a considerable reduction in rice farming and increased coconut and rubber production. The transformation of rice fields into alternative uses heightened Kerala's reliance on other states to fulfil its rice needs (George & Chattopadhyay, 2001).

Sinha, K., Nasim, & M. (2017) revealed that the declining trends in net sown area are primarily attributable to the extensive and ongoing conversion of agricultural land for diverse purposes. Policymakers are failing to acknowledge the issues facing agriculture due to the reduction in net sown area and the rise in fallow land in the state, necessitating their urgent attention.

Bilsborrow (1987) examined the whole conceptual framework for addressing the responses to increased rural population density in developing nations and provided recent empirical evidence illustrating these responses. Nevertheless, examining the international and temporary economic transformations indicates substantial potential for augmented agricultural production, even utilising current technologies. Nonetheless, the outlook for improving living standards in developing nations is more favourable with the decelerated population growth rates.

2. METHODS AND MATERIAL

Data are primarily sourced from secondary source. Data regarding the categorisation of land utilisation patterns were obtained from the *"Economic, Statistics and Evaluation Division, Department of Agriculture and Farmer Welfare, Ministry of Agriculture and Farmer Welfare, Government of India*". It encompasses geographical area, reporting area of land utilisation statistics, forested land, non-agricultural land use, barren and unculturable land, land not available for cultivation, permanent pasture and other grazing land, land under miscellaneous tree crops and groves (excluded from the net area), culturable waste land, fallow lands excluding current fallows, current fallows, fallow land, net area reported, total cropped area, area reported multiple times, agricultural land/cultivable land/culturable land/arable land, cultivated land, uncultivated land, and uncultivable land. Data were collected to categorise land use in India from 1950-51 to 2016-17. Nonetheless, this 67-year dataset was divided into several five-year intervals, decadal spans, and comprehensive periods to analyse the average yearly growth rate. In other words, the annual average growth rate of land use classification changes was considered for investigation. The outcomes of

agriculture were assessed by calculating the annual growth rate (AGR) and the annual average growth rate (GRA). The subsequent calculation pertains to the AGR is;

$$AGR = \frac{V_x - V_{x-1}}{V_{x-1}} \times 100$$

Where, V_x Stand for Present Value and V_{x-1} stand for past value. The equation for GRA is as follows:

$$GRA = \frac{\sum_1^n AGR}{N}$$

Where, GRA is the mean values of all AGR from the period 1 to N.

3. RESULTS AND DISCUSSION

Table 3.1 illustrates India's decadal GRA of land use statistics from 1950-51 to 2016-17. The growth rate for the reporting region of land use statistics has remained consistently low and stable over the decades, with a minor fall in the latter years. The GRA of forests exhibited oscillations over the decades, although usually demonstrating a downward tendency, with a notable decline recorded from 1950-51 to 1971-72, succeeded by relatively modest variations. The area designated for non-agricultural uses saw significant fluctuations in growth rates, with large rises throughout the 1970s and 1990s, followed by a fall in growth rates in the latter years. The barren and uncultivable land growth rate exhibited oscillations over the decades, with notable declines in the 1960s and 1970s, succeeded by somewhat constant growth rates in subsequent years. The growth rate of Permanent Pastures and Other Grazing Lands has exhibited significant variability over the decades, with notable gains in the 1950s, succeeded by varying levels of decline and fluctuation. In the Land Under the Miscellaneous Tree Crops & Groves category, a significant decrease in the GRA was observed during the initial decade (1950-51 to 1960-61), succeeded by oscillations characterised by alternating phases of increase and decrease. The growth rate of culturable wasteland has exhibited oscillations over the decades, characterised by reductions and increases. The growth rate of fallow lands, encompassing both current and other fallows, exhibited oscillations over the decades, with notable increases during specific eras.

Both net area sown and total cropped area had largely positive growth rates, but with oscillations recorded across the decades. The growth rate for areas sown more than once exhibited considerable variability over decades, with notable increases recorded during specific times. Agricultural land exhibited relatively stable growth rates with modest swings over the decades, reflecting continuous agrarian land use practices. Examining the decadal GRAs of land use statistics in India indicates a complicated pattern of oscillations and trends across all categories of land use from 1950-51 to 2016-17.

The decadal examination of land utilisation statistics in India from 1950-51 to 2016-17 indicates a complex pattern of varying growth rates among different categories. Specific sectors, such as forests and non-agricultural land, saw significant variations reflecting shifting environmental and developmental goals, whilst agricultural land demonstrated more stable growth. These patterns highlight the evolving characteristics of land use practices shaped by urbanisation, agricultural policy, and environmental conservation initiatives. To guarantee sustainable land management in the future, it is essential for

policymakers to persist in monitoring these changes and to execute adaptive plans that reconcile economic development with environmental conservation.

Furthermore, the overall yearly average growth rates are considered to observe the comprehensive alterations in land use patterns. Table 3.2 illustrates the comprehensive GRA of several land usage metrics from 1950-51 to 2016-17. These figures include forests, non-agricultural uses, barren and unculturable land, fallow land, cultivated land, and others. Examining these growth rates yields insights into the trends and alterations in land use patterns within the designated timeframe. The GRA for forests over the period was 0.92 per cent, signifying a modest rise in forest cover over time. The area designated for non-agricultural purposes experienced the highest GRA of 1.75 per cent among all, indicative of urbanisation and industrialisation tendencies resulting in land conversion. Barren and unculturable land, albeit exhibiting an annual negative growth rate of -1.19 per cent, indicates initiatives to reclaim or repurpose these areas for more productive applications.

Table 3.1: Decadal GRA of Land Utilisation Statistics in India from 1950-51 to 2016-17

Year	**1950-51 to 1960-61**	**1961-62 to 1970-71**	**1971-72 to 1980-81**	**1981-82 to 1990-91**	**1991-92 to 2000-01**	**2001-02 to 2010-11**	**2011-12 to 2016-17**
Reporting area for land utilisation statistics	0.49	0.18	0.01	0.03	0.01	0.07	0.05
Forests	3.11	1.74	0.56	0.04	0.31	0.25	0.10
The area under non-agricultural uses	5.18	1.06	1.79	0.80	1.14	1.06	0.89
Barren and unculturable land	-0.56	-2.38	-3.32	-0.22	-1.07	-0.17	-0.18
Not available for cultivation	0.69	-1.27	-1.17	0.29	0.13	0.55	0.47
Permanent pastures & other grazing lands	8.07	-0.48	-1.00	-0.49	-0.67	-0.34	0.06
Land under Misc. tree crops & groves (not incl. in net area sown)	-10.99	-0.08	-1.88	0.68	-0.94	-0.72	-0.39
Culturable waste land	-1.73	-0.85	-0.42	-1.08	-0.95	-0.74	-0.54
Other uncultivated land, excluding fallow land	-2.53	-0.66	-0.83	-0.66	-0.85	-0.58	-0.29
Fallow lands other than current fallows	-4.18	-2.34	1.20	0.02	0.62	0.20	1.50
Current fellows	1.40	-0.36	5.67	0.62	0.82	1.53	1.03
Fallow Lands	-1.95	-1.38	3.36	0.17	0.70	0.76	1.23
Net area sown	1.16	0.57	-0.01	0.21	-0.11	0.06	-0.25
Total cropped area	1.50	0.84	0.45	0.78	-0.01	0.73	0.23
Area sown more than once	4.32	2.72	2.82	3.06	0.34	2.76	1.44
Agricultural Land	-0.53	0.13	0.17	0.00	-0.09	-0.08	-0.08
Cultivated land	1.14	0.45	0.24	0.10	-0.04	-0.02	-0.14

Source: Authors Calculation from "Economic, Statistics and Evaluation Division, Department of Agriculture and Farmer Welfare, Ministry of Agriculture and Farmer Welfare, Government of India"

**From 2008-09 to 2016-17, the land utilisation pattern for the different categories is provisional data*

Fallow fields, encompassing both current fallows and previously fallowed areas, exhibited favourable growth rates, signifying variations in land left uncultivated during diverse agricultural cycles. The net area sown and cultivated land had moderate yearly growth rates of 0.26 per cent and 0.27 per cent, respectively, indicating stability or slight expansion in agricultural operations. Specific categories, including land designated for assorted tree crops, groves, and culturable wasteland, exhibited negative growth rates, indicating possible problems or alterations in land use policies in particular regions. The examination of the GRA of land use statistics from 1950-51 to 2016-17 reveals significant alterations in land use patterns throughout time. Some categories had positive growth, signifying expansion or enhancement, while others encountered negative growth, indicating problems or shifts in land management techniques. Comprehending these tendencies is essential for informed decision-making in India's land use planning, conservation, and sustainable development initiatives.

Table 3.2: Overall GRA of Land Utilisation Statistics in India during 1950-51 to 2016-17

Year	**1950-51 to 2016-17**
Reporting area for land utilisation statistics	0.12
Forests	0.92
Area under non-agri-cultural uses	1.75
Barren and unculturable land	-1.19
Not available for cultivation	-0.07
Permanent pastures & other grazing lands	0.78
Land under Misc. Tree crops & groves (not incl. in net area sown)	-2.15
Culturable waste land	-0.92
Other uncultivated land, excluding fallow land	-0.95
Fallow lands other than current fallows	-0.54
Current fallows	1.56
Fallow Lands	0.36
Net area sown	0.26
Total cropped area	0.67
Area sown more than once	2.56
Agricultural Land	-0.07
Cultivated land	0.27

Source: Authors Calculation from "Economic, Statistics and Evaluation Division, Department of Agriculture and Farmer Welfare, Ministry of Agriculture and Farmer Welfare, Government of India"

**From 2008-09 to 2016-17, the land utilisation patterns for the different categories are provisional data.*

The research also considers the period during which land use patterns change as a proportion of the total geographical area. Table 3.3 illustrates the periodic land-use alterations as a percentage of the Total Geographical Area in India from 1950-51 to 2016-17. The proportion of area covered by forests has

consistently risen throughout the years, from 12 per cent in 1950-51 to 22 per cent in 2016-17, signifying endeavours in conservation and afforestation. The area designated for non-agricultural uses has shown a modest increase from 3 per cent in 1950-51 to 8 per cent in 2016-17, which may be attributed to urbanisation and industrialisation. Barren and uncultivable land has remained relatively stable, varying between 5 per cent and 12 per cent over the years, possibly due to natural forces or insufficient land reclamation efforts. Permanent pastures and other grazing grounds have exhibited considerable stability, with minor fluctuations of approximately 3-4 per cent over time. There has been a decline in acreage designated for miscellaneous tree crops and groves, suggesting a transition away from tree-based agriculture or alterations in land use patterns. Culturable wasteland has consistently maintained a percentage range of 1-7 over the years, reflecting ongoing efforts to utilise arable land. Both fallow lands (excluding current fallows) and current fallows have demonstrated consistency over the years, with only slight changes.

Net area sown, this parameter has remained relatively stable at around 42-43 per cent, indicating consistent agricultural activity in the country. Thus, over the decades, a mix of trends, including forest conservation, urbanisation, and stability of farming practices.

Table 3.3: Periodic Land Use change in India from 1950-51, 1960-61, 1970-71, 1980-81, 1990-91, 2000-01, 2010-11, and 2016-17 in percentage

Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1950-51	100	86	12	3	12	2	6	7	5	3	36
1960-61	100	91	16	5	11	4	1	6	3	4	41
1970-71	100	92	19	5	9	4	1	5	3	3	43
1980-81	100	93	21	6	6	4	1	5	3	5	43
1990-91	100	93	21	6	6	3	1	5	3	4	43
2000-01	100	93	21	7	5	3	1	4	3	4	43
2010-11	100	94	22	8	5	3	1	4	3	4	43
2016-17	100	94	22	8	5	3	1	4	3	5	42

Source: Authors Calculation from "Economic, Statistics and Evaluation Division, Department of Agriculture and Farmer Welfare, Ministry of Agriculture and Farmer Welfare, Government of India"

**From 2008-09 to 2016-17, the land utilisation pattern for the different categories is provisional data*

Note: the column 1-11 represent as,

1. *Total Geographical Area*
2. *Reporting area for land utilisation statistics*
3. *Forests*
4. *Area under non-agricultural uses*
5. *Barren and unculturable land*
6. *Permanent pastures & other grazing lands*
7. *Land under Misc. tree crops & groves (not incl. in net area sown)*
8. *Culturable waste land*
9. *Fallow lands other than current fallows*
10. *Current fallows*
11. *Net area sown*

Figure 3.1: Represents the periodic land use classification for the period 1950-51

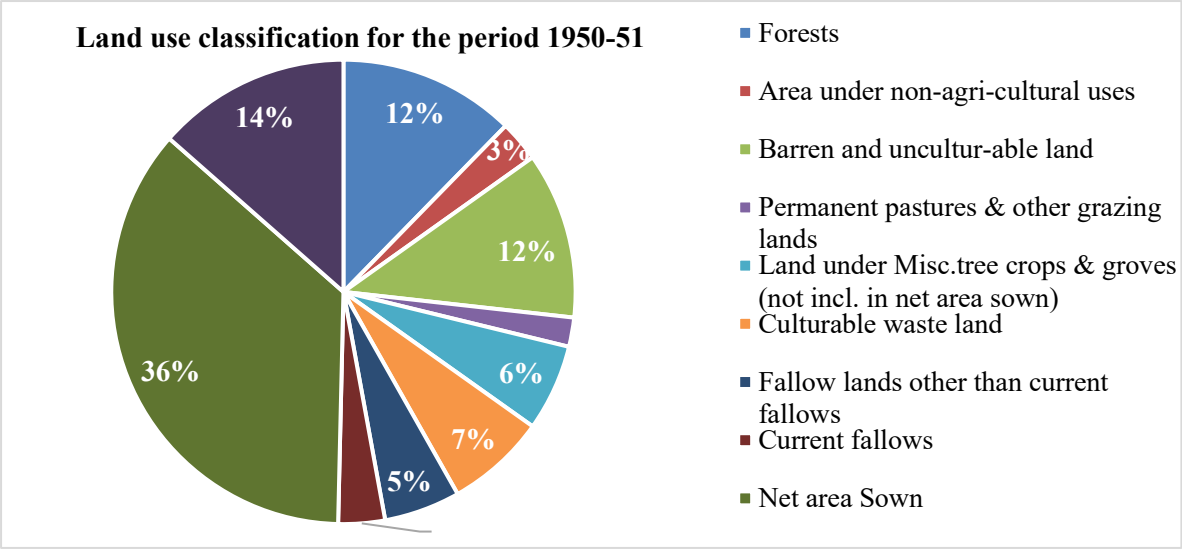


Figure 3.2: Represents the periodic land use classification for the period 1960-61

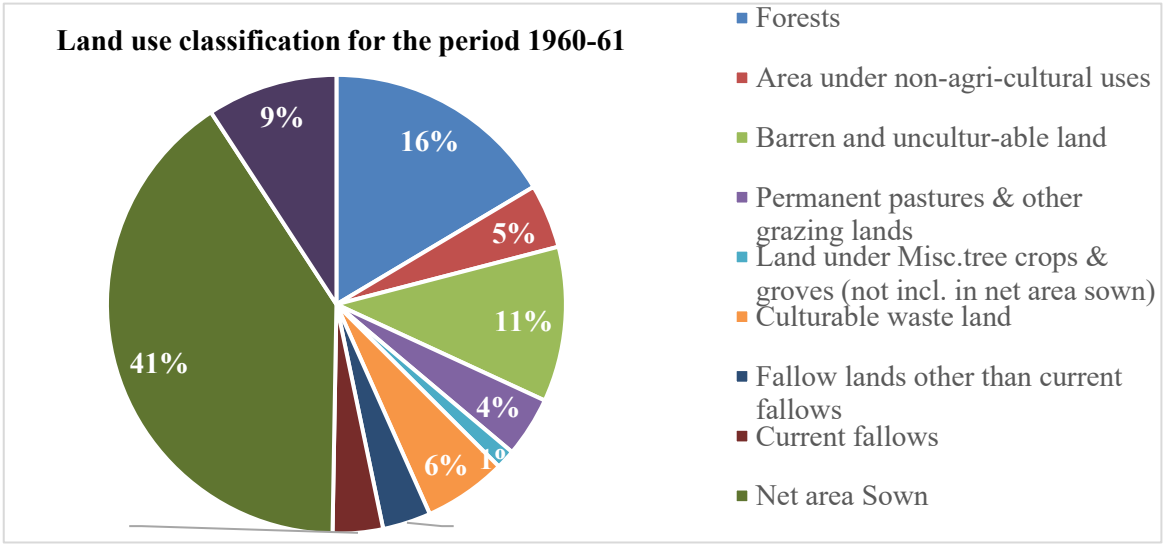


Figure 3.3: Represents the periodic land use classification for the period 1970-71

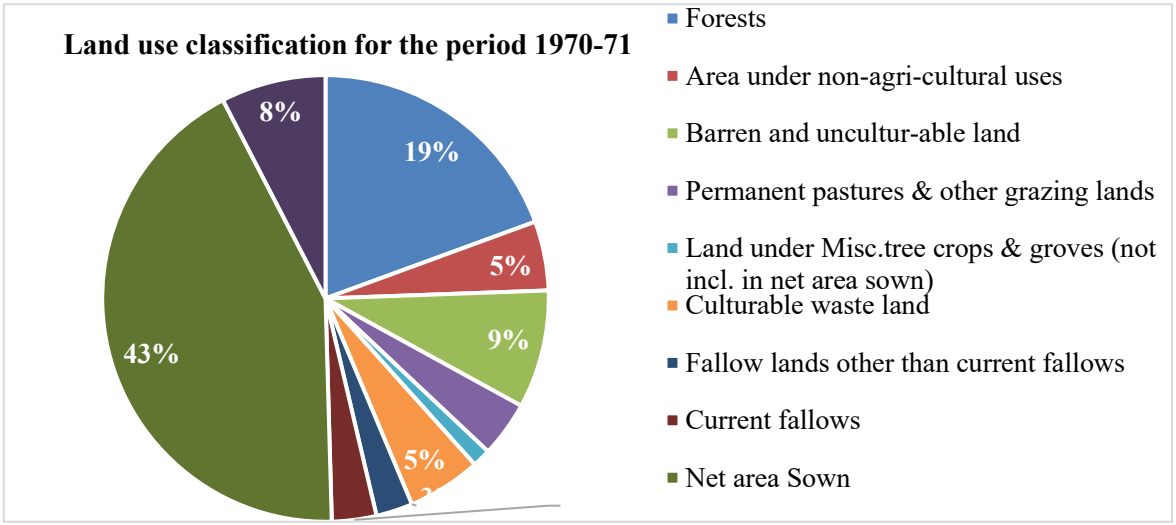


Figure 3.4: Represents the periodic land use classification for the period 1980-81

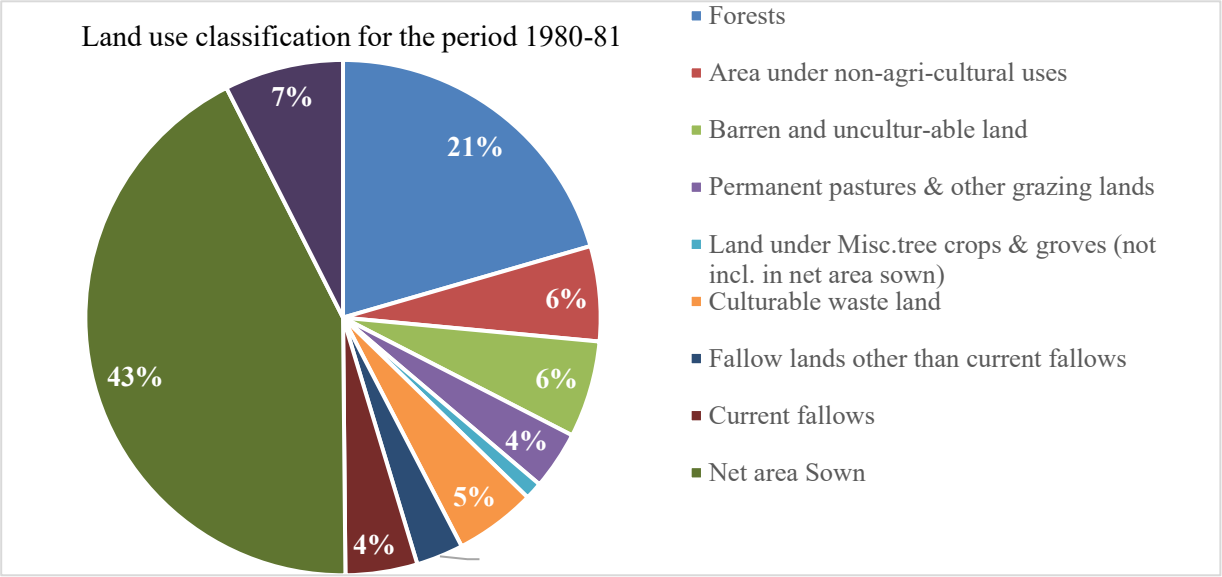


Figure 3.5: Represents the periodic land use classification for the period 1990-91

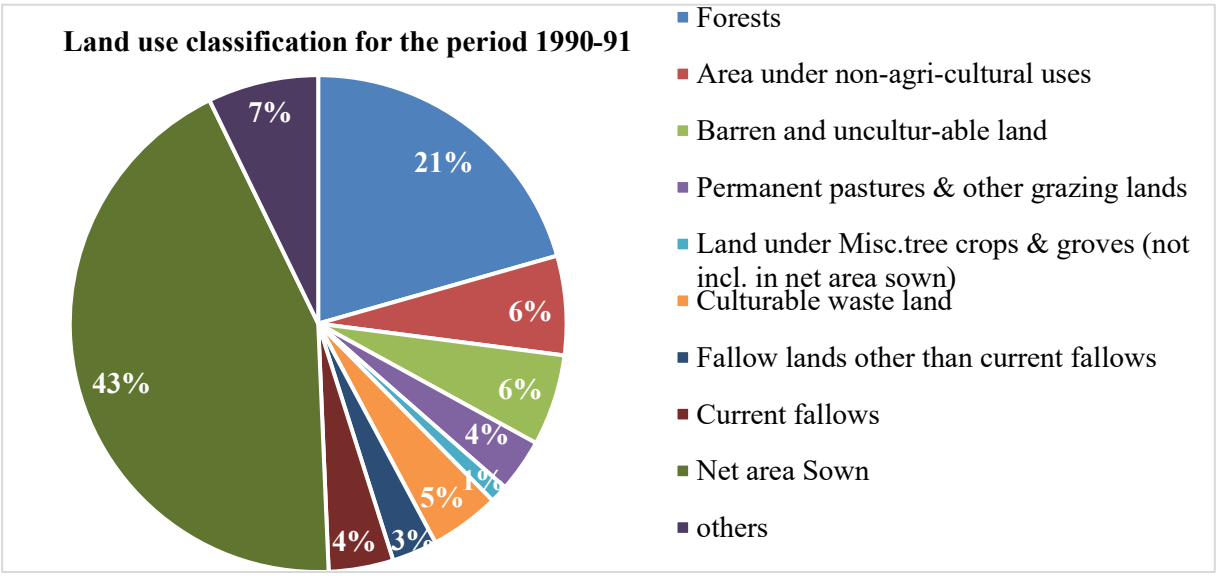


Figure 3.6: Represents the periodic land use classification for the period 2000-01

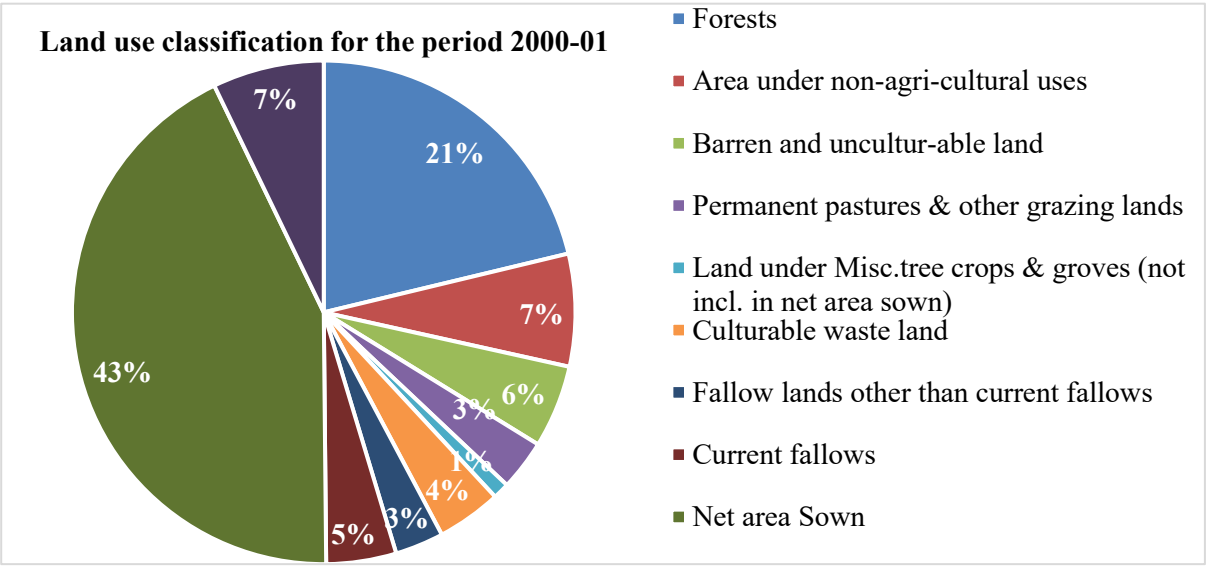


Figure 3.7: Represents the periodic land use classification for the period 2010-11

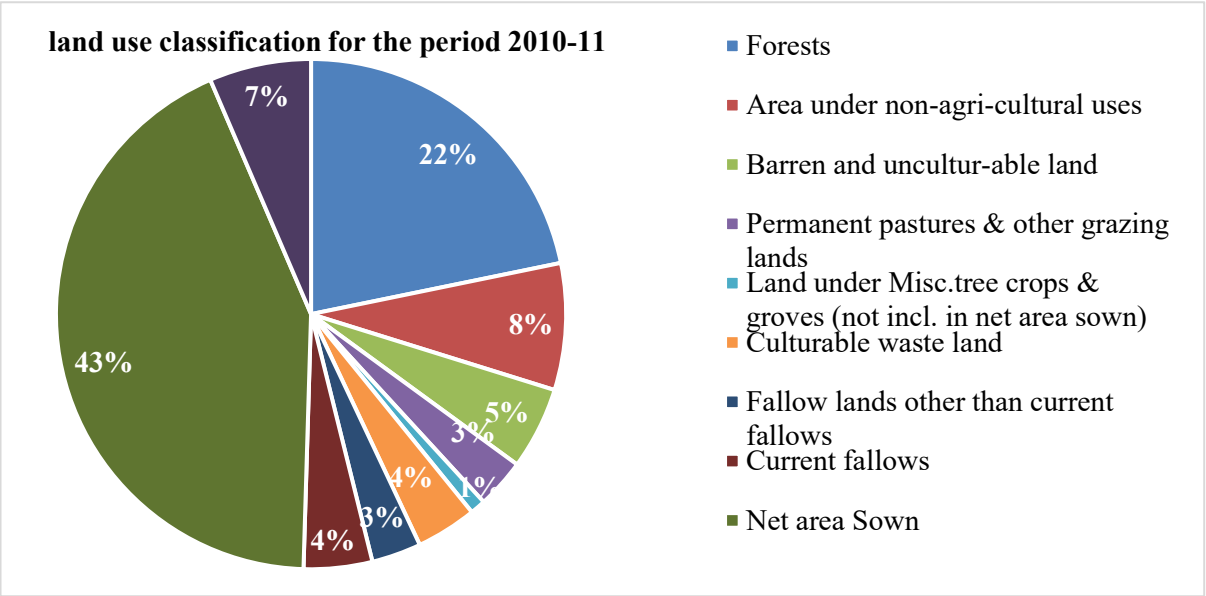
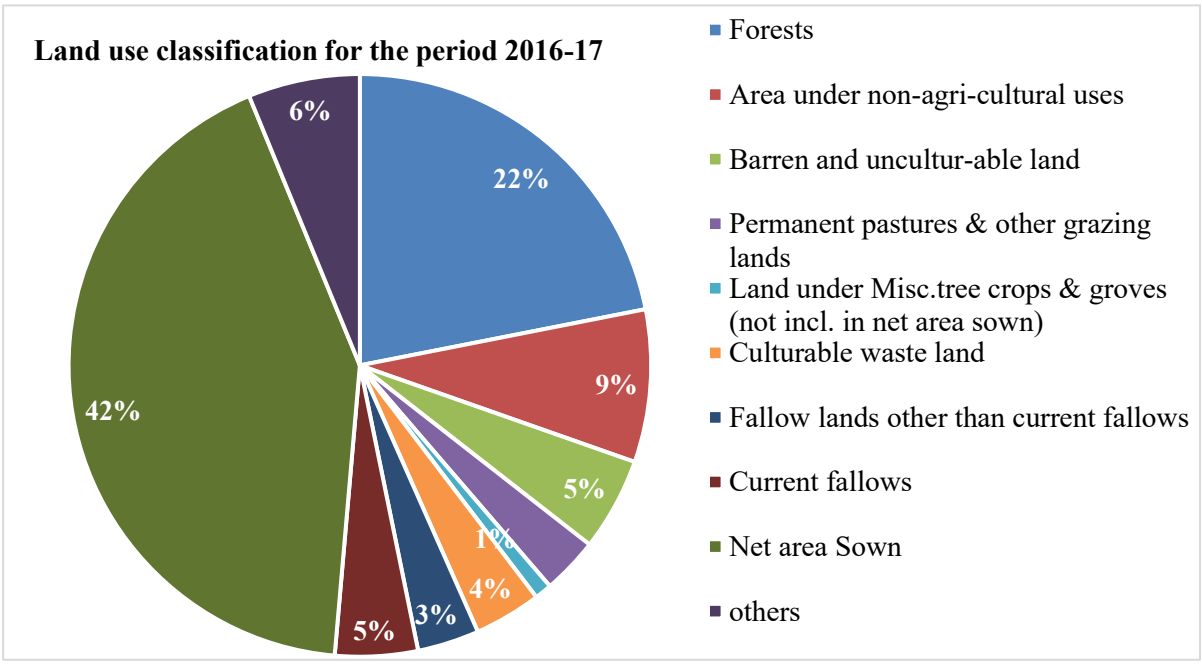


Figure 3.8: Represents the periodic land use classification for the period 2016-17



Source: Authors Calculation for all the above figures from "Economic, Statistics and Evaluation Division, Department of Agriculture and Farmer Welfare, Ministry of Agriculture and Farmer Welfare, Government of India"

Figures 3.1 to 3.8 illustrate the periodic changes in land use in India from 1950-51 to 2016-17. In 1950-51, the distribution of land was as follows: Forest area constituted 12 per cent, non-agricultural uses accounted for 3 per cent, barren and unculturable land represented 12 per cent, permanent pastures and other grazing lands comprised 2 per cent, land designated for miscellaneous tree crops and groves made up 6 per cent, culturable waste land was 7 per cent, fallow lands excluding current fallows were 5 per cent, current fallows constituted 3 per cent, and the net area sown was 36 per cent. During 1960-61, there was an increase in the forest area to 16 per cent, suggesting potential reforestation initiatives or alterations in land use policies. Other categories exhibit minor variations, with a significant rise in permanent pastures and other grazing fields to 4 per cent. During 1970-71, the forest acreage remained steady at 19 per cent, indicating potential

conservation efforts or stabilisation of wooded regions. A marginal reduction in barren and unculturable terrain may be attributed to land reclamation initiatives. From 1980-81 to 2000-01, land use patterns remained generally steady, exhibiting only slight variations between categories. The forest area stays steady at approximately 21 per cent, while other categories exhibit relative stability, suggesting a sustained era of effective land management methods. From 2010-11 to 2016-17, the forest area remained constant at 22 per cent, indicating endeavours to preserve or enhance forest cover. A marginal expansion in land designated for non-agricultural purposes and present fallows may suggest urbanisation or alterations in agricultural methodologies. Still, the net area seeded stays stable at 43 per cent. Consequently, there appears to be a tendency toward preserving or augmenting forest cover in recent years, potentially reflecting heightened environmental consciousness and conservation initiatives. The percentage of land designated for non-agricultural purposes has marginally risen throughout time, reflecting trends of urbanisation and industrialisation.

Notwithstanding these alterations, the net area cultivated has remained comparatively steady, indicating that agricultural productivity has been preserved despite variations in land use patterns. The data reveals a dynamic panorama of land use change in India throughout the years, highlighting significant themes of forest protection, urbanisation, and agricultural sustainability. Ongoing surveillance and flexible management of land resources will be essential for guaranteeing future environmental sustainability and food security.

4. CONCLUSION

Examining land use trends in India from 1950-51 to 2016-17 reveals significant transformations driven by urbanisation, agricultural policies, and environmental conservation initiatives. Forests exhibited a modest rise in coverage, whereas non-agricultural land use underwent substantial expansion, presumably influenced by urbanisation and industrialisation. Variations in the desolate and unbearable ground indicate persistent endeavours in reclamation. Permanent meadows, grazing fields, cultivated land, and agricultural activity were stable. Nevertheless, categories such as land designated for assorted tree crops, groves, and culturable wasteland experienced negative growth rates, suggesting possible problems or alterations in land use policies. Decadal research found intricate patterns, with changes noted across multiple categories, indicating shifting priorities and environmental dynamics. This thorough research underscores the need to comprehend these trends to make informed decisions in India's land use planning, conservation, and sustainable development initiatives. Emphasising forest protection, urbanisation management, and agricultural stability is essential for achieving future balanced and sustainable land management practices.

Data Availability

This statement should describe how readers can access the data supporting the study's conclusions and clearly outline why unavailable data cannot be released.

Study Limitations

Provide all possible limitations faced in the study that might significantly affect the research outcome. If not applicable, write none.

Conflict of Interest

The author affirms that there are no financial or other conflicts of interest that could inappropriately influence, or be perceived to influence, the findings and content of this work. The work has been conducted and presented solely for academic and professional advancement, without prejudice or external influence.

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Authors' Contributions

Dr. Murari Behera, the corresponding author, conceptualised the study, conducted the literature review, and led the writing of the manuscript. Dr Suman Ramapati and Bikash Ranjan Sethy, the co-authors, contributed to data collection and analysis and assisted in manuscript drafting. All authors reviewed and approved the final version of the manuscript.

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