Original Research Article

Land Use Pattern in Kerala-A Temporal Analysis

ABSTRACT

Land is a vital input among all the production resources. The land utilization pattern in Kerala has undergone a tremendous change over the years. The present study examines the temporal variations of land use categories in Kerala from 1985-2019. The time series data on area under land use categories were collected from various published sources and the analysis was done at state level. The GSVA agriculture at constant prices (1985-2019) data was used to estimate the trend breaks. The growth and instability of the land use categories were estimated using CAGR and Cuddy-Della Valle instability index. The land put to non-agricultural uses, cultivable waste, current fallow and other fallow land categories exhibited positive annual growth rates in the overall periods. The permanent pastures and other grazing lands with an instability index value of 65.16 per cent was the most unstable land use category. The trend of decline in arable land and increase in share of uncultivable land over the years was noticed in Kerala.

Keywords: Growth; Kerala; land reforms; land use; policy; population and urbanisation

1. INTRODUCTION

Land endowment, a prime natural resource, is the basic input for agriculture. The land is fixed in supply with unique characteristics like non-reproducibility, specificity to location, immobility and instrumentality. Land use is defined as any permanent or cyclic human intervention to satisfy human needs [1]. Ramaswamy et al. [2] opined that the land use pattern of a region is determined by physical, economic, institutional and technological factors. The methods of land use in Kerala have changed over the past half-century or so. Shijitha [3] revealed that as the economy develops, the impact of a transformation from agriculture to non-agriculture activities, rural life to urban agglomerations reflects in the changes in land utilisation pattern. A study by Karunakaran [4] reported that the intensive and extensive land use is high in Kerala, mainly due to the low per capita land availability. The per capita availability of land in the state is only 0.12 ha [5].

Nair and Dhanuraj [6] in their study revealed that the implementation of land reforms in Kerala resulted in the fragmentation of landholdings which ultimately led to the significant land use changes. This is evident from the statistics that, the average size of operational holding in Kerala in 1970-71 was 0.57 ha which substantially declined to 0.18 ha in 2015-16 [7]. Thus the implementation of the Land Reforms Act of 1963 played a pivotal role in bringing significant changes in the land utilisation pattern of Kerala. Apart from this, population pressure, urbanisation, migration and inflow of remittances augmented the diversion of land for non-agricultural purposes. The share of land utilised for non-agricultural purposes increased substantially from 7.17 % in 1985-86 to 11.60% in 2019-20 in Kerala. On the flip side, the net area sown declined from 56.38% in 1985-86 to 52.42% in 2019-20. This trend of land use change poses a threat to food security and ecological sustainability. Therefore a scientific study of the land use pattern is imperative for formulating pertinent land use policies. Against this backdrop, the study has been undertaken to assess the temporal variations of land use categories in Kerala.

2. METHODOLOGY

The study was based on secondary data for the period 1985-2019. The time series data on area under various land use classes of the state were obtained from Statistics for Planning, Agricultural Statistics at a Glance published by the Government of Kerala. The entire study period of 35 years was subdivided into six sub-periods. The sub-periods were obtained by doing structural break analysis [8]. The GSVA agriculture at constant prices data (1985-2019) was used to obtain trend breaks and the analysis was done in *R studio* software. The analysis resulted in obtaining 5 break points , therefore

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Comment [MF8]: The percentage of land used for non-agricultural purposes has increased significantly from 7.17% in 1985-86 to 11.60% in 2019-2020 in Kerala. On the other hand, the net sown area decreased from 56.38% in 1985-1986 to 52.42% in 2019-20. This land use change poses a threat to food security and environmental sustainability

the six phases obtained for the study are period I (1985-89), period II (1990-94), period III (1995-2003), period IV (2004-2009), period V (2010-2014) and period VI (2015-19).

2.1 Growth rate analysis

The annual growth in the area of the land use categories were estimated using the exponential growth function of the form:

$Y_t = ab^t e^u$

Where,

Y_t = Dependent variable for which growth rate was estimated

a = Intercept

b = Regression coefficient

t = Time trend (Years which take values 1, 2,....., n)

u = Disturbance term for the year 't'

The CAGR values were calculated using the LOGEST function in MS Excel. The standard error of the growth rate was estimated and tested for its significance with 't' statistic.

2.2 Instability analysis

The instability of the land use categories were estimated using Cuddy-Della Valle instability index.

$$\text{IIN} = \frac{\sigma}{\mu} \times 100 \times (1 - \bar{R}^2)^{0.5}$$

Where,

$\bar{R}^2$ = Adjusted coefficient of determination

μ = Mean

σ = Standard deviation

The instability index values ranging from 0 to 15 % indicates low instability, 15% to 30 % indicates medium instability and greater than 30% denotes high instability.

3. RESULTS AND DISCUSSION

The trend and instability in area under various land use categories were estimated for the period 1985-2019. The dynamics of land use classes in Kerala is depicted in Table 1. It could be observed from Table 1 that the forest area remained constant from TE 1987-88 to TE 2019-20. In TE 1987-88, the share of land put to non-agricultural uses to the total geographical area was 7.08% which gradually increased to a share of 11.60% in TE 2019-20. The share of barren land, permanent pastures and area under miscellaneous tree crops declined over the years. The barren and uncultivable land which constituted 2.03% of the total geographical area in TE 1987-88 declined substantially to 0.26% during TE 2019-20. The area under cultivable waste declined from 123500 ha to 97599 ha. An increase in share of current fallow and other fallow land over the years was observed in the study. The labour shortage, migration and non-remunerative income from paddy cultivation enhanced the share of fallow land in Kerala. The share of area sown more than once declined from 17.40% to 13.92% during TE 2019-20.

Comment [MF9]: The percentage of land allocated to non-agricultural uses of the total geographic area was 7.08%, gradually increasing to 11.60% in TE 2019-20. On the other hand, the proportions of barren lands, permanent pastures, and the area planted with various tree crops decreased over the years. Barren (non-cultivable) land made up 2.03% of the total geographic area at TE 1987-88, dropping significantly to 0.26% for the period between TE 2019-20.

Table 1. Dynamics of land use classes in Kerala (in hectare)

Land use classes	TE 1987-88	TE 1989-90	TE 1994-95	TE 2003-04	TE 2009-10	TE 2014-15	TE 2019-20
Forests	1081509 (27.83)	1081509 (27.83)	1081509 (27.83)	1081509 (27.83)	1081509 (27.83)	1081509 (27.83)	1081509 (27.83)
Land put to non-agricultural uses	275466 (7.08)	284700 (7.32)	309957 (7.97)	394188 (10.15)	373206 (9.60)	409177 (10.53)	450995 (11.60)
Barren and uncultivable land	79313 (2.03)	69888 (1.80)	52462 (1.35)	29370 (0.76)	24168 (0.62)	14320 (0.37)	10598 (0.26)
Permanent pastures and other grazing land	3667 (0.09)	3100 (0.08)	1617.67 (0.04)	271 (0.00)	224 (0.00)	43 (0.00)	0 (0.00)
Land under miscellaneous tree crops	45800 (1.18)	40066 (1.03)	33497 (0.86)	12489 (0.32)	5607 (0.14)	2657 (0.07)	2168 (0.06)
Cultivable waste	123500 (3.18)	112833 (2.90)	88148 (2.27)	66774 (1.72)	95657 (2.46)	98113 (2.52)	97599 (2.51)
Fallow other than current fallow	28166 (0.72)	27900 (0.71)	27688 (0.71)	38257 (0.98)	45514 (1.17)	55974 (1.44)	47311 (1.22)
Current fallow	45066 (1.16)	46733 (1.20)	44330 (1.14)	72915 (1.88)	75885 (1.95)	71016 (1.83)	57457 (1.48)
Net area sown	2203008 (56.70)	2218766 (57.10)	2246286 (57.81)	2189722 (56.36)	2085566 (53.66)	2047328 (52.68)	2037094 (52.42)
Area sown more than once	675915 (17.40)	742033 (19.10)	803433 (20.68)	782641 (20.14)	622672 (16.02)	563681 (14.50)	541058 (13.92)
Gross cropped area	2878922 (74.10)	2960800 (76.19)	3045833 (78.39)	2972363 (76.50)	2708238 (69.69)	2611009 (67.19)	2578152 (66.33)
Other land use	0	0	0	0	98948 (2.54)	106147 (2.73)	105279 (2.71)
Arable land	2445541 (62.94)	2446300 (62.94)	2439950 (62.80)	2380158 (61.26)	2308230 (59.39)	2275089 (58.54)	2241630 (57.68)
Total uncultivable land	1439955 (37.05)	1439197 (37.04)	1445546 (37.20)	1505338 (38.74)	1578056 (40.61)	1611197 (41.46)	1648381 (42.41)
Total geographic area	3885497 (100)	3885497 (100)	3885497 (100)	3885497 (100)	3886287 (100)	3886287 (100)	3886287 (100)

*Figures in parentheses indicate per cent to total geographical area., * TE -Triennium
*Other land use classes (marshy land, water logged area, social forestry and still water)

The other land use category formed in the year 2005 showed a marginal increase from 2.54% in TE 2009-10 to 2.70% in TE 2019-20. The arable land or land suitable for cultivation had a remarkable decline from 62.94% in TE 1987-88 to 57.68% in TE 2019-20. On the contrary, the total uncultivable land leaped up from 37.05% to 42.41%. This revealed that the share of agricultural land area was dwindling in the state.

3.1 Growth rate

The annual growth rates of land use classes for the period 1985-2019 is presented in Table 2. Since there was no change in area of forest from 1985, the CAGR was observed to be zero. The land utilised for non-agricultural purposes, exhibited an annual growth rate of 1.66 per cent in period I, 1.70% in period II and 3.32 per cent during period III. However during period IV, the land put to non-agricultural uses, showed a negative annual growth rate of -2.03%. This trend was mainly due to several development schemes initiated by the government. The scheme for promotion of cultivation

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of fallow land (2004-05) and the enactment of Kerala Conservation of Paddy and Wetland Act (2008) together led to the decline in growth of area under non-agricultural uses and fallow land in Kerala from 2004-2009. In the fifth and sixth phases, the land put to non-agricultural uses increased at an annual rate of 2.08% and 1.77%. The growth rate of this land category for the overall period was 1.48%.

Table 2. Compound Annual Growth Rates of land use categories in Kerala

Land use classes	1985-86 to 1989-90	1990-91 to 1994-95	1995-96 to 2003-04	2004-05 to 2009-10	2010-11 to 2014-15	2015-16 to 2019-20	Overall 1985-86 to 2019-20
Forests	0	0	0	0	0	0	0
Non-agricultural uses	1.66	1.70***	3.32***	-2.03**	2.08***	1.77***	1.48***
Barren land	-6.13**	-5.09***	-6.62***	-3.51***	-10.36***	-5.66***	-5.85***
Permanent pastures & other grazing lands	-8.05**	-11.92**	-22.83***	-5.24***	-32.08***	0	-16.84***
Misc. tree crops	-6.47***	-2.89**	-10.56***	-12.67***	-13.25***	-4.91***	-10.20***
Cultivable waste	-4.42	-4.28***	-2.72**	7.98***	0.73*	-0.54	0.04
Other fallow	-0.47	0.52	3.78***	2.51**	4.24**	-4.15***	2.79***
Current fallow	1.83*	-0.93*	6.39***	2.46**	-0.92	-4.51**	1.67***
Other land use classes	-	-	-	-	0.38	-0.32*	-0.23
Net area sown	0.36**	0.17	-0.43***	-0.91***	-0.40**	0.01	-0.39***
Area sown more than once	4.78*	1.03***	0.16	-4.96**	-1.25**	-2.23**	-1.09***
Gross cropped area	1.41*	0.35***	-0.27**	-1.95***	-0.58***	-0.48***	-0.55***
Arable land	0.02	-0.07**	-0.36***	-0.49***	-0.28***	-0.25***	-0.33***
Total uncultivable land	-0.03	0.12**	0.60*	0.76***	0.41***	0.34***	0.51***

*** denotes significant at 1% level., ** denotes significant at 5% level, * denotes significant at 10% level

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The barren and uncultivable land, permanent pastures and other grazing lands and land under miscellaneous tree crops showed a declining trend in all the six periods and in the overall period. The CAGR of barren land, permanent pastures and miscellaneous tree crops for the overall period was -5.85%, -16.84% and -10.20%. The illegal encroachment by the people for cultivation on pasture lands led to the substantial decline of this land category in the overall period. The cultivable wasteland exhibited negative growth rates of -4.42%, -4.28% and -2.72% in phase I, phase II and phase III respectively. In the subsequent fifth and sixth phases, the growth rates were positive. The extensive use of land for non-agricultural activities resulted in the decline of cultivable wastelands.

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Comment [MF15]: Illegal encroachment by citizens on both agricultural and pasture lands resulted in a significant decrease in this land category in the overall period. The arid arable lands showed negative growth, reaching rates of (-4.42%, -4.28%, and -2.72% in the first, second, and third stages, respectively. While in the subsequent fifth and sixth stages, the growth rates were positive. This is a result of the intensive use of land for non-profit activities. agricultural, which led to the degradation of arable land.

In the case of current fallow land category, the CAGRs were reported to be highest in the third and fourth phases. The annual growth rate of current fallow land were 6.39% and 2.46% respectively. The decline in area sown more than once during these phases contributed to the increase of fallow land categories. The labour intensive and non-profitable cultivation of paddy compelled the farmers to leave their land fallow leading to the increase in share of fallow lands. However, during the fifth

and sixth phases, the current fallow land had negative growth rates of -0.92% and -4.51% which was mainly due to the introduction of fallow less panchayat scheme by GoK in 2010.

Table 3. Instability indices of land use categories in Kerala

Land use classes	1985-86 to 1989-90	1990-91 to 1994-95	1995-96 to 2003-04	2004-05 to 2009-10	2010-11 to 2014-15	2015-16 to 2019-20	Overall 1985-86 to 2019-20
Forests	0	0	0	0	0	0	0
Land put to non-agricultural uses	1.52	0.49	2.80	3.38	2.14	0.41	4.70
Barren and uncultivable land	0.27	1.84	7.34	0.86	11.75	1.24	18.11
Permanent pastures	0.72	3.94	20.15	5.52	61.37	-	65.16
Land under misc. tree crops	0.11	1.09	4.20	3.73	11.42	2.40	22.12
Cultivable waste	2.30	1.62	5.65	4.33	2.31	1.65	21.32
Other fallow	2.97	3.99	4.65	2.31	2.86	2.52	9.78
Current fallow	0.98	2.85	4.89	5.50	4.74	4.57	15.13
Other land use classes	-	-	-	-	2.13	0.61	2.32
Net area sown	0.04	0.16	0.87	0.28	0.41	0.70	1.78
Area sown more than once	1.47	0.49	7.25	10.18	3.39	2.12	10.71
Gross cropped area	0.38	0.11	1.16	2.06	0.71	0.24	3.44
Arable land	0.35	0.13	0.54	0.16	0.32	0.10	0.85
Total uncultivable land	0.60	0.22	1.43	0.25	0.44	0.14	3.01

In the first and second phases, the growth rates of net area sown were 0.36% and 0.17%. In the subsequent third, fourth and fifth phases, the growth rates were -0.43%, -0.91% and -0.40%. The overall growth rate was -0.39%. Although the area sown more than once witnessed positive growth rates of 4.78%, 1.03% and 0.16% in period I, period II and period III, in the succeeding phases there was a declining trend. In the overall period, the CAGR was -1.09%. In the first phase, the arable land showed a positive growth rate of 0.02%, but in the later phases, the growth rates were negative. On the contrary, the total uncultivable land experienced negative growth rate of -0.03% in the first phase and in the subsequent phases the growth rates were positive. This throws the light that the land area suitable for cultivation declined considerably in Kerala. The growth rates of arable land and total uncultivable land for the overall period were -0.33% and 0.51%. In the overall period, except for cultivable waste and other land use classes, the growth rates of all the land use categories were observed to be significant at 1 % level.

3.2 Instability index

The instability indices of the land use categories are presented in Table 3. Among the various land use classes, the most unstable one was permanent pastures and other grazing lands. The instability index substantially increased from 0.72% in phase I to 61.37% in phase V. Since 2016, the area under permanent pastures got exhausted completely in Kerala. The overall instability index was

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65.16%. Followed by the permanent pastures, the land under miscellaneous tree crops (22.12%) and cultivable wasteland (21.32%) were noted to be highly unstable. The current fallow and the barren and uncultivable land exhibited a medium instability of 15.13% and 18.11%. The most stable land use categories were arable land (0.85%) and net area sown (1.78%). The land put to non-agricultural uses was also reported to be highly stable (4.70%).

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4. CONCLUSION

The land utilisation pattern in Kerala has undergone a tremendous change for the past few decades. The trend of conversion of land for non-agricultural purposes has been escalating in Kerala. These factors have contributed to the substantial increase of this land category. Appropriate policy measures must be undertaken to minimise the impact of these factors in aggravating the land use shifts. Rural development programmes such as MGNREGA needs to be promoted on an extensive scale to bring underutilised lands under cultivation. The barren and uncultivable lands should be diverted for construction and other developmental activities. Even strict enforcement of acts pertaining to land use in Kerala is strongly recommended for evading underutilisation and land conversion.

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