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Dynamics of Land Use Pattern with Special Reference to Fallow Lands – An Empirical Investigation in Tamil Nadu

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I

INTRODUCTION

Land and water are the crucial natural resources for any development activity. Consequently, access to land and control over its uses were the prime sources of conflict within and between communities throughout human history. Like any other resource land has two dimensions, viz., quality and quantity, and both of these crucial aspects are under serious threat due to the intensive and extensive use of land both for agricultural and non-agricultural purposes. Though technological progress in agriculture and agricultural intensification have mitigated the ever-increasing demand for land for food production, burgeoning population and the consequent demand for land for non-agricultural purposes are posing a serious challenge to both researchers and policy makers. Intensive agriculture coupled with large-scale irrigation projects without suitable drainage facilities has affected the land quality in many places thus leaving them under-utilised or unutilised. Tamil Nadu shares about 6.8 per cent of the total population in India while its share in total land area of the country is only 4 per cent and its share in the total water resources is about 3 per cent of the total water resources in India. In Tamil Nadu the per capita availability of land is only 0.19 ha while the per capita net sown area is only 0.10 ha. Even though the share of agricultural sector in the state domestic product of Tamil Nadu has declined from about 52 per cent to 22 per cent between 1960-61 and 2000-01 agriculture continues to be the major source of livelihood for the rural people. Agriculture still employs more than 50 per cent of the workforce in the state. As a basic input for agriculture, land occupies a pre-eminent position among all the resources required for a modern economy. Competition between agricultural and non-agricultural sectors for land is intensifying due to the increasing pressure on land for food production, housing and industrial expansion. Between 1960-61 and 2000-01 the total cultivated area in Tamil Nadu has decreased by about 14 per cent from 7.32 million ha to 6.34 million ha. However, this reduction in cropped area has been more than compensated by the increase in productivity of crops so that higher production has been possible.

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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 ignited intensive cultivation resulting in conversion of marginal lands into productive agricultural lands through capital-intensive cultivation. Nadkarni and Deshpande (1979) highlight the importance of institutional factors leading to under-utilisation of agricultural lands especially when people employed in urban areas keep lands idle for using it after retirement or for speculative purposes. Their study also revealed that an increase in the size of operational holdings has a positive impact on current fallows. An analysis of land use pattern and the extent of under-utilisation of land in Andhra Pradesh reveals that land use pattern was mainly influenced by the extent of adoption of modern technology (Reddy, 1991). However, this is not applicable to drought-prone regions where technological diffusion is highly limited. Another study concludes that the land use pattern is influenced by the demand for land for cultivation of crops, forest and fodder to meet the food requirements of the people and the raw material requirement of the industries using agricultural products as raw material (Giri,1966).

Pandey and Tewari (1987) analysed the dynamics of land use and estimated the shift in land use in each state with the help of a simple identity of linearly additive land use changes. A more recent state-level analysis of trends and dynamics of annual shift in land use in different states of the country (Sharma and Pandey, 1992) revealed that there was a general declining trend in area under permanent pastures, grazing land and barren and uncultivable land. The land requirement for non-agricultural use was met from the area under cultivable waste. Current and other fallow land registered a positive growth in most of the states. Inter-sectoral land budgeting indicated a shift in area from both desirable and undesirable ecological sectors towards agricultural and non-agricultural sector. In Bihar, the area under fallow lands has been increasing over time thereby reducing the net sown area (Singh and Vashist, 1997). The current fallows and other fallows in India have shown a positive growth trend while the area under cultivable wastes have shown a declining trend over the period 1970-71 to 1990-91. The area under current fallows in India recorded a compound growth rate of 0.84 per cent per annum while the area under other fallows has grown at the rate of 0.95 per cent per annum during this period (Pandey and Tewari, 1996). As Tamil Nadu is in the forefront of economic growth led by industrialisation and urbanisation, there is an increasing demand for land in Tamil Nadu especially for construction of roads and houses. The demand for additional land for non-agricultural purposes has been estimated to be around 4.66 lakh ha during the year 2010 (Subramanian *et al*., 1994). In spite of this increasing pressure on land, there is also a tendency to keep land idle due to factors like labour scarcity, indicating that all is not well with land management. A study of how land is used and trends in

land use, would help us in indicating how land is managed and in evolving a better-informed land policy.

II

METHODOLOGY

The present study is based on an analysis of secondary data on land use pattern at the district and state levels and analysis of primary data on various aspects of land use decisions at the farm level. The time series data on land use pattern in all the districts of Tamil Nadu were obtained from *Season and Crops Reports of Tamil Nadu* published by the Government of Tamil Nadu, for the period from 1960-61 to 1999-2000.[1] The dynamics of changes in land use pattern in different districts of Tamil Nadu were analysed for all the composite (undivided) districts of Tamil Nadu state since time-series data over this period are not available for the newly created districts. The data for composite districts were arrived at by summing up the data for newly carved out districts that were part of the original composite (undivided) districts. The analysis of primary data is based on a survey of 900 farms spread over six regions of Tamil Nadu. These regions were chosen in such a way that they represent different agro-climatic characteristics, irrigation systems and farming practices prevalent in the state of Tamil Nadu. In each of these six regions, two blocks were selected at random and from each of the blocks 75 farms were selected at random so as to make a total sample size of 150 farms in each region. Data on various aspects of farming and land use decisions, family characteristics including non-agricultural income, cropping pattern, opinion survey on reasons for increase in fallow lands at farm level were collected from each of the farm households using a structured questionnaire.[2] The data for land use and cropping pattern relate to the agricultural years 1999-2000 and 2000-2001.

Analysis of Data

Simple statistical and econometric analysis was done to study the dynamics of land use pattern in different districts and to identify the factors affecting changes in area under fallow lands.

(a) Estimation of Growth Rates

Compound growth rates of various land use categories were worked out on the basis of log-linear regression equations.

(b) Analysis of Instability in Area under Different Land Use Categories

Instability index is a simple analytical technique to find out the fluctuations or instability in any time-series data. It is estimated as follows:

(i) Estimate the parameters of a log-linear trend line for the variable (Y_t) for which instability is to be estimated.

(ii) If the estimated parameter is statistically significant, then the instability index (IIN) is defined as

$$IIN = CV \times \sqrt{1 - R^2}$$

where CV= coefficient of variation for the time-series calculated as

$$\text{CV} = \frac{\text{S.D.}}{\text{Mean}} \times 100$$, where, S.D. = standard deviation

(iii) If the estimated parameter in the regression equation in step (a) is not significant, then the CV itself is the instability index.

(c) Location Coefficient

Location coefficient (L) is useful to identify the pattern of distribution of the given category of lands across different regions of a country or state. This is defined as follows:

$$L = \frac{L_{ij} / L_i}{L_j / L_s}$$

where,

L_{ij} = area of j-th category of land in i-th district,

L_i = area of all categories of land in the district,

L_j = area of j-th category of land in the state,

L_s = area of all categories of land in the state.

A higher value for location coefficient for a district or region indicates the higher concentration of that particular category of land in that district or the region.

(d) Analysis of Factors Affecting the Extent of Fallow Lands

Econometric analysis was carried out using both time-series data at the state level and cross section, secondary data at district level as well as cross section data at farm level to identify the factors affecting area under fallow lands.

III

RESULTS AND DISCUSSION

(a) Macro-Level Dynamics of Land Use Pattern

The changes in proportion of different categories of lands presented in Table 1 reveal that there has been a marginal increase in forest lands from 14 to 16.50 per cent mainly due to the afforestation efforts. Several categories of common property lands such as barren and uncultivable lands, cultivable wastes, permanent pastures

and grazing lands have all shown a declining trend. Their total share in geographical area of the state has declined from 17 per cent to 7.28 per cent during the last five decades. A major part of these lands have gone into non-agricultural uses the share of which has increased from 9.80 per cent to 14.73 per cent during the same period. While the share of current fallows hovered around 8 per cent, the share of other fallows increased from about five percent to 8.50 per cent. The net sown area has almost remained constant around 43 per cent implying that the increase in other fallows has just been offset by the conversion of cultivable wastes and permanent pastures and grazing lands for cultivation purposes.

TABLE 1. SHARE OF DIFFERENT LAND USE CATEGORIES TO TOTAL GEOGRAPHICAL AREA IN TAMIL NADU
(AVERAGES FOR THE RESPECTIVE DECADES)

(*per cent*)

Sr. No.	Particulars	1950s	1960s	1970s	1980s	1990s
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Forest	14.00	14.70	15.40	16.00	16.48
2.	Barren and uncultivable land	7.50	6.80	5.40	4.30	3.80
3.	Land put to non-agricultural uses	9.80	10.40	12.40	13.80	14.73
4.	Cultivable wastes	6.70	5.10	3.20	2.40	2.53
5.	Permanent pastures and other grazing lands	2.90	2.60	1.50	1.10	0.95
6.	Current fallows	8.60	7.40	9.20	12.40	7.95
7.	Other fallows	5.10	4.70	4.10	5.40	8.45
8.	Total fallow lands (6+7)	13.70	12.10	13.30	17.80	16.40
9.	Land under miscellaneous tree crops and groves	1.90	2.00	1.70	1.40	1.78
10.	Net area sown	43.50	46.30	47.20	43.20	43.34
11.	Total geographical area	100	100	100	100	100

The decadal trends in area under different land use categories reveal that there was a 20 per cent increase in area under forests from 17.85 lakh ha to 21.43 lakh ha while there was about 50 per cent drop in area under barren and uncultivable lands from 9.57 lakh ha to 4.93 lakh ha between 1950s and 1990s. This sharp decline in barren and uncultivable lands is probably due to the increasing pressure on land caused by increase in population and increasing demand for land for non-agricultural purposes. As a result of the increasing demand for land for industrial, housing and infrastructure developments, the land put to non-agricultural uses has shown a sharp increase of about 50 per cent from 12.50 lakh ha to 19.16 lakh ha during this period. On the other hand, the increasing demand for land for agricultural purposes has largely been met by bringing in cultivable wastes under plough. As a result of such extensive agricultural practices, the area under cultivable wastes decreased by about 60 per cent from 8.55 lakh ha to 3.29 lakh ha over the last 50 years.

Though the area under *current fallows* increased to a peak level of 15.84 lakh ha during 1980s, it decreased to around 10.50 lakh ha during 1990s. One of the most disturbing trends is the sharp increase in *other fallows* from 6.5 lakhs ha in 1950s to 11 lakh ha in 1990s in spite of huge investments on increasing the area under irrigation through both public and private investments. The increasing trend in *other fallow*s actually took place during the latest two decades. The current fallows reached the maximum during the 1980s while the other fallows reached the maximum during the 1990s. Consequently, the area under total fallow lands crossed 20 lakh ha during the latest two decades thus accounting for more than 15 per cent of the total geographical area of the state and more than one-third of the net sown area. Though there was a moderate increase in the net sown area during the sixties and seventies probably due to the extensive agricultural practices by bringing in more areas of cultivable waste under plough, there has been stagnation in the net sown area in the state around 56 lakh ha during the latest two decades. The gross cropped area also remained stagnant around 67 lakh ha during the last 50 years thus leaving the cropping intensity constant around 120 per cent. Another important dimension which is a cause for concern is the sharp decline in common lands (cultivable wastes, permanent pastures and grazing lands, and land under miscellaneous tree crops) from about 13.14 lakh ha to 7.14 lakh ha between 1960 and 2000, which is probably due to the increasing population pressure especially on common lands, which are more prone to encroachment and privatisation.

Growth rates were worked out for both the state-level and district level data on land use pattern to get a more detailed picture on spatial and temporal dimensions of the dynamics of land use pattern in the state. The decade-wise growth rate analysis for Tamil Nadu state for the period 1960-2000 (Table 2) reveal that the decline in *cultivable wastes* and *permanent pastures and other grazing lands* was the highest during all the three previous decades possibly due to population pressure and increasing demand for land for agriculture. This trend has, however, been reversed during the latest decade and both of these two land use categories have recorded positive growth rates during the 1990s. The growth in *fallow lands* during the last four decades was the highest among the growth rates of all the land use categories, followed by the growth rate in land put to non-agricultural uses. The more disturbing trend is the highest growth of 1.97 per cent per annum observed in *other fallow lands* – those lands that remain uncultivated for more than five years. This growth is observed only during the last two decades. Together with near-stagnation in the productivity of major crops, the increase in *other fallow lands* is a major challenge to the growth of Tamil Nadu agriculture. Increasing urbanisation and industrialisation have resulted in a higher growth rate in land being put to non-agricultural uses. The decade-wise growth rates indicate that there has been a positive growth rate in either the current fallows or other fallows during the entire period of 40 years.

TABLE 2. COMPOUND GROWTH RATE OF DIFFERENT LAND USE CATEGORIES IN TAMIL NADU

(*per cent*)

Sr.No.	Particulars	1960s	1970s	1980s	1990s	1960-61 to 1999-2000
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Forest	0.65	0.09	0.85	-0.09	0.39
2.	Barren and uncultivable land	-0.70	-4.2*	-0.11	-0.94*	-2.00*
3.	Land put to non-agricultural uses	0.96	2.21*	0.45	0.85	1.15*
4.	Cultivable wastes	-2.39*	-4.6**	-2.1	2.14*	-2.4*
5.	Permanent pastures and grazing lands	-3.14**	-4.9**	-2.84*	0.11	-3.24**
6.	Current fallows	0.80	5.00**	- 4.1**	-0.81	0.5
7.	Other fallows	-0.24	-3.10*	8.30**	1.44*	1.97*
8.	Land under miscellaneous tree crops and groves	-0.33	-2.51*	- 4.57**	0.31	-0.6
9.	Net sown area	-0.03	-0.03	0.33	-0.49	-0.28
10.	Gross cropped area	-0.30	0.35	0.19	-0.80*	-0.3

Notes: 1) The definition of different land use classes remained consistent over time and space. All the secondary data were collected from government publications, viz., *Season and Crops Report and the Tamil Nadu – An Economic Appraisal*, for various years.

2) * and ** indicate significance of growth rates at 5 and 1 per cent level, respectively.

Both net sown area and gross cropped area declined by about 0.3 per cent per annum during this period as a whole (1960-2000). A comparison of decadal growth rates in net sown area and gross cropped area reveals that though the growth rates in these two land use categories were negative during the latest decade, the negative growth was not significant in the case of net sown area (-0.49) while there was significant reduction in (-0.80 per cent per annum) in gross cropped area due to the decline in double cropped area. This also coincides with the near-stagnation in the productivity of major crops in the latest decade. To sum up the trends in land use pattern in Tamil Nadu during the last four decades: (a) there has been a continuous increase in land put to non-agricultural uses which is a major competitor to agricultural sector for the demand for land; and (b) within agricultural sector, both the total fallows and current fallows have shown an increasing trend while the net sown area and gross cropped area have shown a decreasing trend.

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 and these are presented in Table 3. It could be observed from the table that the instability index during the period 1970-2000 was the highest for the area under *current fallows* followed by the area under *other fallow lands*. The decadal instability was also found to be higher for fallow lands as compared to other categories of land use in all the three decades during the period between 1970 and 2000. The highest instability in current fallows was due to the fact that the area under current fallows shows very high year-to-year fluctuation due to the variations in rainfall since more than 50 per cent of the cultivated area in Tamil Nadu is under rainfed lands. This is borne out by the fact that though there was a continuous

reduction in instability in gross irrigated area in the state, the instability in net and gross cropped area remained almost constant over the last three decades.

TABLE 3. INSTABILITY INDEX FOR LAND USE PATTERN IN TAMIL NADU

Sr.No. (1)	Particulars (2)	1970-71 to 1979-1980 (3)	1980-81 to 1989-1990 (4)	1990-91 to 1999-2000 (5)	1970-71 to 1999-2000 (6)
1.	Forest	1.05	0.89	0.06	1.40
2.	Barren and uncultivable land	3.75	16.71	1.20	12.81
3.	Land put to non-agricultural uses	4.72	0.42	0.23	3.24
4.	Cultivable wastes	2.43	2.41	2.97	12.50
5.	Permanent pastures and other grazing lands	3.97	1.89	1.25	9.46
6.	Current fallows	23.40	11.41	10.59	25.81
7.	Other fallows	7.02	11.74	5.38	15.32
8.	Land under miscellaneous tree crops and groves	5.50	10.22	3.78	13.95
9.	Net area sown	3.97	3.26	3.29	4.16
10.	Gross cropped area	4.72	4.45	4.75	5.41
11.	Gross irrigated area	9.13	8.38	3.44	9.47

(c) Dynamics of Distribution of Fallow Lands in Tamil Nadu – The Spatial Dimension

Location coefficients were estimated to study the spatial dynamics of current fallow lands over the last 30 years across different districts. The results from this analysis provided in Table 4 indicate that there has been a sharp increase in the concentration of other fallow lands in South Arcot and Coimbatore districts, while there has been a reduction in the concentration of other fallow lands in Madurai, Tirunelveli, Kanyakumari, Salem, Chengalpattu and Tiruchirappalli districts.

TABLE 4. DYNAMICS OF SPATIAL DISTRIBUTION OF OTHER FALLOWS AND COMMON LANDS IN TAMIL NADU

Sr. No. (1)	Districts (2)	Location coefficient for other fallows				Location coefficient for common lands			
		1970-71 (3)	1980-81 (4)	1990-91 (5)	1999-2000 (6)	1970-71 (7)	1980-81 (8)	1990-91 (9)	1999-2000 (10)
1.	South Arcot	0.82	0.90	0.43	0.30	1.28	1.92	1.68	1.03
2.	Coimbatore	1.20	0.56	0.52	0.56	0.55	0.34	0.15	0.12
3.	Thanjavur	0.56	0.57	0.73	0.62	0.93	0.90	0.96	0.92
4.	Tirunelveli	2.57	2.61	2.06	2.17	1.38	1.57	1.90	2.42
5.	Ramanathapuram	1.10	1.99	2.10	2.23	1.11	0.69	0.84	1.13
6.	Salem	1.01	0.90	0.49	0.35	0.72	0.90	0.92	0.70
7.	Chengalpattu	0.89	0.69	0.55	1.69	1.92	1.60	1.80	1.61
8.	Dharmapuri	0.23	0.52	0.14	0.14	0.32	0.74	0.78	0.65
9.	Kanyakumari	0.19	0.08	0.13	0.08	0.30	0.13	0.08	0.07
10.	Madurai	0.78	0.63	0.85	0.76	0.69	0.60	0.56	0.48
11.	North Arcot	0.91	0.87	0.80	0.48	0.78	0.73	0.68	0.55
12.	Pudukkottai	0.97	1.37	1.08	2.05	1.12	1.05	1.61	1.56
13.	Tiruchirapalli	0.85	0.68	2.21	1.53	1.29	1.39	1.23	2.07

Note: Common lands include cultivable wastes, permanent pastures and grazing lands and under miscellaneous tree crops.

The location coefficients for other fallow lands indicate that the other fallow lands were more concentrated in relatively dry and drought-prone regions of the state such as Ramanathapuram, Tirunelveli and Pudukkottai districts. All these districts are predominantly tank irrigated areas with very little area under wells which are relatively more stable source of water supply. There has been a sharp increase in the concentration of other fallow lands in Pudukkottai and Ramanathapuram districts but a sharp decrease in it in Salem and South Arcot districts. The latter two districts have recorded steep increase in area under private well irrigation. Districts with high rainfall (Kanyakumari district) and industrially less progressive (Dharmapuri district) have very low concentration of other fallow lands. Apart from Tiruchirappalli district, the economically poorer districts such as Tirunelveli, Ramanathapuram, and Pudukkottai have witnessed an increasing concentration of common lands thus lending scope for redistribution of common lands to poor people so as to put them under effective use.

Analysis of Factors Affecting Area under Fallow Lands

Several factors are responsible for the increase in fallow lands. One of the major factors is rainfall, which affect the net sown area thus having a direct bearing on the area under current fallows as well as other fallows. Continuous failure of monsoons and even the delayed onset of monsoons may lead to increase in other fallows. The changes in the relative profitability of crops might also lead to changes in cropping pattern, which may affect the area under fallow lands. For example, the improvements in productivity of irrigated or water-intensive crops as well as their improved profitability per unit area might lead to the diversion of lands for cultivating water-intensive crops in smaller area as compared to larger area under less-water intensive crops. Such a shift towards water-intensive crop might be responsible for increase in fallow lands. This reasoning seems plausible given the fact that the area under rainfed groundnut, cotton and many other millets has decreased over the years. The other factor might be the increasing labour scarcity in rural areas and the consequent increase in wage rates thus making rainfed crops less profitable. Further, increase in urban wage rates and expansion in non-farm opportunities might result in a situation wherein even the farm families move out of agriculture especially in those in areas where agriculture is less profitable. Inadequate capital and non-availability of timely credit facilities might also result in fallowing of lands.

Since the impact of all these factors cannot be captured by secondary data due to the non-availability of data on some of the factors discussed above, two sets of analysis were done to identify the factors affecting area under fallow lands – one based on the secondary data on fallow lands and the related factors at state level and the other based on primary data collected from the farmers exclusively for this study. The state level analysis is based on time-series data while the micro-level analysis is based on cross-section data.

Multiple linear regression analysis was done to identify the factors affecting the extent of fallow lands using time-series data for Tamil Nadu state for the period from 1960 to 2000. This is an aggregate analysis that captures the factors underlying the temporal changes in area under fallow lands over a period of time. The results of the analysis of factors affecting other fallows are presented in Table 5. The model fitted appears to be a good fit for the data with the adjusted R-squared value of 0.83 implying that more than 80 per cent of the variation in the extent of fallow lands is explained by the independent variables used in the analysis. The results also appear more realistic in view of the fact that the area under other fallow lands is more stable since they represent the persistence of the same area of land remaining fallow for more than a year. The length of the roads is found to have a negative effect on the extent of other fallows mainly because the extension of road facilities in rural areas facilitate better access to markets and provide impetus to agricultural development. The increase in road facilities could therefore play a crucial role in bringing out significant changes in the cropping pattern and hence profitability of farming thereby increasing the chances of more area under cultivation. The increase in area under irrigation as a percentage to gross cropped area has had a negative impact on the extent of other fallow lands primarily because the area under other fallow lands will decrease with increase in the area under assured irrigation sources. The expansion in irrigation facilities helps to reduce the instability in cropped area thus reducing the probability of continuous fallowing of lands thereby reducing the area under other fallows.

TABLE 5. REGRESSION ANALYSIS OF FACTORS AFFECTING OTHER FALLOWS IN TAMIL NADU USING STATE-LEVEL TIME-SERIES DATA

DEPENDENT VARIABLE: PERCENTAGE OF AREA UNDER OTHER FALLOW LANDS TO TOTAL GEOGRAPHICAL AREA

Sr.No.	Independent variables	Regression coefficients	t value	Level of significance
(1)	(2)	(3)	(4)	(5)
1.	Intercept	14.96	3.046	0.005
2.	Rainfall	-0.104	-0.577	0.569
3.	Length of roads per square km of geographical area	-1.305	-3.054	0.005
4.	Per cent of gross irrigated area to gross cropped area	-2.135	-3.703	0.001
5.	Time	0.008	5.465	0.00

Adjusted R-squared = 0.829; F=36.12; Signif. of F=0.00; N=40.

As the analysis above based on time-series data is unlikely to capture the cross-sectional variations in the distribution of fallow lands, it is useful to examine the factors affecting the distribution of fallow lands using district-level cross sectional data. In this analysis the triennium average of respective variables at district-level for

the latest three years (1997-98 to 1999-2000) for which data were available were used. The results of the regression analysis are presented in Table 6. The adjusted R-squared and the F-value of the regression analysis indicate that the model provides a good fit for the data. While population density and rainfall have a favourable impact of reducing the extent of fallow lands, urbanisation and land put to non-agricultural uses - both indicating a shift in land and labour from agriculture to non-agriculture - tend to increase the extent of other fallow lands. Population density has reduced the fallow lands possibly because of the fact that increasing pressure on land leads to more intensive use of scarce land resources.

TABLE 6. REGRESSION ANALYSIS OF FACTORS AFFECTING OTHER FALLOW LANDS USING DISTRICT-LEVEL CROSS-SECTIONAL DATA:1997-98 to 1999-2000

DEPENDENT VARIABLE: PERCENTAGE OF OTHER FALLOW LANDS TO GEOGRAPHICAL AREA

Sr.No. (1)	Variables (2)	Coefficients (3)	t value (4)	Level of significance (5)
1.	Constant	28.473	3.451	0.002
2.	Population density	-2.276E-02	-2.107	0.047
3.	Length of roads per square km of geographical area	-2174.409	-1.333	0.196
4.	Ratio of urban population to total population	23.256	2.326	0.030
5.	Land put to non-agricultural uses	0.659	3.226	0.004
6.	Rainfall (mm)	-1.281E-02	-2.493	0.021

Adj. R-squared = 0.48; F=5.95**; N=28.

Decline in Common Lands

One of the significant features of land use dynamics in Tamil Nadu is the continuous decline in common lands, viz., the cultivable wastes, pastures and grazing lands, and barren and uncultivable lands over the last 40 years. Therefore, the question as to where have the common lands gone remains unanswered – whether to increase the area under cultivation or the land put to non-agricultural uses. This section is precisely an attempt to answer this important question, using regression analysis of time-series data on common lands and the related factors. The results of the analysis which are presented in Table 7 bring out interesting explanations for the decline of common lands. Out of the five explanatory variables, four turned out to be statistically significant. The increase in land put to non-agricultural uses has a significant negative impact on the extent of common lands while net sown area has no significant impact on common lands implying that the common lands were mostly diverted for non-agricultural purposes. Increase in population density had negative effect on common lands while road infrastructure has positive effect on common lands.

TABLE 7. FACTORS AFFECTING THE EXTENT OF CPR LANDS IN TAMIL NADU

Sr.No. (1)	Variables (2)	Coefficient (3)	t-ratio (4)	Level of significance (5)
1.	Constant	20563558	10.095	0.00
2.	Time	369735.7	8.268	0.00
3.	Land put to non-agricultural use	-0.93201	-4.629	0.0001
4.	Net sown area	-5.15E-02	-0.927	0.3604
5.	Road density	61946360	2.787	0.0087
6.	Population density	-7046765	-7.897	0.00

Adjusted R-squared = 0.94; F=130.48, N = 40.

Farm Level Study on Distribution of Fallow Lands

An opinion survey was also conducted as a part of the field survey for primary data collection, to know the farmers' rationale for fallowing of cultivable lands. The opinion survey among farmers revealed that in most of the sample blocks, rainfall fluctuations and labour scarcity were reported as the major reason for the increase in fallow lands. In places where water is not a major constraint for cultivation, labour scarcity is reported to be the sole reason for fallowing of lands or resorting to less-labour intensive crops. This is because the agricultural sector is still labour-intensive and hence even a small increase in wages increases the cost of cultivation significantly. Therefore, fallowing is mainly resorted to whenever there is scarcity of labour resulting in wage increase. Both water scarcity and credit constraints were reported to be major factors responsible for fallowing of lands mainly in tank-irrigated areas where the wide fluctuations in tank water availability together with the predominance of rice-based cropping system leads to fallowing of lands and/or crop failures in years of poor rainfall. Further, most of the farmers in tank irrigated do not have access to groundwater and hence cultivate single-season rice crop during north-east monsoon season and most of their lands are left fallow during the rest of the year. Hence, provision of supplementary sources of irrigation is an important pre-requisite to stabilise the area under cultivation in these areas.

Using the data collected at farm level on various aspects of farming and household characteristics, a regression analysis was carried out to explain the differences in extent of other fallow lands[3] at the farm level. This is a cross-section analysis aimed at identifying the factors affecting the differences in ratio of fallow lands to total farm size across different regions of Tamil Nadu state at a given point of time.

TABLE 8. FACTORS AFFECTING EXTENT OF OTHER FALLOWS – ANALYSIS BASED ON FARM-LEVEL DATA

Sr.No. (1)	Variable (2)	Coefficient (3)	t-value (4)	Significance (5)
1.	Intercept	0.3078	0.647	0.52
2.	Non-agricultural income	0.1236	2.426	0.02
3.	No. of family labour in agriculture	0.3203	0.833	0.49
4.	Farm size	0.8233	26.911	0.00
5.	Number of fragments	-0.3195	-0.49	0.63
6.	Distance to land	-0.3082	-0.725	0.47
7.	Labour scarcity[4]	1.149	2.731	0.00
8.	Credit availed	-0.8963	-2.094	0.04
9.	Share of irrigated area (per cent)	-0.7173	-12.066	0.00

Adj. R-squared = 0.947; F= 191.19; Signif. F= 0.00; N=900.

The adjusted R-squared value indicates that the model provides a good fit to the data. More than 80 per cent of the variation in the dependent variable is explained by the independent variables included in the model. Non-agricultural income of the farm households, size of holdings, labour availability, credit availability and extent of irrigated area in the farm were found to be statistically significant in explaining the changes in area under fallow lands across farms (Table 8). An increase in non-agricultural income of the household is found to increase the area under fallow lands. This is primarily due to the non-availability of adequate labour for farm work and also due to the fact that farm family members move out of agriculture to seek employment mainly because the profitability in agriculture is less than off-farm income and/or there are severe constraints to agriculture such as non-availability of labour, water and credit. Size of holding is another important factor that determines the extent of fallow lands. As the size of holding increases, water, credit and labour constraints become the major limiting factors for a corresponding expansion in cultivated area and hence there is a positive association between size of holdings and extent of fallow lands. This is supported by the findings by Nadkarni and Deshpande (1979). Labour constraint reflected by seasonal labour scarcity was also found to be a significant factor contributing for the area under fallow lands at the farm level, while the availability of institutional credit significantly reduces the extent of fallow lands. Irrigated area in the farm is found to have a strong negative effect on the area under fallow lands by increasing the profitability and improving the stability in farm income.

V

CONCLUSIONS

The dynamics of land use pattern in the state over the last forty years reveals that there was a significant decline in the area under cultivable wastes and barren and

uncultivable wastes while there was a sharp increase in the land put to non-agricultural uses. The study reveals that there has been a significant reduction in the area under common lands mainly because of the diversion of these lands for non-agricultural purposes. The analysis of state-level and district-level time-series data on trends in land use pattern revealed that the most disturbing trend in land use pattern in the state is the sharp increase in *other fallows* from 6.5 lakhs ha in 1950s to 11 lakh ha in 1990s. The increasing trend in *other fallow*s actually took place during the latest two decades probably due to the instability in the irrigated area. Consequently, the area under total fallow lands surpassed 20 lakh ha during the last two decades thus accounting for more than 15 per cent of the total geographical area of the state and more than one-third of the net sown area. The spatial distribution of fallow lands in Tamil Nadu reveals that the fallow lands are more concentrated in the western and southern districts of the state as compared to the northern and eastern parts of the state. This is probably due to low rainfall and the limited availability of reliable sources of surface irrigation in the western and southern parts of the state. Therefore, concerted efforts should be directed at increasing the yield and profitability of rainfed crops and it is necessary to popularise the water harvesting technologies suitable for drylands so as to stabilise the area under cultivation in these regions.

The most disturbing trend is the very high growth rate in other fallow lands in the districts such as Chengalpattu, Kanyakumari, Thanjavur, Tiruchirappalli and Madurai, which are endowed with relatively more reliable surface water resources. This is probably due to the increase in the instability of area irrigated by surface water resources. Another reason could be the concentration of efforts and limited resources (credit, labour, etc.) on irrigated portion of lands thus neglecting the unirrigated areas (Nadkarni and Deshpande, 1979). Therefore, stabilisation of irrigated acreage is perhaps a more important step than the expansion of irrigation so as to better utilise land resources. It is heartening to note that the length of roads is found to have a negative effect on the extent of other fallows mainly because the extension of road facilities in rural areas facilitate better access to markets and provide impetus to agricultural development. The increase in road facilities could therefore play a crucial role in bringing out significant changes in the cropping pattern and hence profitability of farming thereby increasing the chances of more area under cultivation. The analysis of factors affecting the extent of fallow lands at the farm level using cross-section data reveals that increase in farm size, non-agricultural income and labour shortage have strong positive impact on the extent of fallow lands, while the credit availability and irrigation facilities are found to reduce the extent of fallow lands at the farm level. Another important measure is the institutional reform to ensure the prevention or regulation of converting fertile agricultural lands for non-agricultural purposes is another important mechanism to stabilise the net sown area. The dryland research system needs to be more problem-oriented and it should be made more suitable for farm-level risks associated with yield loss due to rainfall failures. Conversion for non-agricultural purposes appears to be the most important

threat to the common property land resources such as cultivable wastelands, land under miscellaneous tree crops and groves and grazing lands. Therefore, policy and research focus are needed to conserve and manage the common lands in a better manner to ensure rainwater harvesting, providing livelihood, fodder and fuel security to rural poor as well as to sustain the ecological balance. Research activities should focus more on increasing the productivity and profitability of less water-intensive crops so as to reduce the stress on water resources as well as to increase the area that could be cultivated with a given quantum of water. Institutional arrangements need to focus on the prevention of idling of fertile agricultural lands located close to urban areas for speculative purposes.

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NOTES

1. The classification of land use categories in Tamil Nadu remained the same during the entire period of analysis.

2. The field survey was conducted exclusively for the study under a research project entitled "Economic Analysis of Trends and Distribution of Fallow Lands in Tamil Nadu", funded by the State Land Use Board (State Planning Commission), Government of Tamil Nadu, and carried out by the authors.

3. We have attempted to analyse the factors affecting other fallow lands as this is more severe problem than the current fallows. The growth rate of other fallow lands in the state has been much higher than the growth rate in current fallows (see Table 1). Other fallow lands registered a significant positive growth rate during the last two decades as well as during the 40 years period between 1960 and 2000. Further, other fallow lands are those lands which remain fallow for more than one year and hence the growth in other fallow lands pose serious problems in stabilising the net area sown.

4. It is seasonal labour scarcity, measured by the wage differential between lean season and peak season. This was cross-checked with the differences between labour availability and labour demand during different seasons. As our study is based on 900 farms spread across six agro-climatic regions of Tamil Nadu, there were significant differences in wage rates across regions.

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