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An Investigation into Land Use Dynamics in India and Land Under-Utilisation

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I

INTRODUCTION

The rapid pace of economic development along with population growth, urbanisation and industrialisation exert tremendous pressure on the limited natural resource base of a country. This poses a serious challenge to researchers and policy makers to strike a balance in the use of natural resources, keeping in mind the need for their conservation of sustainable development and food and livelihood security. Land, being one of the most basic natural resource, has always been the subject matter of debate regarding its effective use. The pressure exerted by India's growing economy on land and other natural resources has intensified in the post-liberalisation phase and will further intensify in the future in the face of the burgeoning population and the demand for the conversion of agricultural lands to non-agricultural uses. The changes in land use over time have important implications; the pre-eminent being the effect on ecology which ultimately impacts the quality of peoples' lives. Therefore, there is a need for serious policy debate as to how to address various issues related to land use planning in a country where pressure on the land is four to six times more as compared to the world average (Rai, 2008). An understanding of the land use dynamics in the country can greatly contribute to this debate. However, little research attention has been given to this aspect.

The country level studies reported that while there is tendency for land shifts to the agricultural sector, there is also a positive growth trend in fallow lands which ultimately tend to move into cultivable wastes (Pandey and Tewari, 1996). State level studies reported a diversion of common land to non-agricultural uses in Tamil Nadu. There were also indications of a sharp increase in other fallows (Ramasamy *et al*, 2005). Pandey and Tewari (1987) reported the operation of the *vicious cycle* in Uttar Pradesh, whereby waste land reclamation adds to the cultivated area on one hand, and on the other, increase in fallow land depletes the cultivated area, thereby resulting in constant net sown area. This phenomenon thus nullifies the wasteland reclamation and development efforts.

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Ramasamy *et al.* (2005) reported a high degree of association of other fallows with surface irrigation. At the farm level, the study revealed that increase in farm size, non-agricultural income and labour shortage have a positive impact on fallow land. Reddy (1991) in a study on Andhra Pradesh, focused on technological factors affecting land use. He reported that technological factors led to the underutilisation of land due to the resource crunch faced by the farmers on account of the capital intensive nature of modern inputs. Nadkarni and Deshpande (1979) in a study in Karnataka and Maharashtra, highlighted the climatic and institutional factors affecting under-utilised lands, viz., other fallows, current fallows and culturable wastes.

Little research attention has been paid to study the land use dynamics in India since the inception of economic reforms in 1991. The present study aims to document the intra and inter-sectoral land use dynamics in India in the post-liberalisation phase, 1992-93 to 2005-06, and examine the different aspects of agricultural land use in relation to intensive and extensive cultivation and the under-utilisation of land.

II

METHODOLOGY

The study is based on time series data collected from *Land Use Statistics*, published by Directorate of Economic and Statistics, Ministry of Agriculture, Government of India.

Shares and Growth Rates of Different Categories of Land Use

The area averages for the triennium ending 1992-93 and 2005-06 were worked out to study the changing composition of different land use classes across states[1] and at the country level.

Annual compound growth rates in different land use categories were estimated using the exponential trend equations. The annual rates of change (dY/dt) in various land use classes were computed from the exponential trend equations.[2]

Land Use Dynamics

To study the intra and inter-sectoral land use dynamics, the methodology as described by Pandey and Tewari (1987) is adopted in this study. The authors grouped the various land use classes into three broad sectors, viz., (i) ecological sector (E), comprising forests (F), permanent pastures and grazing land (P), miscellaneous tree crops and groves (M) and barren and uncultivable land (U); (ii) non-agricultural sector (N) and (iii) agricultural sector (A), comprising cultivable wastes (W), net sown area (C), current fallows (F_c) and other fallows (F_o).

Land area of the country being constant, it was assumed that land use changes can only occur through inter-class transfers, and, hence the land use changes over time are linearly additive. The accounting identity for land use was thus, expressed as:

$$\Delta R = (\Delta F + \Delta P + \Delta M + \Delta U) + (\Delta N) + (\Delta W + \Delta F_o + \Delta F_c + \Delta C) \quad \ldots(1)$$

$$\text{or } \Delta R = \Delta E + \Delta N + \Delta A \quad \ldots(2)$$

where, R = Total reporting area
ΔE = Net change in ecological sector
ΔA = Net change in agricultural sector.

Possible land use shifts within the ecological sector were postulated. Land may shift from M and P to F; from F to P and from U to F. Shift from M and P to F would have no adverse ecological implications, while shift from U to F is highly desirable. However, a shift from F to P, and F and M to U would have serious adverse ecological effects.

Thus, in this context, the ecological sector (E) was further divided into the desirable sub-sector (E_1) and the undesirable sub-sector (E_2). The net change in the ecological sector can thus be budgeted as:

$$\Delta E = \Delta E_1 + \Delta E_2 \quad \ldots(3)$$

where, $\Delta E_1 = \Delta F + \Delta P + \Delta M$
$\Delta E_2 = \Delta U$

The net change in the agricultural sector, if positive ($+\Delta A$), will be at the cost of the ecological sector, since there is little chance of land shift from the non-agricultural sector to the agricultural sector. If however, the net change in agricultural sector is negative ($-\Delta A$), the land use shift may occur due to either the ecological (desirable and/or undesirable sub-sector) or non-agricultural sector or both.

Land use dynamics within the agricultural sector will also have important implications. If there is a positive net change to the agricultural sector ($+\Delta A$), and also an increase in the net sown area ($+\Delta C$), the situation would be favourable for agricultural growth. But, if there is no addition to the net sown area ($\Delta C = 0$), it would imply a situation where there is addition to cultivated area, on the one hand, and depletion in cultivated area by means of land use shifts to F_c, F_o and W, on the other hand, thereby leaving the net sown area (NSA) constant. This situation connotes a very adverse situation as an increase in the agricultural sector could occur at the cost of the desirable ecological sector. Further, this situation would require larger investments and efforts to reclaim such waste lands.

The overall inter-sectoral land use shifts were then budgeted as:

$$\Delta R = \Delta E_1 + \Delta E_2 + \Delta N + \Delta A \quad \ldots(4)$$

Factors Influencing Regional Variations in Under-Utilisation of Land

This study also makes an attempt to ascertain the factors which influence the variations in under-utilisation of land across states. Two separate linear multiple regression equations were fitted; one each for the proportion of other fallows and culturable wastes. The analysis pertained to seventeen major states of the country (during 2005-06) for which consistent data regarding the explanatory variables were available. Five explanatory variables were included in each equation, viz., the proportion of land under landholdings more than 4 hectares (X_1), leased-in land as proportion of land owned (X_2), proportion of cultivated area under irrigation (X_3), credit availability per hectare (X_4) and rural infrastructure index (X_5). The variable credit availability was dropped from the analysis on account of its highly non-significant influence on the dependent variables. The final analysis, thus consisted of four independent variables in both regression equations.

It is hypothesised that as the size of land holding increases, the intensity of land use declines. Leased-in area as a proportion of land owned is an indicator for the extent of tenancy in a state. It has been postulated in earlier studies that tenancy promotes the full utilisation of agricultural land. The proportion of net sown area under irrigation is expected to increase the under-utilisation of land as the availability of irrigation may tend to direct more efforts on the irrigated area at the expense of other areas. Rural infrastructure is expected to have a negative effect on the extent of under-utilised land. These hypotheses are tested in this study on the basis of cross-section data.

Zero order correlation matrix was prepared to test for multicollinearity so as to explore the possibilities for re-specification of the variables in case multicollinearity was observed among the independent variables. However, the analysis did not reveal any significant multicollinearity and hence the variables stated above were as such included in the regression analysis.

III

RESULTS AND DISCUSSION

Sectoral Shares

The state-wise distribution of different categories of land use at two periods of time, viz., T.E. 1992-93 and T.E. 2005-06 are presented in Table 1. Within the ecological sector, forests account for the highest share of land area at around 23 per cent while permanent pastures and grazing land and miscellaneous trees and groves together account for 4.5 per cent of total reporting area (desirable sub-sectors). Barren and uncultivable land constitutes about 6 per cent (undesirable ecological sub-sector).

The state-wise disaggregated analysis reveals that the area under forests as a percentage of the total reporting area is highest in the north-eastern (NE) states

TABLE 1. AREA UNDER VARIOUS LAND CLASSES IN T.E. 1992-93 AND 2005-06

('000 ha)

State	Total reporting area		Forests		Non-agril. uses		Barren and uncultivated land		Permanent pastures and grazing land	
	1992-93	2005-06	1992-93	2005-06	1992-93	2005-06	1992-93	2005-06	1992-93	2005-06
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Andhra Pradesh	27440	27405	6157	6199	2326	2670	2139	2084	820	676
			(22.44)	(22.62)	(8.48)	(9.74)	(7.80)	(7.60)	(2.99)	(2.47)
Bihar	17330	17330	2936	2955	2102	2438	1016	1009	126	105
			(16.94)	(17.05)	(12.13)	(14.07)	(5.86)	(5.82)	(0.73)	(0.59)
Gujarat	18822	18868	1888	1854	1107	1145	2660	2607	848	850
			(10.03)	(9.83)	(5.88)	(6.07)	(14.13)	(13.82)	(4.51)	(4.50)
Haryana	4381	4373	169	44	292	428	111	97	31	25
			(3.86)	(1.01)	(6.67)	(9.79)	(2.53)	(2.22)	(0.71)	(0.57)
Himachal Pradesh	3395	4544	1038	1099	201	453	146	673	1203	1515
			(30.57)	(24.19)	(5.92)	(9.97)	(4.30)	(14.81)	(35.43)	(33.34)
Jammu & Kashmir	4505	3781	2747	2023	291	293	293	289	125	125
			(60.98)	(53.50)	(6.46)	(7.75)	(6.50)	(7.64)	(2.77)	(3.31)
Karnataka	19050	19050	3074	3071	1189	1342	800	788	921	943
			(16.14)	(16.12)	(6.24)	(7.04)	(4.20)	(4.14)	(4.83)	(4.95)
Kerala	3885	3885	1081	1082	293	427	63	28	2	0
			(27.82)	(27.85)	(7.54)	(10.99)	(1.62)	(0.72)	(0.05)	(0.00)
Madhya Pradesh	44278	44546	14225	15006	2370	2623	2122	1771	2710	2198
			(32.13)	(33.69)	(5.35)	(5.89)	(4.79)	(3.98)	(6.12)	(4.93)
Maharashtra	30758	30758	5333	5213	1124	1396	1682	1724	1180	1251
			(17.34)	(16.95)	(3.65)	(4.54)	(5.47)	(5.61)	(3.84)	(4.07)
Orissa	15540	15571	5503	5813	748	999	471	843	663	443
			(35.41)	(37.33)	(4.81)	(6.42)	(3.03)	(5.41)	(4.27)	(2.85)
Punjab	5033	5033	241	308	404	429	77	21	4	4
			(4.79)	(6.12)	(8.03)	(8.52)	(1.53)	(0.42)	(0.08)	(0.08)
Rajasthan	34251	34266	2345	2666	1605	1786	2785	2476	1771	1708
			(6.85)	(7.78)	(4.69)	(5.21)	(8.13)	(7.23)	(5.17)	(4.98)
Tamil Nadu	13012	13027	2150	2118	1612	2126	512	509	121	112
			(16.52)	(16.26)	(12.39)	(16.32)	(3.93)	(3.91)	(0.93)	(0.86)
Uttar Pradesh	29797	29870	5156	5152	2444	2783	1035	849	300	294
			(17.30)	(17.25)	(8.20)	(9.32)	(3.47)	(2.84)	(1.01)	(0.98)
West Bengal	8636	8686	1117	1174	1593	1670	155	26	7	5
			(12.93)	(13.52)	(18.45)	(19.23)	(1.79)	(0.30)	(0.08)	(0.06)
North east	23202	22974	11705	13107	1322	1671	3524	1739	257	170
			(50.45)	(57.05)	(5.70)	(7.27)	(15.19)	(7.57)	(1.11)	(0.74)
India	304890	305327	68135	69745	21373	24816	19659	17543	11096	10427
			(22.35)	(22.84)	(7.01)	(8.13)	(6.45)	(5.75)	(3.64)	(3.42)

(Contd.)

TABLE 1 (CONCLD.)
AREA UNDER VARIOUS LAND CLASSES IN T.E. 1992-93 AND 2005-06

('000 ha)

State	Misc. trees and groves		Cultivable waste land		Total fallows		Net sown area (NSA)		Area sown more than once		Net irrigated area	
	1992-93	2005-06	1992-93	2005-06	1992-93	2005-06	1992-93	2005-06	1992-93	2005-06	1992-93	2005-06
(1)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
Andhra Pradesh	258	278	798	696	4010	4406	10899	10397	2190	2352	4220	3969
	(0.94)	(1.01)	(2.91)	(2.54)	(14.61)	(16.08)	(39.72)	(37.94)	(7.98)	(8.58)	(15.38)	(14.48)
Bihar	296	352	381	320	2939	2762	7548	7388	2646	2290	3335	3331
	(1.71)	(2.03)	(2.19)	(1.85)	(16.96)	(15.94)	(43.55)	(42.63)	(15.27)	(13.21)	(19.24)	(19.22)
Gujarat	4	4	1968	1977	1532	579	9056	9852	1212	1394	2398	3388
	(0.02)	(0.02)	(10.46)	(10.48)	(8.14)	(3.07)	(48.11)	(52.22)	(6.44)	(7.39)	(12.74)	(17.96)
Haryana	4	8	29	34	203	195	3551	3542	2307	2897	2604	2953
	(0.09)	(0.18)	(0.66)	(0.78)	(4.63)	(4.46)	(81.05)	(81.00)	(52.66)	(66.25)	(59.44)	(67.53)
Himachal Pradesh	43	62	120	128	71	73	573	541	400	419	99	105
	(1.27)	(1.36)	(3.53)	(2.82)	(2.09)	(1.61)	(16.88)	(11.91)	(11.78)	(9.22)	(2.92)	(2.31)
Jammu & Kashmir	72	71	141	141	106	87	730	750	344	347	311	310
	(1.60)	(1.88)	(3.13)	(3.73)	(2.35)	(2.30)	(16.24)	(19.84)	(7.64)	(9.18)	(6.90)	(8.20)
Karnataka	317	297	446	419	1574	1905	10595	10285	1431	2143	2124	2725
	(1.66)	(1.56)	(2.34)	(2.20)	(8.26)	(10.00)	(55.62)	(53.99)	(7.51)	(11.25)	(11.15)	(14.30)
Kerala	34	10	102	68	72	112	2236	2159	777	820	329	393
	(0.88)	(0.26)	(2.63)	(1.75)	(1.85)	(2.88)	(57.55)	(55.57)	(20.00)	(21.11)	(8.47)	(10.12)
Madhya Pradesh	73	20	1588	1511	1712	1683	19407	19735	3804	5855	4097	6967
	(0.16)	(0.05)	(3.59)	(3.39)	(3.87)	(3.78)	(43.83)	(44.30)	(8.59)	(13.14)	(9.25)	(15.64)
Maharashtra	287	250	1010	916	2012	2544	17976	17465	3069	4906	2158	3061
	(0.93)	(0.81)	(3.28)	(2.98)	(6.54)	(8.27)	(58.44)	(56.78)	(9.98)	(15.95)	(7.02)	(9.95)
Orissa	857	482	533	392	434	841	6303	5758	3104	2933	1940	1810
	(5.51)	(3.10)	(3.43)	(2.52)	(2.79)	(5.40)	(40.56)	(36.98)	(19.97)	(18.84)	(12.48)	(11.62)
Punjab	4	4	27	9	78	14	4192	4243	3270	3803	3866	4038
	(0.08)	(0.08)	(0.54)	(0.18)	(1.55)	(0.28)	(83.29)	(84.30)	(64.97)	(75.56)	(76.81)	(80.23)
Rajasthan	18	16	5566	4580	3846	4107	16261	16926	2811	4549	3872	5804
	(0.05)	(0.05)	(16.25)	(13.37)	(11.23)	(11.99)	(47.48)	(49.40)	(8.21)	(13.28)	(11.30)	(16.94)
Tamil Nadu	231	282	294	374	2255	2497	5650	5010	1093	636	2485	2568
	(1.78)	(2.16)	(2.26)	(2.87)	(17.33)	(19.17)	(43.42)	(38.46)	(8.40)	(4.88)	(19.10)	(19.71)
Uttar Pradesh	557	599	1037	845	2004	1882	17250	17472	8188	8807	10592	13537
	(1.87)	(2.01)	(3.48)	(2.83)	(6.73)	(6.30)	(57.89)	(58.49)	(27.48)	(29.48)	(35.55)	(45.32)
West Bengal	61	60	102	38	409	348	5374	5366	3111	4207	1911	3086
	(0.71)	(0.69)	(1.18)	(0.44)	(4.74)	(4.01)	(62.22)	(61.78)	(36.02)	(48.43)	(22.13)	(35.53)
North east	635	604	764	621	1166	868	3829	4216	1584	1247	835	440
	(2.74)	(2.63)	(3.29)	(2.70)	(5.03)	(3.78)	(16.50)	(18.35)	(6.83)	(5.43)	(3.60)	(1.92)
India	3781	3386	14975	13139	24441	24937	142035	141334	41316	49805	47277	58560
	(1.24)	(1.11)	(4.91)	(4.30)	(8.01)	(8.17)	(46.59)	(46.29)	(13.55)	(16.31)	(15.51)	(19.18)

Figures in parentheses indicate percentage to total reporting area.

followed by Jammu & Kashmir, Orissa and Madhya Pradesh. In Madhya Pradesh, Orissa and north-eastern states, the share of land area under forests have increased since 1992-93. The states having the lowest forest cover are Haryana, Punjab, Rajasthan and Gujarat. In Gujarat and Haryana, the shares of land area under forests have declined since1992-93.

The share of barren and uncultivable land in the total reporting area is the highest in Gujarat and Himachal Pradesh, while the states of West Bengal, Punjab and Kerala have the lowest shares. Himachal Pradesh and north eastern states have registered the most prominent changes in the share of land area under barren and uncultivable land during the period. While, this share has increased in Himachal Pradesh, the north eastern states registered a drop in this share during the same period.

The area under permanent pastures and grazing land and area under miscellaneous crops as percentage of reporting area is the highest in Himachal Pradesh, followed by Karnataka and is the lowest in Punjab.

Within the agricultural sector, net sown area (NSA) accounts for the largest share (46 per cent) of total reporting area at all-India level. Haryana and Punjab have the largest share of land under NSA (81 per cent and 84 per cent, respectively), while in Himachal Pradesh, north east states and Jammu & Kashmir, NSA constitute a comparatively smaller proportion of land area (12 per cent, 18 per cent and 20 per cent, respectively). In the other states, this share ranges from 37 per cent in Orissa to 62 per cent in West Bengal. At the all-India level, there has been no change in the share of NSA during the period 1992-93 to 2005-06. However, the proportion of NSA has registered a decline in several states during the period, most noticeably in Tamil Nadu and Orissa, where the share of NSA decreased from 43 per cent and 41 per cent in 1992-93 to 38 per cent and 37 per cent in 2005-06, respectively.

The states of Tamil Nadu, Andhra Pradesh, Bihar and Rajasthan have a very large proportion (12-19 per cent) of total reporting area lying under fallow, while in Punjab, Himachal Pradesh, Jammu & Kashmir and Gujarat, other fallows and current fallows together constitute a relatively smaller proportion (less than 1 per cent to 3 per cent). The share of cultivable waste is high in Rajasthan (13 per cent) and Gujarat (10 per cent). The states of Haryana, Punjab and West Bengal on the other hand have a very low share of cultivable wastes (less than 1 per cent).

The states of West Bengal, Tamil Nadu, Bihar and Kerala have very high shares (11-19 per cent) of their reporting area under non-agricultural uses, hinting towards a high rate of urbanisation and industrialisation. The results reveal that the share of land area under non-agricultural uses has registered the sharpest increase (2-4 per cent) in Tamil Nadu, Bihar and Kerala between 1992-93 to 2005-06. States like Maharashtra, Rajasthan and Madhya Pradesh have relatively lesser proportion (4-6 per cent) of their reporting area under non-agricultural uses.

Trends in Land Use Pattern

The exponential growth rates of land use classes for different states are presented in Table 2. Among all land use categories, the area under non-agricultural uses registered the highest growth rate at the aggregate country level (1.08 per cent per annum). Increasing population, urbanisation and industrialisation might explain significantly the increasing trend in the non-agricultural sector. The desirable ecological sub-sectors of permanent pastures and grazing land, and miscellaneous trees and groves suffered with a declining trend, but forest area registered a significant positive growth during the period, although the growth rate was not substantial (0.18 per cent per annum). Current fallows have remained stagnant during the period while barren and uncultivated land showed a declining trend. A matter of concern is the high rate of growth in other fallows (0.99 per cent per annum). However, an encouraging point is the declining trend in culturable wastelands, probably due to land reclamation for agricultural use. The growth rate of net sown area, on the other hand remained non-significant. These results suggest that there have been land use shifts from permanent pastures and grazing land, miscellaneous trees and groves and barren and uncultivable land towards area under non-agricultural uses and to a smaller extent towards forests.

An important aspect is the trend in common lands. Permanent pastures and culturable wastelands could be clubbed as common lands while the area under miscellaneous tree crops (at least a significant share of it) might be private lands. The estimated growth rate of the common lands, at an all-India level, revealed a declining trend (-0.68 per cent per annum).

Growth rates computed for different states revealed that the area under non-agricultural uses showed an increasing trend in all the states except Punjab, where it remained constant. The annual growth rate in this category was the highest for Himachal Pradesh (7.5 per cent), followed by Kerala (3 per cent) and Orissa (2.3 per cent). The area under forests recorded a positive growth in Himachal Pradesh, Madhya Pradesh, Orissa, Punjab and the north-east. In all other states forest cover either declined or remained stagnant. The annual rate of decline was sharpest in Haryana (-11 per cent) and Jammu & Kashmir (-3 per cent).

Permanent pastures and the area under miscellaneous crops both showed a declining trend in the north east, West Bengal, Orissa and Madhya Pradesh. Apart from these states, permanent pastures either declined or remained stagnant in all other states, except Himachal Pradesh, Rajasthan and Gujarat, where its growth rates were significant and positive. The area under miscellaneous crops recorded positive growth in Tamil Nadu, Uttar Pradesh, Haryana, Bihar and Andhra Pradesh, while in the remaining states it registered either a declining trend or remained stagnant.

Barren and uncultivable land registered the highest growth in Himachal Pradesh (15 per cent per annum) and Orissa (5 per cent per annum). In Haryana and Maharashtra also, this land use category showed a significant and positive growth.

TABLE 2. STATE-WISE GROWTH RATES IN LAND USE CLASSES (1992-93 TO 2005-06)

		Ecological sector				Agricultural sector							
States/ land use (1)	Non-agricult -ural use (2)	Forests (3)	Perm. pastures and grazing land (4)	Misc. trees and groves (5)	Barren and unculti-vable land (6)	Cult. waste land (7)	Other fallows (8)	Current fallows (9)	NSA (10)	Gross sown area (11)	Area sown more than once (12)	Net irrigated area (13)	Gross irrigated area (14)
Andhra Pradesh	1.24[b]	-0.07[b]	-1.43[a]	1.12[a]	0.00	-1.08[a]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bihar	0.80[a]	0.02[a]	-1.26[a]	0.92[a]	-0.02[a]	-1.55[a]	-0.69[a]	-1.12[a]	0.17[b]	0.00	0.00	0.39[b]	0.95[b]
Gujarat	0.14[b]	0.00	0.02[a]	0.00	0.00	0.00	-9.99[a]	0.00	0.20[b]	0.00	0.00	1.60[a]	1.41[b]
Haryana	1.99[b]	-10.70[a]	0.00	6.59[a]	1.02[a]	0.00	0.00	0.00	0.00	0.72[a]	1.76[a]	0.96[a]	1.72[a]
Himachal Pradesh	7.54[a]	0.48[a]	2.36[a]	0.00	14.74[a]	0.00	-3.33[b]	0.91[b]	-0.50[a]	-0.19[b]	0.00	0.00	0.49[a]
Jammu & Kashmir	0.80[a]	-2.65[a]	0.00	-0.07[b]	-0.10[a]	0.00	5.37[a]	-2.32[a]	0.21[a]	0.23[a]	0.00	0.00	0.00
Karnataka	0.87[a]	0.00	0.00	-0.70[a]	-0.16[a]	-0.55[a]	1.13[b]	2.31[c]	-0.39[b]	0.00	2.31[b]	1.67[a]	0.00
Kerala	3.13[a]	0.00	0.00	-10.16[a]	-5.44[a]	-2.19[b]	3.81[a]	4.19[a]	-0.48[a]	-0.20[b]	0.00	1.41[a]	0.00
Madhya Pradesh	0.61[a]	0.29[a]	-1.99[a]	-5.62[b]	0.00	0. 25[c]	0.00	1.78[c]	0.00	0.00	0.00	1.71[c]	1.58[c]
Maharashtra	1.13[a]	0.00	0.00	0.00	0.59[c]	0.00	0.00	2.27[a]	-0.27[a]	0.31[c]	3.81[a]	1.31[b]	2.12[a]
Orissa	2.30[a]	0.70[a]	-3.24[a]	-5.50[a]	4.64[a]	-2.22[a]	0.00	7.72[a]	-0.85[a]	-0.95[b]	0.00	0.00	0.00
Punjab	0.00	0.55[b]	0.00	0.00	-7.55[b]	0.00	0.00	-13.14[a]	0.00	0.47[a]	0.79[a]	0.00	0.62[a]
Rajasthan	0.69[a]	0.00	0.30[a]	0.00	-0.79[a]	0.00	2.41[a]	0.00	0.00	0.00	0.00	1.36[b]	0.00
Tamil Nadu	1.03[a]	-0.11[a]	-0.78[a]	2.09[a]	0.00	1.81[a]	4.28[a]	0.00	-1.38[a]	-1.83[a]	-5.49[b]	0.00	-1.80[b]
Uttar Pradesh	0.94[a]	0.00	0.00	1.10[a]	-1.46[a]	-1.41[a]	-2.89[a]	0.00	0.11[b]	0.19[c]	0.00	1.66[a]	1.39[a]
West Bengal	0.61[a]	-0.14[a]	-3.36[b]	-1.64[c]	-6.39[a]	-6.41[a]	-3.01[a]	3.58[a]	-0.18[a]	1.05[a]	2.53[a]	4.23[a]	7.92[a]
North east	1.98[a]	0.90[a]	-3.14[a]	-0.43[a]	--5.79[a]	-2.55[a]	0.00	-2.31[b]	0.77[a]	0.00	-1.83[a]	-5.55[a]	-4.39[a]
India	1.08[a]	0.18[a]	-0.58[a]	-0.88[a]	-0.65[a]	-0.83[a]	0.99[a]	0.00	0.00	0.00	0.84[b]	1.03[a]	1.25[a]

a, b, c Significant at 1, 5 and 10 per cent level, respectively. 0.00 indicates non-significant growth rates.

The annual rate of decline in this category was the highest in Punjab (-8 per cent), West Bengal (-6 per cent) and Kerala (-5 per cent).

Within the agricultural sector, the culturable wastes declined in most states, the sharpest being in West Bengal (-6 per cent per annum), followed by the north east, Orissa and Kerala. The growth rates were either negative or non-significant for all other states, except Madhya Pradesh and Tamil Nadu, where the culturable wastes registered significant and positive growth.

Other fallows showed an increasing trend in Jammu & Kashmir, Kerala, Tamil Nadu, Karnataka and Rajasthan (growth rate ranging from 2-5 per cent per annum). On the other hand, other fallows declined in Gujarat, Himachal Pradesh, Uttar Pradesh, West Bengal and Bihar (the rate of decline ranging from -0.7 to -10 per cent per annum).

Net sown area (NSA) registered a decline or remained constant in most of the states. The decline was highest in Tamil Nadu, followed by Orissa, Himachal Pradesh and Kerala. The NSA showed positive growth in the north east, Jammu & Kashmir, Gujarat, Bihar and Uttar Pradesh.

In sum, the above results indicate that: (i) there has been a continuous increase in land put to non-agricultural uses in all the states; (ii) within the ecological sector, there are overall indications towards decline in common lands, viz., permanent pastures and area under miscellaneous crops and (iii) within agricultural sector, the NSA has declined by as many as 701 thousand hectares at the national level in spite of some increase in the reporting area, but remained constant in few states. Even, in the states, where the growth in NSA is positive, this growth rate is not substantial.

Land Use Dynamics

Table 3 elicits state-wise estimates of annual rate of change in various land use categories, while Table 4 summarises the net sectoral annual rate of change. Thus, in Table 3, we get the intra-sectoral dynamics of land use changes and Table 4 indicates the land shifts among different sectors.

It can be seen from Table 3 that at the all-India level, land shifts have taken place from all ecological sub-sectors, except forests to other sectors. While the decline in barren and uncultivable land is desirable, at the same time, the decline in permanent pastures and area under miscellaneous crops is a matter of concern. The increase in area under forests can be attributed mostly to the increase in forest area in the north eastern states. Apart from the north east, the area under forests has increased in only five other states (viz., Bihar, Himachal Pradesh, Madhya Pradesh, Orissa and Punjab), the annual rate of addition to forest cover ranging from 1,630 hectares in Punjab to 59,030 hectares in Bihar. However, increase in area officially considered as forests may not necessarily be accompanied by an increase in forest cover. Nevertheless, this may be seen as a favourable impact of afforestation programmes and forest policy emphasis which of course has not been uniform throughout the

TABLE 3. STATE-WISE ANNUAL RATES OF CHANGE IN LAND USE CLASSES (1992-93 TO 2005-06)

('000 ha)

		Ecological sector				Agricultural sector				
States Land use (1)	Non-agricultural use (2)	Forests (3)	Perm. pastures and grazing land (4)	Misc. trees and groves (5)	Barren and uncultv. Land (6)	Cult. Waste land (7)	Other fallows (8)	Current fallows (9)	NSA (10)	Net irrigated area (11)
Andhra Pradesh	31.27	-4.35	-10.18	2.90	0.00	-8.00	0.00	0.00	0.00	0.00
Bihar	18.98	59.03	-1.40	3.12	-0.20	-4.71	-6.48	-21.32	12.54	13.59
Gujarat	1.59	0.00	0.17	0.00	0.00	0.00	-1.79	0.00	19.24	48.26
Haryana	7.72	-86.12	0.00	0.35	0.95	0.00	0.00	0.00	0.00	27.25
Himachal Pradesh	21.05	5.18	32.69	0.00	70.57	0.00	-0.62	0.50	-2.78	0.00
Jammu & Kashmir	2.33	-58.51	0.00	-0.05	-0.29	0.00	0.46	-2.09	1.55	0.00
Karnataka	11.21	0.00	0.00	-2.16	-1.27	-2.38	4.85	31.80	-40.37	41.26
Kerala	11.13	0.00	0.00	-1.90	-1.91	-1.53	1.26	2.59	-10.65	5.16
Madhya Pradesh	15.37	41.42	-49.01	-1.29	0.00	3.76	0.00	14.71	0.00	103.42
Maharashtra	15.05	0.00	0.00	0.00	9.63	0.00	0.00	26.12	-47.92	38.84
Orissa	20.62	39.78	-16.58	-35.37	31.34	-9.59	0.00	23.48	-50.94	0.00
Punjab	0.00	1.63	0.00	0.00	-3.02	0.00	0.00	-4.44	0.00	0.00
Rajasthan	11.87	0.00	5.18	0.00	-20.43	0.00	53.31	0.00	0.00	70.93
Tamil Nadu	20.41	-2.35	-0.96	5.20	0.00	6.31	54.13	0.00	-73.75	0.00
Uttar Pradesh	24.54	0.00	0.00	6.15	-13.73	-12.88	-21.79	0.00	19.20	207.64
West Bengal	9.77	-1.66	-0.20	-1.08	-2.13	-3.08	-0.91	9.51	-9.78	111.54
North east	30.61	114.67	-6.19	-2.65	-125.76	-17.75	0.00	-7.91	31.45	-28.93
India	252.73	124.53	-62.45	-31.28	-116.85	-114.32	102.31	0.00	0.00	568.79

Note: Annual rates of change are at geometric mean level.

TABLE 4. STATE-WISE SECTORAL LAND USE DYNAMICS (1992-93 TO 2005-06)

	Annual rate of change ('000 ha.)				
		Ecological sector			
		Desirable	Undesirable	Agricultural sector	
States/Land use	Non-agricultural use	Perm. past. + misc. trees + forests	Barren and Uncult.	Wastes+ Fallows+NSA	Reported area
(1)	(2)	(3)	(4)	(5)	(6)
Andhra Pradesh	31.27	-11.63	0.00	-8.00	0.00
Bihar	18.98	60.75	-0.20	-19.97	0.00
Gujarat	1.59	0.17	0.00	17.45	0.00
Haryana	7.72	-85.77	0.95	0.00	0.00
Himachal Pradesh	21.05	37.87	70.57	-2.90	111.26
Jammu & Kashmir	2.33	-58.56	-0.29	-0.08	-61.22
Karnataka	11.21	-2.16	-1.27	-6.10	0.00
Kerala	11.13	-1.90	-1.91	-8.33	0.00
Madhya Pradesh	15.37	-8.88	0.00	18.47	22.21
Maharashtra	15.05	0.00	9.63	-21.80	0.00
Orissa	20.62	-12.17	31.34	-37.05	1.56
Punjab	0.00	1.63	-3.02	-4.44	0.00
Rajasthan	11.87	5.18	-20.43	53.31	2.06
Tamil Nadu	20.41	1.89	0.00	-13.31	0.00
Uttar Pradesh	24.54	6.15	-13.73	-15.47	8.95
West Bengal	9.77	-2.94	-2.13	-4.26	0.00
North east	30.61	105.83	-125.76	5.79	-18.43
India	252.73	30.28	-116.85	-14.31	61.00

country. In fact, the area under forests declined in five states (viz., Andhra Pradesh, Haryana, Jammu & Kashmir, Tamil Nadu and West Bengal), the annual rate of depletion ranging from 1,660 ha in West Bengal to 86,120 ha in Haryana.

NSA in 1950-51 was 119 million hectares and it increased substantially during the 1950s and 1960s to 140 million hectares in 1970-71. Thereafter, there has virtually been no addition to NSA till 1990-91 as reported earlier by Pandey and Tewari (1996). As observed in this study, the NSA at aggregate country level remained constant during the post-liberalisation period of 1992-93 to 2005-06. However, disaggregated analysis at the state level projects a diverse picture. NSA has decreased in seven states, viz., Himachal Pradesh, Karnataka, Kerala, Maharashtra, Orissa, Tamil Nadu and West Bengal, wherein the annual rate of depletion has ranged from 2,780 hectares in Himachal Pradesh to 7,350 hectares in Tamil Nadu. On the other hand, in Bihar, Gujarat, Jammu & Kashmir, Uttar Pradesh and north east, there has been increase in NSA and the annual rate of addition to net sown area has ranged from 1,550 hectares in Jammu & Kashmir to 19,240 hectares in Gujarat.

Changes in other land use classes within the agricultural sector reveal that culturable wastes have declined at an all-India level, while the other fallows have increased consistently. The decline in culturable wastes points towards the beneficial effects of waste land development and reclamation efforts. However, the concomitant increase in other fallows - in the face of constant net sown area – indicate that while the reclamation of waste lands is adding to the cultivated area, fallow land is on the

other hand, depleting the cultivated area, thereby nullifying the efforts going behind wasteland reclamation and development. When disaggregated at state level, it can be seen that culturable waste has declined or remained constant in most of the states, except Madhya Pradesh and Tamil Nadu, where waste lands have increased annually by 3,760 and 6,310 hectares, respectively. In the states where the wastelands have declined, the annual rate of decline has ranged from 1,530 hectares in Kerala to 12,880 hectares in Uttar Pradesh.

The increase in other fallows at the country level, can mostly be attributed to increased fallow lands in Rajasthan and Tamil Nadu, where the annual rate of addition was 53,310 and 44,130 hectares, respectively. Other fallows increased in three other states, viz., Karnataka, Kerala and Jammu & Kashmir, although the annual rate of addition has been substantially low. Other fallows declined in five states, viz., Bihar, Gujarat, Himachal Pradesh, Uttar Pradesh and West Bengal, but the highest decline is shown in Uttar Pradesh, followed by Bihar. Both these states present a desirable scenario in that both the culturable wasteland and other fallows declined which added to the cultivated area as indicated by the annual rate of addition to NSA by 1,920 and 1,234 hectares, respectively. In the NE also, the reclamation of wastelands has added to the NSA, while the other fallows have remained stagnant. This points to the favourable impact of land reclamation efforts. On the other hand, the situation in Tamil Nadu is quite disconcerting as substantial land is moving from cultivated area to other fallows and the other fallows are gradually moving towards culturable wastes.

At the aggregate country level, the area under non-agricultural use has increased by 2,52,730 hectares, annually. Disaggregated analysis revealed the same scenario in all other states, except Punjab. The states with high annual rate of addition to area under non-agricultural use - at more than 20,000 hectares - are Himachal Pradesh, north east, Tamil Nadu, Orissa and Andhra Pradesh. Among other states, the annual rate of addition ranged from 2,330 hectares in Jammu & Kashmir to 18,980 hectares in Bihar. Only in Punjab, the area under non-agricultural use remained constant during the period.

The net sectoral rate of change, as given in Table 4, reveal that at the aggregate country level, there has been substantial land shifts from the undesirable ecological sub-sector, i.e., barren and uncultivated land. However, the country level data also provide indications that most of the lands released from barren and uncultivable area are going to the non-agricultural sector and to a smaller extent to the desirable ecological sector, mainly forests. Thus land shifts from the barren and uncultivable land, which is desirable, seem to have favoured mostly the non-agricultural sector, thereby mitigating the pressure for diversion of agricultural land to meet the growing needs of the non-agricultural sector.

Although, there has been a net addition to the desirable ecological sub-sector, it may be recalled that within this sector land shifts have taken place from permanent pastures and miscellaneous crops, which were compensated for by a higher rate of

addition to the forest sub-sector. The possibility of land released from pastures and miscellaneous crops to the agricultural sector is nil. Thus, it seems quite probable that the land released as such has gone to the non-agricultural sector and to some extent to the forests.

The land shift from the agricultural sector to the non-agricultural sector is another disconcerting feature in these land shift patterns. These land shifts towards non-agricultural uses point towards a tremendous pressure of urban and industrial expansion on land use, which calls for a more rational approach in urbanisation and industrialisation policies.

Disaggregated analysis at the state level projects a disquieting picture in states like Andhra Pradesh, Haryana, Madhya Pradesh and Orissa. In all these states there has been depletion in the desirable ecological sub-sector while the undesirable ecological sector has either remained constant or increased. Thus, it seems that the addition of land to the non-agricultural sector has come at the cost of desirable ecological sub-sector. In West Bengal, Jammu & Kashmir, Karnataka and Kerala, land shifts have occurred from all other sectors to the non-agricultural sector. These patterns of land shifts, particularly the shift from the desirable ecological sub-sector to non-agricultural sector needs to be checked. In Rajasthan and north east, land shifts have taken place from the barren and uncultivable sector and the land thus released has gone to all other sectors. This trend is favourable to both the desirable part of the the ecological sub-sector and the agricultural sector. In Punjab, there has been no addition to the non-agricultural sector, although depletion in barren and uncultivable land has taken place. Thus, it seems lands released as such are going to the desirable ecological sub-sector. Bihar and Uttar Pradesh reflect the same pattern that was found at the all-India level, i.e., depletion in the agricultural sector and barren and uncultivable land contributed to the addition in the non-agricultural sector and also to a lesser extent to the desirable ecological sub-sector.

Agricultural Land Use

This section deals with different aspects of agricultural land use, across states, in respect to extensive cultivation, intensive cultivation and under-utilisation of land.

Extensive Cultivation

The extent of extensive cultivation has been assessed from the growth rates of NSA, GSA and area sown more than once, as given in Table 2. At the aggregate country level, there has been no growth in NSA, while area sown more than once has registered a positive growth. This indicates that at the all-India level, the tendency for extensive cultivation has abated while at the same time, the intensity of cultivation by multiple cropping has increased to meet the growing food requirements.

However, disaggregated analysis at the state level reveals that five states, viz., Bihar, Gujarat, Jammu & Kashmir, Uttar Pradesh and north east have recorded

positive growth in NSA. In all these states, the area sown more than once has remained constant or declined. This points to the probable existence of a tendency of extensive cultivation in these states which needs to be contained. The states of Haryana and Punjab project a desirable scenario in that while there has been no growth in NSA, the GSA and area sown more than once, both have registered a positive growth.

In Karnataka, West Bengal and Maharashtra, the growth in NSA has been negative, while area sown more than once has registered positive growth. This indicates that land shifts from cultivated areas are being compensated for by an increased intensity of cultivation in the remaining areas under cultivation. The situation in Himachal Pradesh, Orissa and Tamil Nadu is alarming as both NSA and area sown more than once have shown negative growth, thus indicating that on one hand, land shift is occurring from the cultivated areas, and on the other, no efforts are being made to adequately utilise the remaining areas by increasing the intensity of cultivation.

Intensive Cultivation

The influence of irrigation intensity on cropping intensity has been assessed for two points of time, viz., 1992-93 and 2005-06 – with the help of two simple linear regression equations – based on cross section data of states. The dependent variable in these equations was cropping intensity (percentage of GSA/NSA) and the independent variable was irrigation intensity (percentage of GIA/NIA). The assumption here is that intensive cultivation depends to a large extent upon the availability of irrigation.

The results of both the regression models revealed that irrigation intensity accounted for substantial variation in cropping intensity (61.9 per cent and 83 per cent for 1992-93 and 2005-06, respectively.) The coefficients of irrigation intensity were highly significant (at 1 per cent level of significance) in both the models. This indicates that states which have brought more land under irrigation all round the year have succeeded in increasing the intensity of cultivation by multiple cropping. This holds true for states like Haryana, Punjab, West Bengal and Himachal Pradesh. On the other hand, states like Gujarat, Karnataka and Tamil Nadu having low irrigation intensity also have low cropping intensity. This points to the importance of irrigation development in increasing the intensity of cultivation.

The extent of intensive cultivation has been assessed from the changes in cropping intensity (percentage of GSA/NSA) vis-à-vis irrigation intensity (percentage of GIA/NSA) during two points of time, 1992-93 and 2005-06 (Table 5). The results throw some revealing facts. Bihar, Orissa and north east have substantially increased their irrigation intensity over the period, but have registered a negligible or negative percentage change in the cropping intensities. For the states of Gujarat and Jammu & Kashmir, although there was a positive change in irrigation intensity, the change in

cropping intensity was negative. This suggests that these states made investments in bringing more land under irrigation, but have failed in properly utilising their irrigated areas for cultivation. In states like Karnataka and Tamil Nadu, the situation is worse as the net addition to irrigated areas has declined which subsequently resulted in negative or no growth in cropping intensity.

TABLE 5. CROPPING AND IRRIGATION INTENSITY

(per cent)

States	Cropping intensity (GSA/NSA)		Change in cropping intensity	Irrigation intensity (GIA/NIA)		Change in irrigation intensity
	1992-93	2005-06		1992-93	2005-06	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Andhra Pradesh	121.86	124.36	2.05	126.21	131.56	4.24
Bihar	130.63	132.90	1.74	120.81	139.12	15.16
Gujarat	114.82	114.74	-0.07	122.14	126.68	3.72
Haryana	168.45	182.39	8.28	170.17	185.49	9.00
Himachal Pradesh	169.81	173.75	2.31	175.76	168.57	-4.09
Jammu & Kashmir	147.12	144.95	-1.47	140.51	145.98	3.89
Karnataka	115.05	123.96	-7.74	127.71	122.29	-4.24
Kerala	135.42	140.06	3.43	112.24	114.71	-2.20
Madhya Pradesh	121.82	130.97	7.43	102.99	103.47	0.47
Maharashtra	117.49	129.09	9.87	121.72	112.59	-8.11
Orissa	149.37	151.87	1.67	119.37	145.56	21.94
Punjab	182.46	190.55	4.43	184.98	193.51	4.61
Rajasthan	121.72	128.88	5.88	122.70	124.21	1.23
Tamil Nadu	121.57	115.05	-5.36	125.46	116.34	-7.27
Uttar Pradesh	148.75	150.48	1.16	141.28	139.24	-0.01
West Bengal	155.44	180.04	19.04	130.35	174.90	34.18
North East	141.37	128.00	-9.46	104.42	127.27	21.88
India	130.46	136.45	-4.59	132.73	137.34	3.47

Under-utilisation of Land

Other fallows and culturable wastes are considered to be under-utilised lands as these lands are potentially cultivable though not being put to cultivation for one year or more in succession.[3] Culturable wastes have mostly declined or remained constant in most states. Other fallows, on the other hand present a mixed picture. Though at the national level it has shown an increasing trend, in several states the growth has been negative.

Factors Influencing Regional Variations in Under-Utilisation of Land

The linear regression results – based on cross section data of states in 2005-06 - on factors affecting other fallows and culturable wastes are presented in Table 6. The nature of relationship of the estimated regression coefficients of all the explanatory variables are consistent with the hypotheses mentioned earlier. As per the goodness of fit indicators, the model related to culturable wastes was more satisfactory than the

estimated equations for other fallows. However, in the estimated equation for cultivable wastes, out of four, only two variables, viz., proportion of land holdings of more than 4 hectares and leased-in area as a proportion of land owned, emerged significant. The four variables explained 59.9 per cent variation in area under culturable wastes.

TABLE 6. REGRESSION RESULTS ON STATE-WISE VARIATIONS IN FALLOWS AND CULTIVABLE WASTES (2005-06)

Variables (1)	Other Fallows (2)	Cultivable wastes (3)
Intercept	0.018	0.010
	(0.028)	(0.021)
Prop. of land operated by more than 4 ha. holdings	0.026	0.129**
	(0.51)	(0.038)
Leased-in area as prop. of land owned	-0.159	-0.282***
	(0.233)	(0.137)
Prop. of area under irrigation	0.014	-0.028
	(0.052)	(0.039)
Rural Infrastructural index	0.0001	0.0001
	(0.0001)	(0.0001)
R^2	0.065	0.599

** and *** Significant at 1 and 2 per cent level of significance.
Figures in parentheses are 't' values.
# indicates highly non-significant value of regression coefficient.

Thus, the results suggest that farmers with large landholdings tend to leave some portion of their land uncultivated, which ultimately, move to the culturable waste category. The negative effect of leased-in area on culturable wastes, underscores the importance of formal tenancy in fuller utilisation of land. Thus, it seems that there is a strong case for revisiting tenancy reforms to ensure fuller utilisation of agricultural land. Further, there is a consensus emerging in the economic literature that land rental markets can play a significant positive role in increasing land access to the poor thus reducing the vulnerability of poor households by offering a more stable livelihood source than frequently volatile and imperfect labour markets (Hanstad *et al.*, 2008). Thus, from both the perspectives of better utilisation of land as well as provision of livelihood options to the rural poor, there is a need for promoting the formal tenancy rental markets.

IV

CONCLUSION

The overall picture regarding land use patterns in India constitutes divergent situations in regard to land use patterns across different states. There is a high degree of concentration of major land use classes in a few states. For instance, the area under the forests are mostly concentrated in the hilly states and also in states having a large number of tribal districts. Under-utilisation of land in the form of culturable wastes is

mostly concentrated in Gujarat and Rajasthan and other fallows in Tamil Nadu, Rajasthan and Bihar. The high level of under-utilisation of land in these states, particularly in Rajasthan might be due to low rainfall and limited availability of surface water irrigation. Net cultivated area as expected is concentrated in the agriculturally developed states of West Bengal, Uttar Pradesh, Haryana and Punjab.

However, one pattern that was consistent across all the states is the increasing trend in land under non-agricultural use. With increasing urbanisation and industrialisation, this trend is inevitable. The results suggest that in many states this land shift to the non-agricultural sector is occurring largely from the desirable sub-ecological sector. In few states, the land shifts are occurring from all other sectors to the non-agricultural sectors. The depletion in the desirable part of the ecological sector has occurred through a decline in forest cover in some states and also a decline in area under miscellaneous trees and groves in others, thus adversely affecting the local village ecology. This definitely calls for policy debate on how best to balance urbanisation and industrial expansion keeping in mind the state of technology, limited natural resource base and ecological considerations. It is imperative to formulate a long-term plan on the type of land to be assigned for urbanisation and industrialisation in various regions of the country. This also leads to the idea of forming a Special Agricultural Zones (SAZ) to protect the diversion of agricultural land to non-agricultural uses.

Budgeting of land use changes within the agricultural sector also throws up some interesting findings. At the country level, it seems that reclamation and development of culturable wastes is adding to the cultivated area, on the one hand, and the addition to fallow land is depleting the cultivated area, on the other hand, thereby nullifying the efforts going behind wasteland reclamation and development. On the whole, there is a slight downward pressure on net sown area, which could intensify if more and more agricultural land is used for non-agricultural purposes.

The analysis on the aspects of agricultural land use in terms of intensive and extensive cultivation revealed that some states having brought more land under irrigation have failed to bring the increased irrigated agricultural lands under intensive cultivation, thereby nullifying the huge investments made in irrigation development. Only the states of Haryana, West Bengal, Punjab and Maharashtra have been successful in properly utilizing their irrigated areas. Although at an all-India level, the tendency of extensive cultivation has petered out, there are indications towards the probable presence of tendency of extensive cultivation in some states, viz., Bihar, Gujarat, Jammu & Kashmir, Uttar Pradesh and the north east, which needs to be checked.

Culturable wastes increased with an increase in the area under large landholdings and decreased with increase in the proportion of leased-in land. Both these findings underline the need for revisiting tenancy laws so as to have beneficial effects on the livelihood options for the rural poor and landowners alike. The findings also underline the need for the deepening and widening of insurance cover to farming in

high risk areas for reducing other fallows. A more reliable data base, using modern remote sensing techniques, GPS, GIS and computerisation of land records calls for a more rigorous analysis of culturable wastes and other fallows in region specific situations.

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NOTES

1. The analysis was carried out for 16 major states of India. In addition, 8 states of the north-eastern region of the country were clubbed into one state group, the north east, on account of their similarity in topographic, climatic and socio-economic factors. The states of Bihar, Uttar Pradesh and Madhya Pradesh were bifurcated in 2000-01. However, for the sake of uniformity in comparison over time, the analyses have been carried out for the unified states.

2. Exponential regression model used is of the form $Y = at^b$

Where, Y = area under a land use category in time t

a and b are parameters to be estimated

Annual compound growth rate (ACGR) = $e^b - 1$

Annual rate of change (ARC) = dY/dt

3. Other fallows and cultivable wastes: Other fallows are fallows for the past one to five years and cultivable wastes are lands not cultivated for more than five years in succession. Cultivable wastes can only be brought back into NSA after development and reclamation.

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