

An analysis of land use dynamics and its determinant factors in

West Bengal, India

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Abstract

Land and water these two natural resources are the important for any development activity. So, its proper utilization is the serious matter of concern there for to understand the present land use pattern and its changes is critical for future generations. West Bengal is a heartland state in eastern India, with only 2.70 per cent of India total land area which supports 7.55 per cent of human in India. This paper attempts to analyse land use dynamics in West Bengal, the study was mostly based on the secondary data on land use pattern for nine fold classification were collected for the period from 2000-01 to 2010-11 for all the districts of West Bengal. The present study finds that the highly decline trends has been observed in forest and net sown area, on the other hand non-agricultural and current fallow land have shown increasing trends are likely to have serious implication of land use. Similarly, the factor analysis result shows that population and road length growth rate are also associated with non-agricultural land use changes. This indicates that increases population and road length results in increasing non-agricultural land. The paper has emphasized for the scientific, conservation and development of land resources in the state.

Key words: trends of land use, land use pattern, land use dynamics, factors of land use changes.

Introduction:-

Land and water these two natural resources are the important for any development activity. Like any other resources land uses are the important and finite natural resources of the earth, which most of resources and economic activities of individuals or society are connected with. So, its proper utilization is the serious matter of concern there for to understand the present land use pattern and its changes is critical for future generations. The technological advantage in land resources has fulfil the

ever-increasing demand for food production, livelihood on the one hand and another the demand for land for non-agricultural land use purposes create serious challenge to the researchers and policy makers.

Indian agriculture is a prelude to economic development and a pre-requisite for poverty alleviation and overall economic development (Ravallion and Dutta, 1996; Singh and Baleka, 1999; Anonymous, 2007). 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).

West Bengal, with only 2.70 per cent of India total land area which supports 7.55 per cent of human in India. West Bengal is the large agricultural dependent state and its prime source of livelihood for the rural. In this regard the competition between forest, agricultural and non-agricultural land intensifying due to increasing pressure on land for food production, housing and infrastructure development. The study shows that the share of net sown area in the state of West Bengal has declined from 62.36 to 57.36 per cent between 2000-01 and 2010-11. West Bengal has shown a considerable shift under different land-use classes during the study periods.

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. Land use is a highly dynamic process in West Bengal. There are wide variation in the distribution, utilization and dynamics of land resources among the different districts of the state, depend on topographic, geographical and human factors.

So with this background, the studies try to investigate the dynamics of land use pattern in West Bengal with the following objective: i. to analyse the general land use pattern in West Bengal, ii. to study the land use dynamics in West Bengal and iii. to finds the factors of land use dynamics in West Bengal.

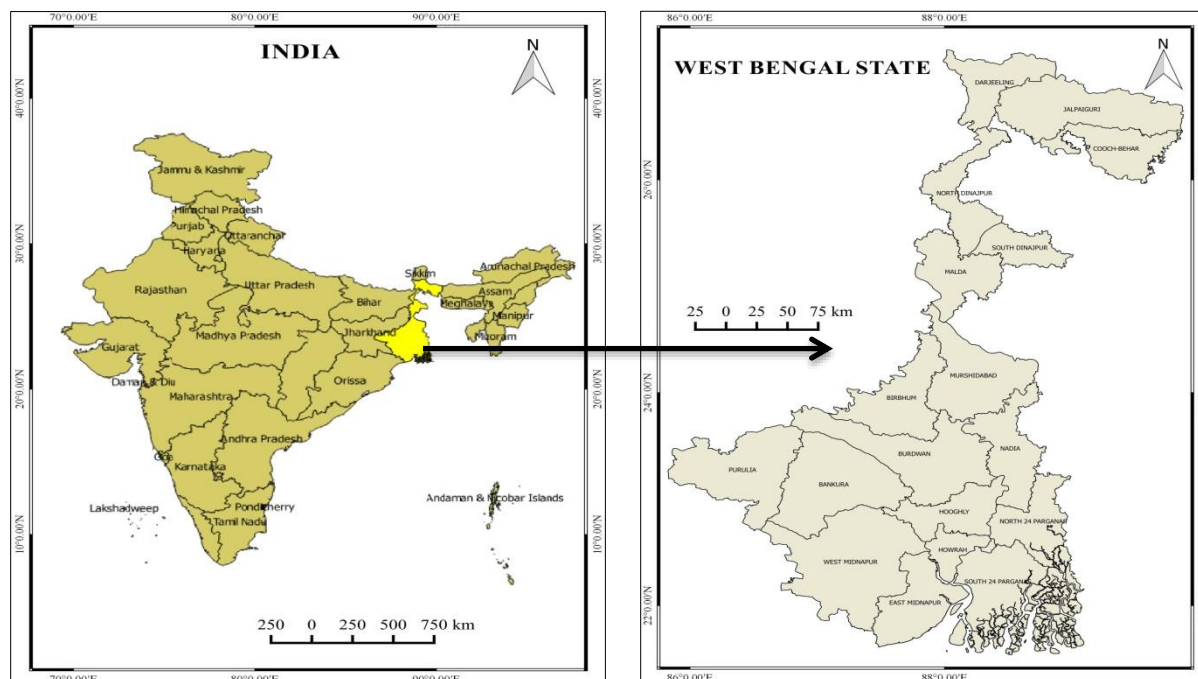
Methodology:-

The study mainly based on secondary sources data on land use pattern for nine fold classification collected over the districts of West Bengal for the period of 2000-01 to 2010- 11 from the Department of Land and Land Reforms, Government of West Bengal. A simple statistical and cartographic technique was done to finds the land use pattern and dynamics of land use in different districts in West Bengal. In order to finds the factors that influence of land use pattern in West

Bengal using multiple linear regression model.

Study Area:-

West Bengal is a heartland state in eastern India, stretching from the Himalayas in the north to the Bay of Bengal in the south. It lies between 85 degree 50 minutes and 89 degree 50 minutes east longitude, and 21 degrees 25 minutes and 27 degrees 13 minutes north latitude. It is India's fourth-most populated state. The state contributes 7.8 per cent population in India. There are 23 districts and 5 divisions at present in West Bengal. West Bengal's climate varies from tropical savannah in the southern portions to humid subtropical in the north. The main seasons are summer, rainy season, a short autumn, and winter.



Results and Discussion

Trends in Different Land-use Classes in West Bengal:-

The first part of my study to find the trends in different land-use classes in West Bengal, percentage share and growth rate of changes are presented in this Table 1. The table shows that in West Bengal total land cover at about 86 lakh hectares. The area under forest has decreased at 16767 hectares (growth rate of about -1.41 per cent), from 119 thousand hectares in 2000-01 to 117

thousand hectares in 2010-11. This decline could be an effect on deforestation and its create gap between deforestation and afforestation.

TABLE 1. TRENDS IN DIFFERENT LAND-USE CLASSES IN WEST BENGAL

District Name	Area (hectares)		Growth Rate of Change
	2000	2010	
Total Reporting Area	8687707	8684113	-3594 -0.04
Area Under Forest	1190436 13.70	1173669 13.52	-16767 -1.41
Area Under Non Agricultural Uses	1567364 18.04	1822844 20.99	255480 16.30
Barren And Unculturable Land	26862 0.31	17126 0.20	-9736 -36.24
Permanent Pastures Lands	4283 0.05	4844 0.06	561 13.10
Land Under Mics. Trees & Groves	57044 0.66	53213 0.61	-3831 -6.72
Culturable Wasteland	37141 0.43	28751 0.33	-8390 -22.59
Fallow Lands Other Than Current Fallows	28835 0.33	18200 0.21	-10635 -36.88
Current Fallows	358360 4.12	584244 6.73	225884 63.03
Net Area Sown	5417382 62.36	4981222 57.36	-436160 -8.05

Note: In area bold indicates percentage share

In changes bold indicate growth rate of changes in percentage

The area under non-agricultural is another important land uses which has shown a substantial increase in trends, from 157 thousand hectares in 2000-01 to 182 thousand hectares in 2010-11. It increases 255480 hectares (growth rate of about 16.30 per cent) during the study periods in the area under non-agricultural land uses. The area under non-agricultural land uses increase because for the urbanization and infrastructural development which is happening in this state.

It is evident from the Table that during the study periods area under barren land in the state of West Bengal has decreased by about 9736 hectares (growth rate of about 36.24 per cent), from 26862 hectares in 2000-01 to 17126 hectares in 2010-11, while permanent pasture land area has increased by about 561 hectares over the years due to increasing demand for grasses and fodder for livestock. In the area under miscellaneous trees & crops share a very low area of total reporting area, this land use has also shown declined trends at about 3831 hectares (growth rate of about 6.72 per cent) during the study periods. This decline might be due to a shift of this land towards non-agricultural uses or pasture lands. These land support mostly local village economy, thus these land-

use classes need to check.

The culturable wasteland and other fallow land have shown a decline of over 8390 hectares (growth rate of about 22.59 per cent) and 10635 hectares (growth rate of about 36.88 per cent) respectively from 2000-01 to 2010-11. The decreases in these land use due to increases in area under non-agricultural land.

The net sown area is another important land use; it shares at about 57.36 per cent of the total reporting area during the period of 2010-11. It showed decline trends by about 436160 hectares (growth rate of 8.05 per cent), from 541 thousand hectares in 2000-01 to 498 thousand hectares in 2010-11, while current fallows land has shown increasing trends. The share of current fallows has increased by about 225884 hectares (growth rate of 63.03 per cent), from 35 thousand hectares in 2000-01 to 58 thousand hectares in 2010-11 in the state of West Bengal. The net sown area has shown a decline because of increase in area under current fallow land during the study periods in the state of West Bengal.

Pattern of land Use in West Bengal:-

After explaining the general land use pattern of West Bengal, now I will try to show a glimpse of districts wise land use pattern in the state. Here it is found that area under forest, net sown area and non-agricultural land is quit contributing significant share among all the land uses classes in West Bengal. These three lands contribute near about 92 per cent of the total reporting area during the periods of 2010-11 in West Bengal. The district-wise distribution of different categories of land use at two time periods 2000-01 and 2010-11 are presented in Table 2.

The table shows that the district wise disaggregated analysis reveals that the area under forest as a percentage of total reporting area is highest in South 24 Parganas (44.93 per cent) followed by Darjeeling (38.28 per cent), Jalpaiguri (28.75 per cent), Bankura (21.65 per cent) and West Midnapur (18.52 per cent) districts in West Bengal state. In Bankura, Cooch-Bihar and West Midnapur districts, the share of land area under forest have increased since 2000-01. The districts having the lowest forest cover are Murshidabad, Hooghly, North Dinajpur, East Midnapur, Nadia, South Dinajpur and Malda share less than one per cent of the total reporting area. In Purulia, Burdwan, East Midnapur, Birbhum and Hooghly districts have shown decline trends during the study periods.

Non-agricultural is another important land uses in West Bengal, the districts of West Bengal, Howrah (38.30 per cent), North 24 Parganas (32.28 per cent), Hooghly (30.80 per cent), Burdwan (30.28 per cent) and East Midnapur (25.78 per cent) have a very large proportion of total

TABLE 2. AREA UNDER VARIOUS LAND USE CLASSES IN WEST BENGAL (2001 and 2011) (in hectare)

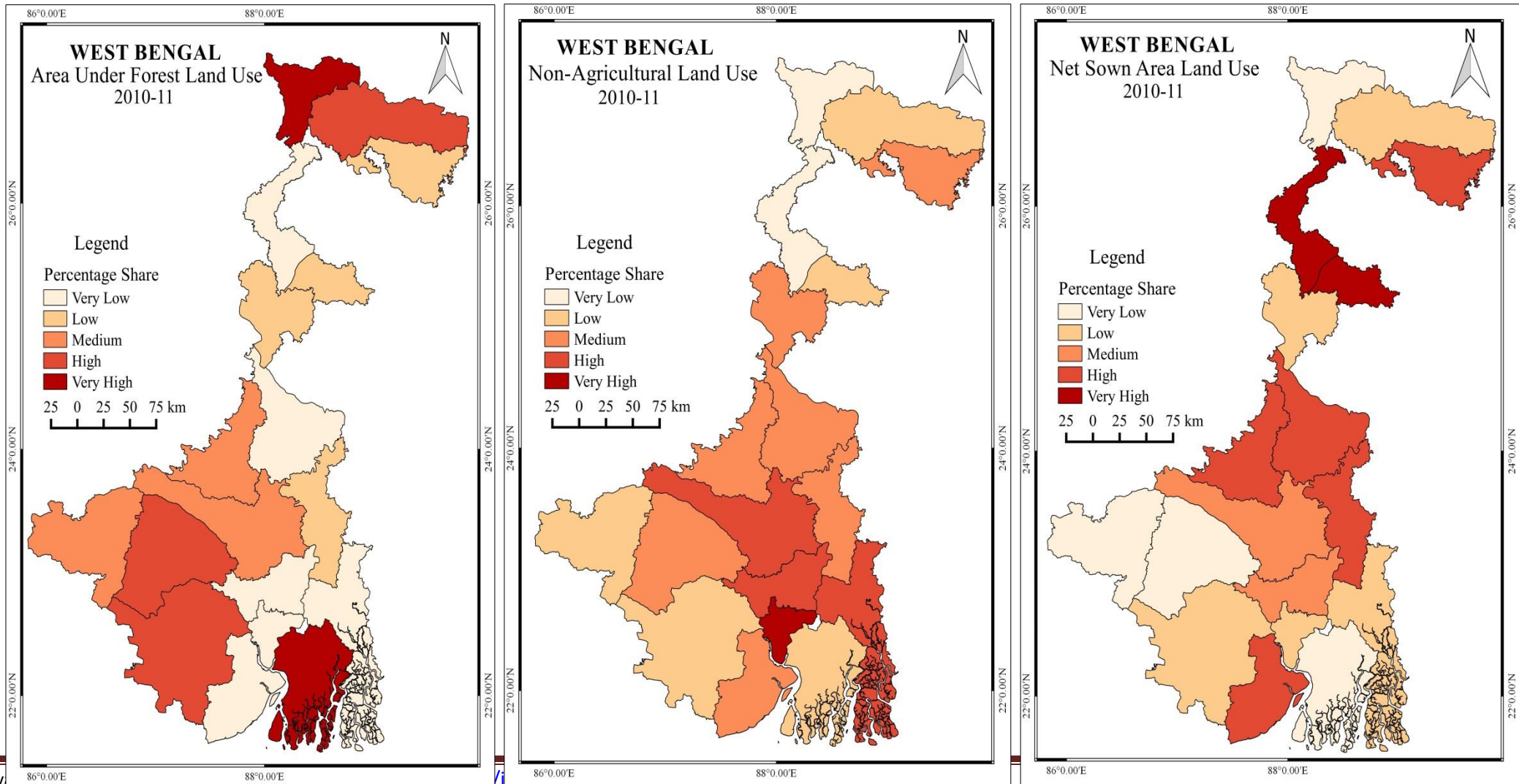
District Name	Total Reporting Area		Forests		Non Agricultural Land Uses		Barren And Unculturable Land		Permanent Pasture Lands	
	2000-01	2010-11	2000-01	2010-11	2000-01	2010-11	2000-01	2010-11	2000-01	2010-11
24 Parganas (North)	380330	386524	--	--	101737	124782	--	--	--	--
			--	--	26.75	32.28	--	--	--	--
24 Parganas (South)	966172	948710	426300	426300	136695	143323	1168	70	6	23
			44.12	44.93	14.15	15.11	0.12	0.01	0.00	0.00
Bankura	688103	687998	148351	148930	121714	148482	1561	1424	657	775
			21.56	21.65	17.69	21.58	0.23	0.21	0.10	0.11
Birbhum	451116	451118	16030	15853	81844	101191	1736	281	723	171
			3.55	3.51	18.14	22.43	0.38	0.06	0.16	0.04
Burdwan	698453	698762	28781	21165	167495	211565	1265	858	181	261
			4.12	3.03	23.98	30.28	0.18	0.12	0.03	0.04
Cooch-Behar	331376	331565	3151	4256	50329	69431	280	263	33	8
			0.95	1.28	15.19	20.94	0.08	0.08	0.01	0.00
Darjeeling	325469	325469	124574	124575	41174	40527	4683	2465	1169	830
			38.28	38.28	12.65	12.45	1.44	0.76	0.36	0.26
Dinajpur (North)	312467	312466	579	580	30892	33426	121	267	70	129
			0.19	0.19	9.89	10.70	0.04	0.09	0.02	0.04
Dinajpur (South)	221908	221909	932	932	28332	34171	48	10	--	--
			0.42	0.42	12.77	15.40	0.02	0.00	--	--
Hooghly	312224	313379	649	530	74603	96526	241	89	34	8
			0.21	0.17	23.89	30.80	0.08	0.03	0.01	0.00
Howrah	136015	138676	--	--	41905	53115	66	--	94	--
			--	--	30.81	38.30	0.05	--	0.07	--
Jalpaiguri	622700	622700	179000	179000	93661	90669	3323	2989	7	--
			28.75	28.75	15.04	14.56	0.53	0.48	0.00	--
Malda	371048	370862	1675	1679	84818	90112	3	--	--	--
			0.45	0.45	22.86	24.30	0.00	--	--	--
Midnapur (East)	490744	396594	1220	899	104105	102236	644	689	104	180
			0.25	0.23	21.21	25.78	0.13	0.17	0.02	0.05
Midnapur (West)	833136	928581	169607	171935	134481	156588	2103	2480	780	581
			20.36	18.52	16.14	16.86	0.25	0.27	0.09	0.06

Murshidabad	532501	532499	771	771	114240	130761	1834	1984	84	7
			0.14	0.14	21.45	24.56	0.34	0.37	0.02	0.00
Nadia	390657	390655	1216	1216	75933	90220	608	54	98	64
			0.31	0.31	19.44	23.09	0.16	0.01	0.03	0.02
Purulia	623288	625646	87600	75048	83406	105719	7178	3203	243	1807
			14.05	12.00	13.38	16.90	1.15	0.51	0.04	0.29
State Total	8687707	8684113	1190436	1173669	1567364	1822844	26862	17126	4283	4844
			13.70	13.52	18.04	20.99	0.31	0.20	0.05	0.06
District Name	Mics. Trees & Groves		Culturable Wasteland		Other Fallow Lands		Current Fallows		Net Area Sown	
	2000-01	2010-11	2000-01	2010-11	2000-01	2010-11	2000-01	2010-11	2000-01	2010-11
24 Parganas (North)	4349	4817	--	--	--	--	14379	33908	259865	223017
	1.14	1.25	--	--	--	--	3.78	8.77	68.33	57.70
24 Parganas (South)	2815	2557	1562	1344	145	7	19187	16685	378294	358401
	0.29	0.27	0.16	0.14	0.02	0.01	1.99	1.76	39.15	37.78
Bankura	581	1435	6675	2130	2351	1970	62144	118763	344069	264089
	0.08	0.21	0.97	0.31	0.34	2.86	9.03	17.26	50.00	38.39
Birbhum	784	824	3369	2815	2567	2696	6538	7331	337525	319956
	0.17	0.18	0.75	0.62	0.57	5.98	1.45	1.63	74.82	70.93
Burdwan	632	1986	7530	4876	5308	1237	9772	4352	477489	452462
	0.09	0.28	1.08	0.70	0.76	1.77	1.40	0.62	68.36	64.75
Cooch-Behar	6085	5800	753	286	186	55	5635	855	264924	250611
	1.84	1.75	0.23	0.09	0.06	0.17	1.70	0.26	79.95	75.58
Darjeeling	2500	2350	1676	1487	4009	3216	8804	16437	136880	133582
	0.77	0.72	0.51	0.46	1.23	9.88	2.71	5.05	42.06	41.04
Dinajpur (Norht)	2490	1513	144	125	7	157	4755	1501	273409	274768
	0.80	0.48	0.05	0.04	0.00	0.50	1.52	0.48	87.50	87.94
Dinajpur (South)	580	1157	33	30	34	408	1487	1586	190462	183615
	0.26	0.52	0.01	0.01	0.02	1.84	0.67	0.71	85.83	82.74
Hooghly	2292	1588	2605	1518	487	119	768	594	230545	212407
	0.73	0.51	0.83	0.48	0.16	0.38	0.25	0.19	73.84	67.78
Howrah	1097	1461	261	54	641	153	4907	4480	87044	79413
	0.81	1.05	0.19	0.04	0.47	1.10	3.61	3.23	64.00	57.27
Jalpaiguri	6518	4992	236	102	248	104	3200	10717	336507	334127
	1.05	0.80	0.04	0.02	0.04	0.17	0.51	1.72	54.04	53.66

Malda	3085	3244	95	96	259	294	58200	57453	222913	217984
	0.83	0.87	0.03	0.03	0.07	0.79	15.69	15.49	60.08	58.78
Midnapur (East)	3409	2149	838	296	893	237	2457	1856	377074	288052
	0.69	0.54	0.17	0.07	0.18	0.60	0.50	0.50	76.84	72.63
Midnapur (West)	7713	10016	3294	3993	4192	2972	13798	93817	497168	486199
	0.93	1.08	0.40	0.43	0.50	3.20	1.66	10.10	59.67	52.36
Murshidabad	1188	1078	688	1367	92	240	20567	333	393037	395958
	0.22	0.20	0.13	0.23	0.02	0.45	3.86	0.06	73.81	74.36
Nadia	4686	3729	1001	631	93	113	8530	4181	298492	290447
	1.20	0.95	0.26	0.16	0.02	0.29	2.18	1.07	76.41	74.35
Purulia	6240	2517	6381	7601	7323	4222	113232	209395	311685	216134
	1.00	0.40	1.02	1.21	1.17	6.75	18.17	33.47	50.01	34.55
State Total	57044	53213	37141	28751	28835	18200	358360	584244	5417382	4981222
	0.66	0.61	0.43	0.33	0.33	0.21	4.12	6.73	62.36	57.36

Note: Figures in Bold indicate percentage to total reporting area
--no data available

FIGURE 1: DIFFERENT LAND USE PATTERN IN WEST BENGAL (2010-11)



reporting area lying under non-agricultural land uses; this indicates that these districts have a high rate of Urbanization and infrastructural development. The table shows that the share of land under non-agricultural land increases almost all the districts, the highest increases in Burdwan, Bankura, North 24 Parganas, Purulia and West Midnapur during 2000-01 to 2010-11. Districts like North Dinajpur (10.70 per cent), Darjeeling (12.45 per cent), Jalpaiguri (14.56 per cent), South 24 Parganas (15.11 per cent) and South Dinajpur (15.40 per cent) have relatively lesser area share of their total reporting area under non-agricultural land uses.

West Bengal is the large net sown area. Here the share of the net sown area is higher in most of the districts. Likewise the share of net sown is reported highest in North Dinajpur (87.94 per cent) followed by South Dinajpur (82.74 per cent), Cooch-Bihar (75.58 per cent), Murshidabad (74.36 per cent) and Nadia (74.35 per cent) districts, while in Purulia (34.55 per cent), South 24 Parganas (37.78 per cent), Bankura (38.39 per cent) and Darjeeling (41.04 per cent), net sown area constitute a comparatively smaller proportion of land area. But the concern is that there have been also shown decline trends in most of the districts during the periods, most noticeably changes in Purulia, East Midnapur, Bankura and North 24 Parganas districts due to ever-increasing developmental activities.

After discussing the major land use pattern of West Bengal, now I will try to examine pattern in the area under less area cover land uses during the study periods, trends in different land uses were computed and the result is presented in Table 1. It is evident from the table that barren land, pasture land, mics. trees, wasteland, other fallow and current fallow land are cover less area, while current fallow is the dominated among these land uses. Except for current fallow land, all the remaining land share less than one percent of the total reporting area during the study periods in the state of West Bengal. The barren and other fallow lands higher share in Darjeeling district, while pasture and Culturable wasteland have highly shared in Purulia districts and Cooch-Bihar district highly share by mics. trees among all the districts during the study periods. On the other hand, the districts of Purulia (33.47 per cent), Bankura (17.26 per cent), Malda (15.49 per cent) and West Midnapur (10.10 per cent) have a very large cover of total reporting area under current fallow land; this land constitutes a relatively larger area cover.

Land Use Dynamics in West Bengal:-

The substantial changes in land use pattern have taken place during the study periods, mainly driven by biophysical factor and human needs. In dynamics of land use section we discuss the changes in land use pattern for different districts during the study periods of 2000-01 to 2010-11.



The districts-wise estimation of growth rate of changes in various land use categories is presented in Table 3.

TABLE 3. DISTRICTS-WISE GROWTH RATES IN LAND USE CLASSES (2000-01 TO 2010-11)

District Name	Forests	Non Agricultural Land Uses	Barren Land	Pasture Lands	Mics. Trees & Groves	Culturable Wasteland	Other Fallo Lands
24 Parganas (North)	--	23045	--	--	468	--	--
	--	22.65	--	--	10.76	--	--
24 Parganas (South)	0	6628	-1098	17	-258	-218	-138
	0.00	4.85	-94.01	283.33	-9.17	-13.96	-95.17
Bankura	579	26768	-137	118	854	-4545	-381
	0.39	21.99	-8.78	17.96	146.99	-68.09	-16.21
Birbhum	-177	19347	-1455	-552	40	-554	129
	-1.10	23.64	-83.81	-76.35	5.10	-16.44	5.03
Burdwan	-7616	44070	-407	80	1354	-2654	-4071
	-26.46	26.31	-32.17	44.20	214.24	-35.25	-76.70
Cooch-Behar	1105	19102	-17	-25	-285	-467	-131
	35.07	37.95	-6.07	-75.76	-4.68	-62.02	-70.43
Darjeeling	1	-647	-2218	-339	-150	-189	-793
	0.00	-1.57	-47.36	-29.00	-6.00	-11.28	-19.78
Dinajpur (Norht)	1	2534	146	59	-977	-19	150
	0.17	8.20	120.66	84.29	-39.24	-13.19	2142.86
Dinajpur (South)	0	5839	-38	--	577	-3	374
	0.00	20.61	-79.17	--	99.48	-9.09	1100.00
Hooghly	-119	21923	-152	-26	-704	-1087	-368
	-18.34	29.39	-63.07	-76.47	-30.72	-41.73	-75.56
Howrah	--	11210	--	--	364	-207	-488
	--	26.75	--	--	33.18	-79.31	-76.13
Jalpaiguri	0	-2992	-334	--	-1526	-134	-144
	0.00	-3.19	-10.05	--	-23.41	-56.78	-58.06
Malda	4	5294	--	--	159	1	35
	0.24	6.24	--	--	5.15	1.05	13.51
Midnapur (East)	-321	-1869	45	76	-1260	-542	-656
	-26.31	-1.80	6.99	73.08	-36.96	-64.68	-73.46
Midnapur (West)	2328	22107	377	-199	2303	699	-1220
	1.37	16.44	17.93	-25.51	29.86	21.22	-29.10
Murshidabad	0	16521	150	-77	-110	679	148
	0.00	14.46	8.18	-91.67	-9.26	98.69	160.87
Nadia	0	14287	-554	-34	-957	-370	20
	0.00	18.82	-91.12	-34.69	-20.42	-36.96	21.51
Purulia	-12552	22313	-3975	1564	-3723	1220	-3101
	-14.33	26.75	-55.38	643.62	-59.66	19.12	-42.35
State Total	-16767	255480	-9736	561	-3831	-8390	-10635
	-1.41	16.30	-36.24	13.10	-6.72	-22.59	-36.88

Note: In figure Bold indicates growth rate in percentage

As is evident from the table 3, during the study periods, the highest increase in area under forests land in the West Midnapur 2328 hectares. Apart from that, the area under forest lands has increased in Cooch-Bihar, Bankura, Malda, Darjeeling and North Dinajpur districts. On the other hand the area under forest land declined in Purulia recorded highest declined (12552 hectares) followed by Burdwan, East Midnapur, Birbhum and Hooghly districts, while the districts of Jalpaiguri, South Dinajpur, South 24 Parganas, Nadia and Murshidabad have shown no changes during the study period in the state of West Bengal. The decline in barren land and increase in pasture land is desirable land use, at the same time, the decline in mics. tree is a matter of concern. The growth rate of changes in area under barren land highly increase in West Midnapur (377 hectares) and decline in Purulia (3975 hectares) districts, while in pasture land highly increase Purulia (1564 hectares) and decline in Birbhum (552 hectares) districts during the study periods. Similarly, an area under mics. trees have shown highly increase in West Midnapur (2303 hectares) and decline in Purulia (3723 hectares) districts. It can be seen that the land shift has taken place from mics. trees toward the pasture land in Purulia districts during the study periods in the state of West Bengal.

The loss of farm to other uses is an unavoidable phenomenon during economic development, population growth and urbanization periods (Tan et.al., 2009). The demand for non-agricultural land uses increases because of requirement of housing, infrastructural development and share of urban population rapidly increasing during the last decade. The district level analysis shows the same trends of land use changes in most of the districts (figure). The districts with high rate of increase to area under non-agricultural uses are Burdwan (44070 hectares), Bankura (26768 hectares), North 24 Parganas (23045 hectares), Purulia (22313 hectares), West Midnapur (22107 hectares) and Hooghly (21923 hectares). Even districts like Cooch-Bihar (19102), South Dinajpur (5839) and North Dinajpur (2534 hectares), which are agricultural dominated districts, also witnessed an increase in area under non-agricultural land uses. Among the other districts which witness an increase in area under non-agricultural uses are Birbhum, Murshidabad, Nadia, Howrah, South 24 Parganas and Malda during the study periods in the state of West Bengal. However, it is interesting to note that the districts of Jalpaiguri (2992 hectares), East Midnapur (1869 hectares) and Darjeeling (647 hectares) have shown decline trends in area under non-agricultural uses.

Net sown area plays a very important role in particularly rural villages, providing livelihood, food supply and inclusive economic development. West Bengal is one of the agricultural dominated

states in India. During the last decades growing population and increased demand for agricultural production, but the net sown area in the state has not increased during the study periods of 2000-01 to 2010-11. On the contrary, the net sown area has declined during the last decade. In case of net sown area, Murshidabad added by about 2921 hectares to net sown area while North Dinajpur increased net sown area nearly 1359 hectares during 2001-2011. Except these two districts remain all other districts have shown decline trends of net sown area during the study period. The highest loss in net sown area was recorded in Purulia (95551 hectares), followed by East Midnapur (89022 hectares), Bankura (79980 hectares), North 24 Parganas (36848 hectares), Burdwan (25027 hectares) and South 24 Parganas (19893 hectares).

Changes in other land use classes reveal that culturable wasteland and other fallow land have shown declined trends in the state of West Bengal, while the current fallow land have increased consistently. The decline of these two lands it indicates towards the beneficial effects on cultivated land. However, on the other hand increase in current fallow land- in the face of constant net sown area- indicate that the reclamation of waste land and other fallow lands is adding to the cultivated area, current fallow land is on the other hand, depleting the cultivated area, thereby nullifying the effort going behind wasteland and other fallows reclamation and development. The districts wise analysis reveals that culturable wasteland has declined in most of the districts, except Malda, Murshidabad, West Midnapur and Purulia which shown increase trends during the study period. In the districts where the wasteland have shown highest decline are Bankura, Burdwan, Hooghly and Birbhum. In case of other fallow land the districts of Burdwan, Purulia, West Midnapur, Darjeeling and East Midnapur have shown highest decline trends, while the districts of South Dinajpur, North Dinajpur, Murshidabad and Birbhum have shown increase trends during the study period in the state of West Bengal.

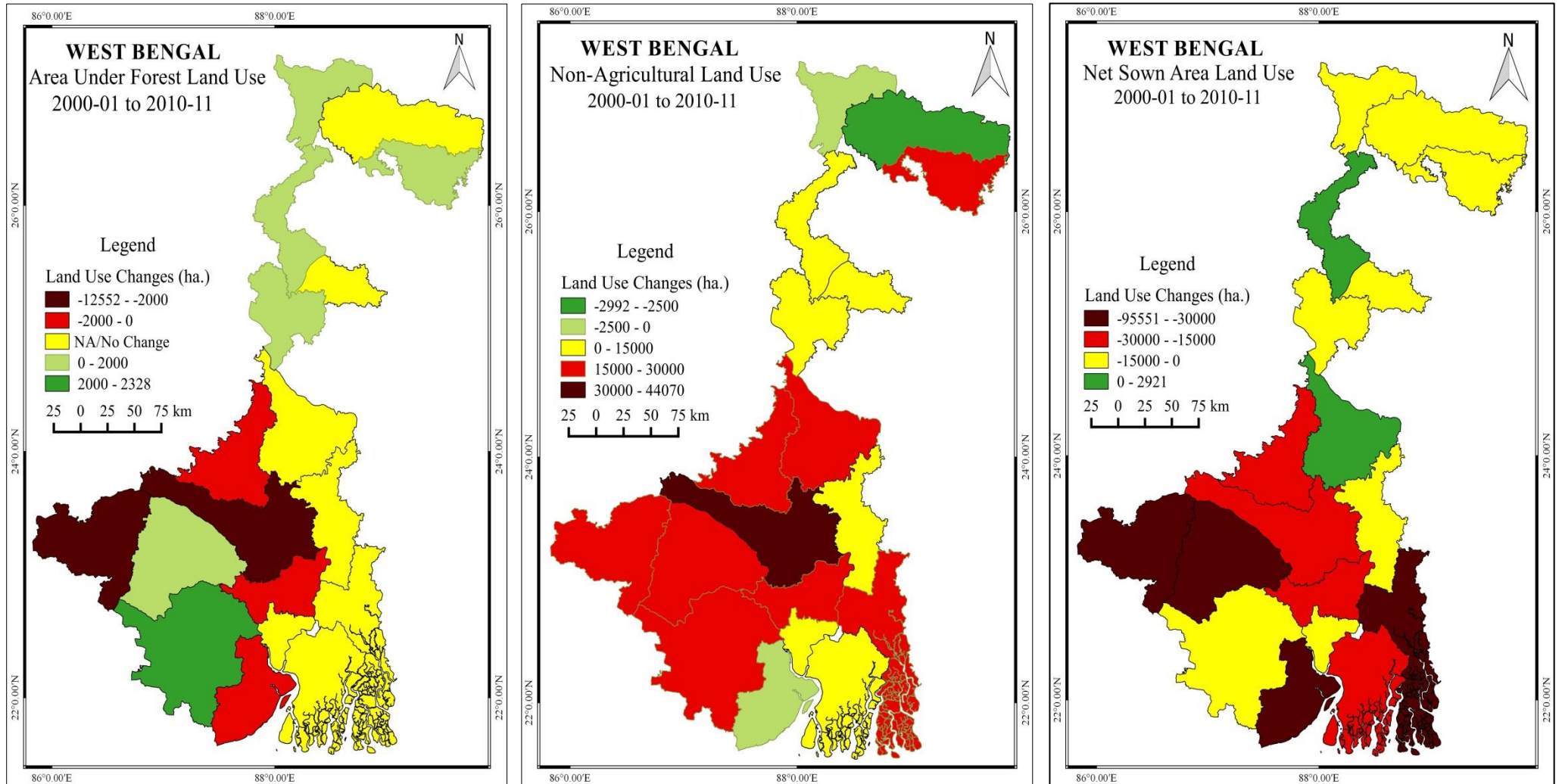
The increase in current fallows at state level, can mostly be attributed to increase in Purulia (96163 hectares) and West Midnapur (80019 hectares). Current fallows also increased in other districts, viz., Bankura, North 24 Parganas, Darjeeling, Jalpaiguri, Birbhum and South Dinajpur. Current fallows highest declined in the districts of Murshidabad, Burdwan, Cooch-Bihar, Nadia and North Dinajpur the rate of decline has been substantially low.

Disaggregated analysis at the districts level shows worst pictures in districts like Purulia, East Midnapur, Burdwan and Bankura. In all these districts there has been depletion in the favourable



land while unfavourable land has increased. In Murshidabad, North Dinajpur and Jalpaiguri, land shift have taken place from undesirable land use and thus this districts have shown favourable trends of land shift.

FIGURE 2: LAND USE DYNAMICS IN WEST BENGAL (2000-01 to 2010-11)





Factors Affecting of Land Use Changes:-

Table 4: Multiple Regression Results in Forest Land, Non-Agricultural land and Net Sown Area: Summary of Analysis

Independent Variables	Dependent Variable		
	Area Under Forest (Coefficients)	Net Sown Area (Coefficients)	Non-Agricultural Land (Coefficients)
Total Population Per Lakh	-2.341** (0.033)	-0.832** (0.043)	1.714** (0.021)
Rural Population (Lakh)	0.564 (0.067)	0.552* (0.035)	-0.267 (0.432)
Urban Population (Lakh)	-0.703** (0.017)	-0.962* (0.008)	0.592** (0.029)
Average Literacy Rate	-0.432 (0.571)	0.591** (0.019)	1.317** (0.036)
Total Road Length in Km	-0.281 (0.641)	-0.812* (0.003)	0.407** (0.041)
Net Irrigated Area	-1.204 (0.59)	0.512** (0.015)	0.214 (0.501)
Rainfall (mm)	0.689** (0.03)	0.453 (0.612)	-0.127 (0.763)
R Square	0.671	0.813	0.517
ANOVA (Sig ^a)	0.011	0.004	0.0007

Notes: * and **denote significance at 1 per cent and 5 per cent levels, respectively.

Figures within the parentheses indicate Sig^b

The study also tries to examine the factors of land use changes have also been calculated using a multiple linear regression model. Multiple linear regression model was fitted to find the factors of land use changes in area under forest, net sown area and non-agricultural land uses separately where total population, urban population, rural population, literacy rate, road length, net irrigated area and rainfall were selected as an independent variable.

The study finds that the regression models for each land use classes are statistically significant as in all land uses the ANOVA (F) is less than 0.05 (0.011 for area under forest, 0.004 for net sown area and 0.0007 for non-agricultural land). It is evident from the table that R^2 of area under forest was found to be 0.67, which indicated that the variable specified in the model could explain 67 per cent of the variation in the endogenous variables. Similarly, the net sown area and non-agricultural land R^2 of about 0.81 and 0.51 respectively, this indicated that 81 per cent and 51 per cent of the variation in net sown area and non-agricultural land respectively of the endogenous variable.

The finding indicates that the population addition was found to be responsible for decrease in the land use in forest area as well as net sown area. The coefficient of -2.341 in forest area and net sown area -0.832 makes the total population growth as strongest impact for this land use change. Similarly, it may be noted from the regression equation pertaining to forest area and net sown area that urban population has significant negative coefficient, while the non-agricultural land shown the positive determinant. It indicates that the districts with higher urban population exert more pressure to shift land toward non-agriculture use. Further it may be noted from the regression coefficient of net sown area (0.552) indicate that the increases in rural population had significantly contributed to the increase of net sown area.

The literacy level was found to be an important positive factor of net sown area as well as non-agricultural land. It indicates that educated farmer can put agriculture on scientific away and remain aware about possible benefits; on the other hand educated people can put non-agricultural land use for infrastructure development. The road construction that support rural road with urban centre and infrastructural development contributes to negative factor of agricultural land. The coefficient of road length was of expected sign (-0.812) and shows statistically significant. The increase road lengths contribute to the increase of non-agricultural land and have shown the statistically significant.

The coefficient of irrigation was negative impact on forest area but non-significant. It is well known fact that lands with better qualities and large size are more attractive for real estate development as it reduces cost of development (Firman, 1997). In net sown area the coefficient was positive and significant. These indicate that the irrigation is a critical input for multiple cropping. Rainfall also important determinant of land use changes. The regression analysis finds that the increase in the rainfall contributes to the positive impact of forest area. More rainfall assured water resource facilities while help to increase forest land.

Conclusions:-

The study finds that West Bengal is passing through a critical phase of land transformation. The area under forest is decreasing along with land under net sown area, there is the serious matter of concern. It may also note that forest land shifts towards the non-agricultural land where the net sown area switch towards the non-agricultural and current fallow land. The dynamics of land use pattern in the state over the last decade also reveals that there was a significant decline in the area under barren and wasteland while there was a highly increases in

the land put to non-agricultural uses. The most disturbing trend is the very high growth rate in non-agricultural lands in the districts such as Burdwan, Bankura, North 24 Parganas, Purulia and West Midnapu, with increasing population, urbanization, and infrastructural development this trend is inevitable.

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 and districts level trends in land use pattern reveals that the most important trend in land the state is the sharp increase also the districts of Purulia, West Midnapur and Bankura increase in area under current fallow land. The increasing trends in current fallow land took place due to instability in the irrigated area. Another reason could be the concentration of efforts and limited resources (credit, labour, etc.) on an irrigated portion of lands thus neglecting the unirrigated areas (Nadkarni and Deshpande, 1979).

Multiple regression analysis results showed that actual population, urban population and increase in road length is found to have a negative effect in the state are the main factors influencing conversion of prime forest and net sown area land. Therefore, land use policy and research should not only focus the demand for land from various land use classes but also manage the common lands to ensure rainwater harvesting, providing foods and security for rural poor to maintained land resources which are finite. Another important policy should be maintained land switch to non-agricultural use.

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