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Analysis of Land Use And Land Cover Changes Using Gis, Rs And Determination of Deforestation Factors Using Unsupervised Classification And Clustering

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Abstract: *This paper aims to find out the land use/land cover change detection between the year 1990 and 2010 and also the factors for deforestation in Erode District, TamilNadu, India. SOI toposheets and satellite images Landsat TM and IRS LISS III satellite imageries were used to to identify the land use/land cover categories and the factors for deforestation through Remote Sensing and GIS approach ArcGIS 10.1 software were used to categorize the land use/land cover divisions . Remote Sensing and GIS provide dependable and accurate information than the traditional methods employed for such tasks. The thematic features of the area consisting of forest, crop land, industry, built-up land, road and waste land. Many change detection techniques were used. This paper summarizes and shows the results by using classification and clustering techniques.*
Keywords: *SOI, Land use and Land Cover change, Remote Sensing , GIS and TM.*

I. Introduction

Land use / land cover is dynamic in nature and requires regular monitoring to understand areas of rapid change. some of the most important human alteration affecting the surface of the earth . Changes in land cover through cropping, forestry and urbanization represent the most substantial alternative through their interaction with most components of global environmental changes.GIS can be used for raster data manipulated and analysis. Remotely sensed data can be manipulated to derive GIS data; and GIS data can be used to guide image analysis to extract more complete and accurate information from spectral data. It can be used commonly in the areas of spatial analysis, landscape conceptualization and map validation.

II. Objective

The objective of this paper is to study and estimate the changes in the land area and forest area and to evaluate the importance of different factors by using classification and clustering techniques.

III. Data Used

Landsat TM 1990 and Landsat TM+ 2000 and IRS LISS III 2010 satellite imageries were used. Study area covered by 11 Toposheets and they are 58E/09,58A/14, 58E/03,58E/02, 58E/06, 58E/07, 58E/08,58E/10, 58E/11, 58E/12 and 58E/16

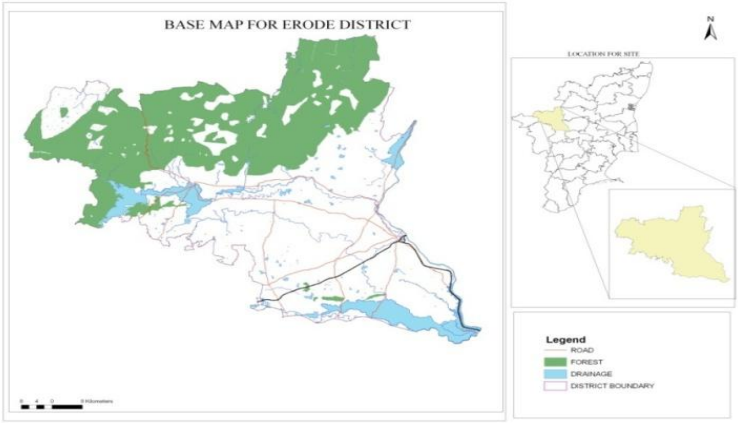
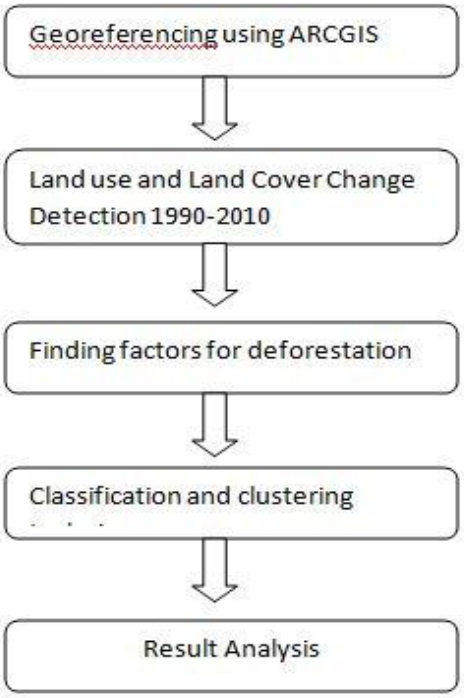


Figure 1: Base Map of Erode District

IV. Methodology



V. Land Use And Land Cover Change Detection (1990-2010)

The land use and land cover change detections from 1990 to 2010 imitate that changes especially in the crop land has increased to 10.98% and plantation crop has decreased to -21.28%. Cultivation practices has increased mainly due to human population growth who exerted in agriculture actives for their survival. Built-up land has increased to 35.55% due to high growth rate of human population. It was observed that the -64.99% of Evergreen forest and Deciduous forest to 30.03% has increased in the reserved forest and open scrub has increased to -36.62. It was found that the 97.40% affected the useful land. Spatial distribution of land use and land change detection between 1990 and 2010 was furnished in Figure 2.

S.No	LEVEL I	LEVEL11	LULC 1990	LULC 2010	Difference	Area in Percentage
1	Built up	Urban Built Up	4438.83	6887.72	1923.3	35.55
		Rural Built Up	14966.7	15966.7	1000	6.26
		Industry	404.89	2055.16	800.78	80.3
2	Agriculture	Crop Land	169801	190751.88	33235	10.98
		Fallow Land	24734	16576.01	0	-49.22
		Plantation	111119	91621.96	-57576.8	-21.28
3	Forest	Evergreen forest	116506.79	70613.66	-43393.13	-64.99
		Deciduous forest	71896.99	102753.07	37075.98	30.03
		Forest Plantation	116.45	114.26	0	-1.92
		Degraded Forest	38245.46	53282.5	6317.14	28.22
4	Grazing land	Grazing land	5849.36	3509.23	954.07	-66.68
5	Waste land	Dense scrub	12561.8	9673.72	0	-29.85
		Open scrub	15589.5	24498.95	-4929.6	36.37
		Barren rocky	1103.28	1103.28	0	0
		Salinity	199.11	260.08	60.97	23.44
6	water body	Tank/Reservoir	8708.61	8805.63	0	1.1
		River/ Stream	5909.67	5109.67	-800	-15.66

Figure 2: Land Use and Land Change Detection between 1990 and 2010

VI. Decision Tree Classifier

This method is one of the best method to classify the instances according to the attributes defined. Here 405 instances and 5 attributes were used. The following table shows that the correlation coefficient for the year 1990 is decreased to zero. But after two decades it is increased to 2%.But the Mean, Root Mean, Absolute error were gradually increased than the year 2010.

YEAR	1990	2000	2010
Correlation coefficient	0.2775	0	0.1831
Mean absolute error	319.9175	333.2121	328.1825
Root mean squared error	456.9369	475.6215	467.5804
Relative absolute error	96.01%	100%	98.49%
Root relative squared error	96.07%	100%	98.31%

TABLE 1 RESULT FOR THE YEARS 1990,2000 and 2010

VII. Em Cluster

The Expectation Maximum clustering is used to generate the best hypothesis for the distributional parameters from 405 instances and 5 attributes. The below tables show the results for two decades.

7.1 Built Up And Crop Land

Table 2 and 5 shows that built up area in Erode district is increased to 77% and in 2000 and decreased to 52% in 2010.Thus the population is increased and the agricultural land has been destroyed for the two decades

1990	2000	2010	2000-1990	2010-2000	1990	2000	2010	2000-1990	2010-2000
60.2408	121.4567	165.7666	61.2159	44.3099	191.133	439.9131	570.9838	248.7801	131.0707
32.6918	34.7866	41.3546	2.0948	6.568	54.5426	70.5562	70.3089	16.0136	-0.2473
83.8414	97.6762	99.657	13.8348	1.9808	260.3409	374.0433	409.55	113.7024	35.5067
176.774	253.9195	306.7782	77.1455	52.8587	506.0165	884.5126	1050.8427	378.4961	166.3301

TABLE 2 :MEAN &STD DEVIATION FOR BUILT UP AREA -1990,2000,2010

1990	2000	2010	2000-1990	2010-2000	1990	2000	2010	2000-1990	2010-2000
14929.547	15263.163	2884.4241	333.6162	-12378.739	16627.3624	19292.6701	3839.897	2665.3077	-15452.773
37745.848	4797.644	32245.498	-32948.204	27447.8541	12496.2499	9654.2894	16066.1028	-2841.9605	6411.8134
999.7068	17295.528	12566.87	16295.8207	-4728.6575	1638.3474	17908.9863	12764.5224	16270.6389	-5144.4639
53675.101	37356.334	47696.792	-16318.767	10340.4578	30761.9597	46855.9458	32670.5222	16093.9861	-14185.424

TABLE 5 :MEAN & STD DEVIATION FOR CROP LAND -1990,2000,2010

7.2 Forest And Industry

Table 3 and 4 predict that the forest area in Erode district was dramatically destroyed to more than 100%.The industry is increased during 2000 and due to advancement of the technology it is decreased during the next one decade.

1990	2000	2010	2000-1990	2010-2000	1990	2000	2010	2000-1990	2010-2000
209159.77	208726.19	29127.352	-433.5803	-179598.84	6611.9969	8282.992	72029.1198	1670.9951	63746.1278
34.8728	801.6759	20141.089	766.8031	19339.4131	127.8625	1328.4768	61842.4258	1200.6143	60513.949
228.7748	118.6587	0	-110.1161	-118.6587	851.9663	0.0006	0	-851.9657	-0.0006
209423.42	209646.53	49268.441	223.1067	-160378.08	7591.8257	9611.4694	133871.546	2019.6437	124260.076

TABLE 3 :MEAN &STD DEVIATION FOR FOREST AREA -1990,2000,2010

1990	2000	2010	2000-1990	2010-2000	1990	2000	2010	2000-1990	2010-2000
0.2258	3.7486	0.237	3.5228	-3.5116	1.0831	10.9447	1.3344	9.8616	-9.6103
2.7905	11.3285	13.2012	8.538	1.8727	11.3178	18.4446	52.2682	7.1268	33.8236
0	0.6045	0.7267	0.6045	0.1222	0.0007	1.9744	2.5221	1.9737	0.5477
3.0163	15.6816	14.1649	12.6653	-1.5167	12.4016	31.3637	56.1247	18.9621	24.761

TABLE 4 :MEAN& STD DEVIATION FOR INDUSTRY -1990,2000,2010

VIII. Results And Discussion

The land use categories such as crop land ,built up land, road ,industry and other waste lands have been identified and mapped from the Land sat TM and IRS LISS III of 1990,2000 and 2010. bout 35% areas are occupied by built up land during the past two decades (1990-2010). People utilize the land for agricultural purposes. The area occupied by the agriculture is decreased to 49% . This is due to shifting of agricultural land to built up and other land. Figure 3, 4 and 5 shows the changes in land use pattern.

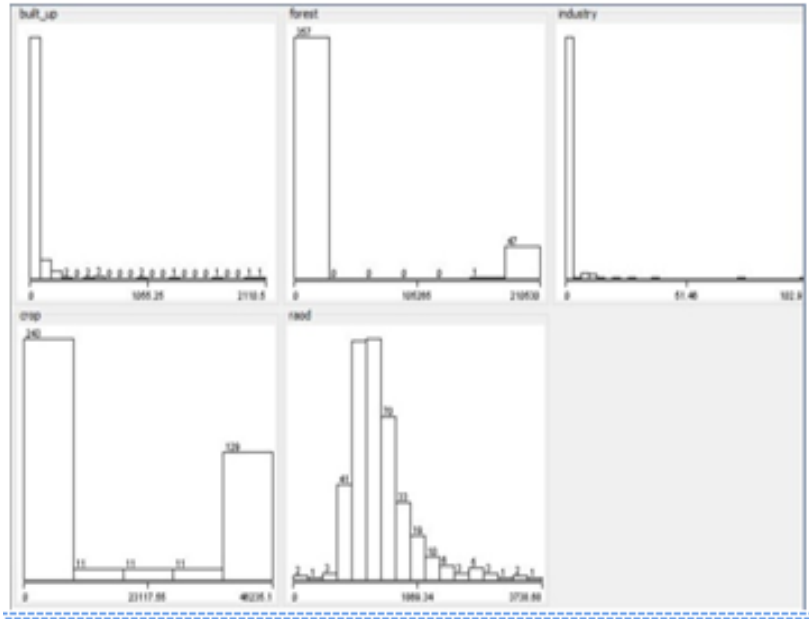


Figure 3 : Land use Pattern during 1990

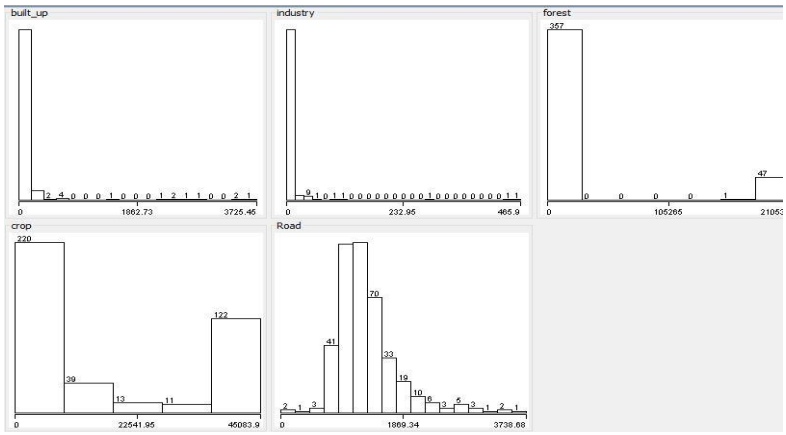


Figure 4: Land use Pattern during 2000

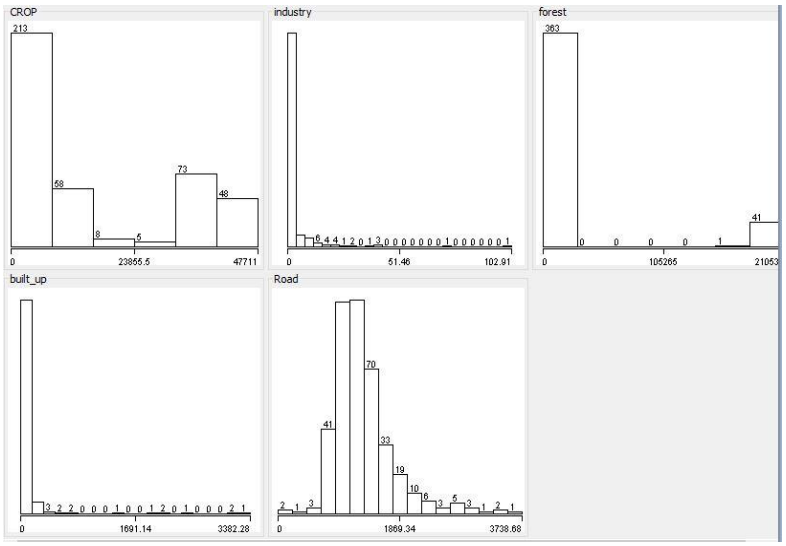


Figure 5: Land use Pattern during 2010

IX. Conclusion

This paper focuses on determining LULC changes in Erode district, TamilNadu India, by using remote sensing data and GIS technology. Our result evidently shows that LU/LC changes were significant during the period 1990, 2000 and 2010 and also a decrease in crop land and forest area and increase in built up areas. Thus the result, indicates the significant impact of population and its development activities on LU/LC change. Thus the study, proves that the data mining techniques such as classification and clustering are the effective tools to determine the land use pattern and factors for deforestation.

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