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Land Use-Land Cover Change Detection Using Remote Sensing and GIS Techniques; Solapur District of Maharashtra, India

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Abstract Land use-land cover study is vital as it deals with how people are using the land. Remote Sensing and Geographical Information System (GIS) are well accepted and more dependable advance techniques to detect change in land use and land cover pattern by providing more reliable direct quantitative information. Therefore in the present study an attempt is made on Solapur district to bring out the quantitative information through the study of satellite imageries purchased in the department and those freely available at Global Land Cover Forecasting (GLCF) site. The results obtained through this study using imageries of 1992, 2000 and 2012 of Solapur district are presented.
Keywords *Remote Sensing; GIS; Land Use/Land Cover; Change Detection*

1. Introduction

Considering potential of Geographical information study many attempts has been made to utilize this techniques for scientific thematic mapping by Geographers, Hydrologists, Geologists, Geomorphologist, Planners from municipality Corporation, Maharashtra Board Electrical Boards, Public Work Department and collectorates of every district. In the present attempt the studies are carried out to know the landuse and land cover from Talukas of Solapur district. This study is planned with an aim to use for the qualitative and quantitative data generated for correlative it for site suitability of Great Indian Bustard from Solapur district.

1.2. Study Area

Solapur district a wildly known drought prone district of Maharashtra extends geographically from $17^0$8' to $18^0$33' North latitude to $74^0$36' to $76^0$26' East longitude. It is well connected by road, rail & airways from Bombay, Hyderabad & Bangalore. Location map of the district is given in Figure 1.

2. Objectives

The study is aimed to bring out vital information on geographical situation through past. The land use and land cover spatial changes will be discerned using remotely sensed data. On the basis of availability of images it is plan of to bring out the temporal changes in land use pattern from 1992 to 2012 by preparing respective thematic maps.

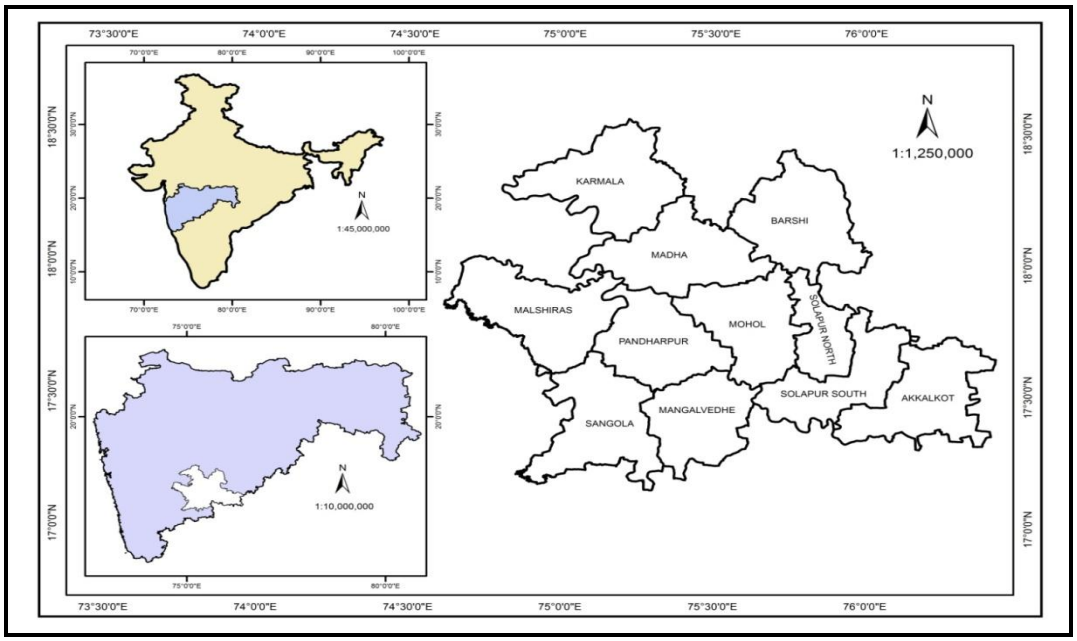

Figure 1: *Location Map of Study Region*

3. Methodology

Systematic study plan was completed in two steps where in first includes supervised classification of TM 1992 (30 m), ETM+ 2000 (30 m) & LISS3 2012 (23.5 m) images while the second will encompass change detection analysis. The flow chart of the methodology attempted is given in Figure 2.

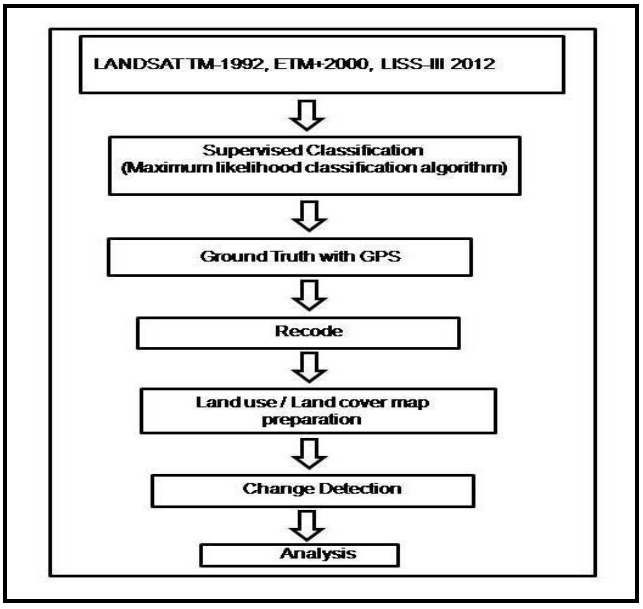

Figure 2: *Flow Chart of Methodology*

All images collected from TM (1992), ETM+ (2000), and LISS-III (2012) where chronologically arranged and were subjected to supervised classification. An attempt was made to classify the images under five classes viz. Agriculture, Water body, Fallow land, Shrub land & Settlement. Out of the available modes of supervised classification Maximum likelihood classification algorithm technique is used considering its potential and suitability in the study planned. In this method care was taken to define signatures of each class after defining the signatures for each land cover category. The software uses those signatures to classify the remaining pixels. The classified land use/ land cover images were taken for ground truth. Ground truth was conducted by using GPS (Global Positioning System) and land use class was corrected by using recode technique, wherever it was needed based on the ground truth information. Considering the suitability of satellite data various satellite data used are tabulated along with their details in Table 1.

Table 1: *Detail of Satellite Data used to Create Land use/ Land Cover Map*

Satellite	Sensor	Path/Row	Year	Resolution
LANDSAT	TM	145/47&48 146/47&48	December 1992	30 m
LANDSAT	ETM+	145/47&48 146/47&48	December 2000	30 m
IRS	LISS 3	96/60 97/60&98/60	January 2012	23.5 m

4. Results and Discussion

The study of the contour and morphology suggest that maximum area under water body is resulted to Karmala, Pandharpur, Sangola, Barshi and Akkalkot Talukas because of river and lake availability, whereas Karmala, Madha, Mohol, and Malshiras are beneficiary Talukas of Ujjani dam. Maximum settlements are found in North Solapur, South Solapur & Pandharpur Talukas which can be attributed to industrial and educational development. There is shrub land and fallow land noteworthy in whole Solapur district which may be due to the lack of water availability and lack of adaption of advance techniques in agriculture. Shrub land covered maximum area lies in Sangola and Malshiras Talukas due to the hilly region exibited by contour diferences and slope along which shallow soil cover is found**.** Maximum area occupied by agriculture in Pandharpur and Mangalwedha may be because of soil suitability as well as water availability in these Talukas. Madha, Karmala and Mohol are most beneficiaries of Ujjani dam due to rejuanation of Sina River by canal which pramoted maximum area under agriculture.

Major noteworthy changes between study periods are exhibited by agriculture and shrub land because the shrub land is converted into agriculture day by day due to the addaption of advance technique in agriculture. The area under settlement is increased due to population growth influenced by workers in agricultureal and allied industry. Solapur is a drought prone area so there is no major change in water body in study period of twenty year.

The result obtained through the study of imageries to evolve change in the land use and land cover of Solapur district are evaluated from twenty years of study period i.e. 1992, 2000, 2012. Land use-land cover of 1992 is presented in Figure 3 and Figure 4. Status of land use in the year 2000 is shown in Figure 5 and Figure 6. Whereas landuse status of year 2012 present in Figure 7 and Figure 8. Taluka wise landuse/ landcover status of 1992, 2000 and 2012 is tabulated in Table 2, Table 3 and Table 4 respectively.

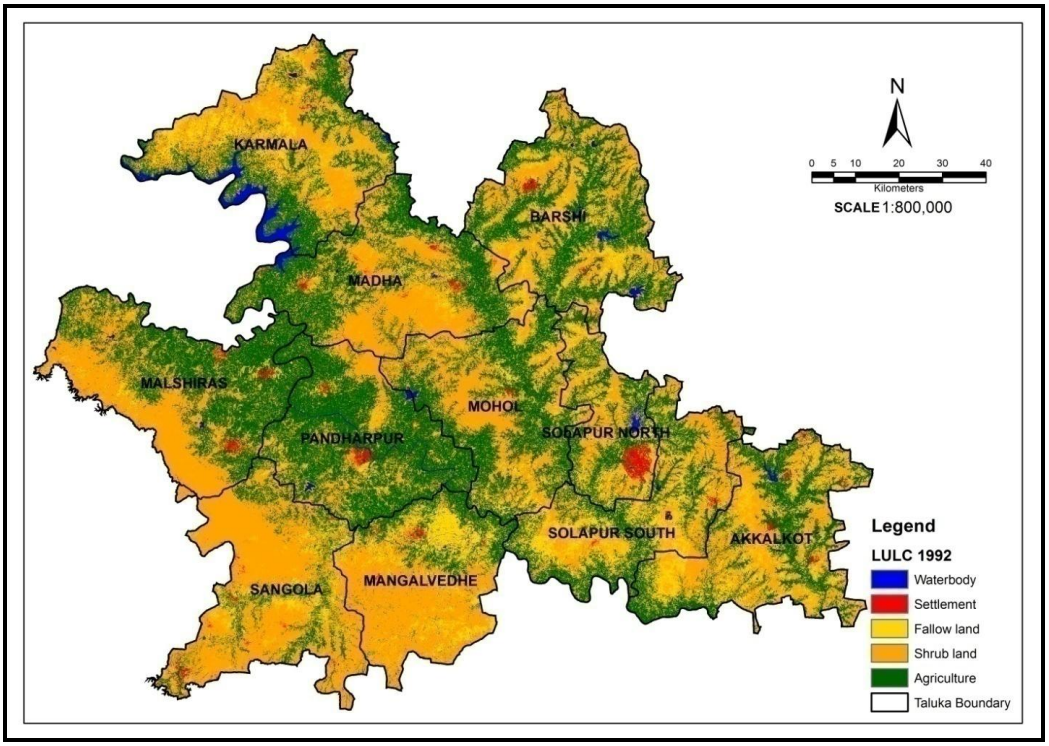

Figure 3: *Taluka Wise Land Use / Land Cover of Solapur District Year 1992*

Table 2: *Taluka Wise Land Use / Land Cover of Solapur District Year 1992*

Taluka Name	Agriculture	Shrub land	Fallow land	Settlement	Water body	Total
Akkalkot	487	482	387	19	32	1407
Barshi	576	552	355	15	47	1545
Karmala	466	537	416	17	159	1595
Madha	569	509	377	14	36	1505
Malshiras	665	786	90	22	41	1604
Mohol	499	599	184	16	22	1320
N.Solapur	201	256	145	62	20	684
Pandharpur	807	305	106	29	44	1291
S.Solapur	379	375	386	25	26	1191
Sangola	339	819	301	14	44	1517
Mangalwedha	431	622	86	19	24	1182
Total	**5419**	**5842**	**2833**	**252**	**495**	**14841**

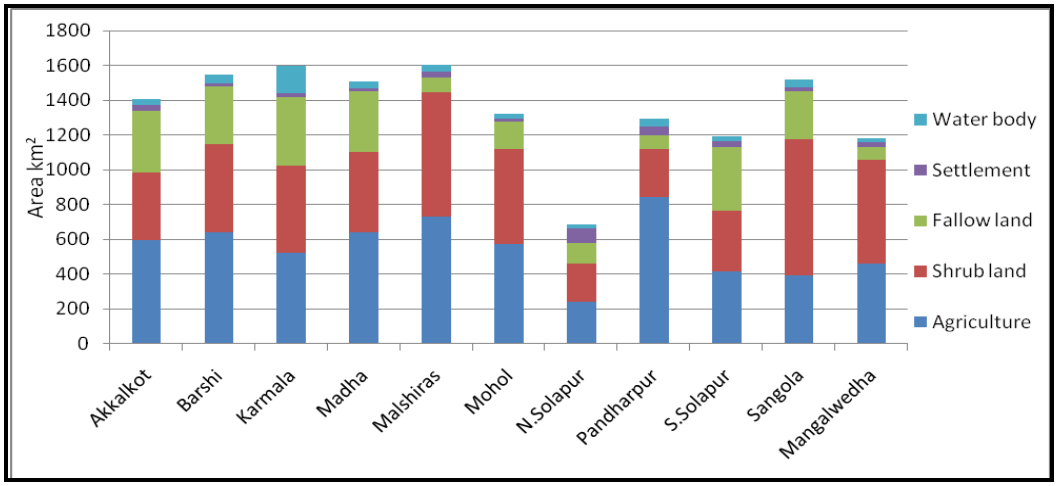

Figure 4: *Taluka Wise Land Use / Land Cover of Solapur District Year 1992*

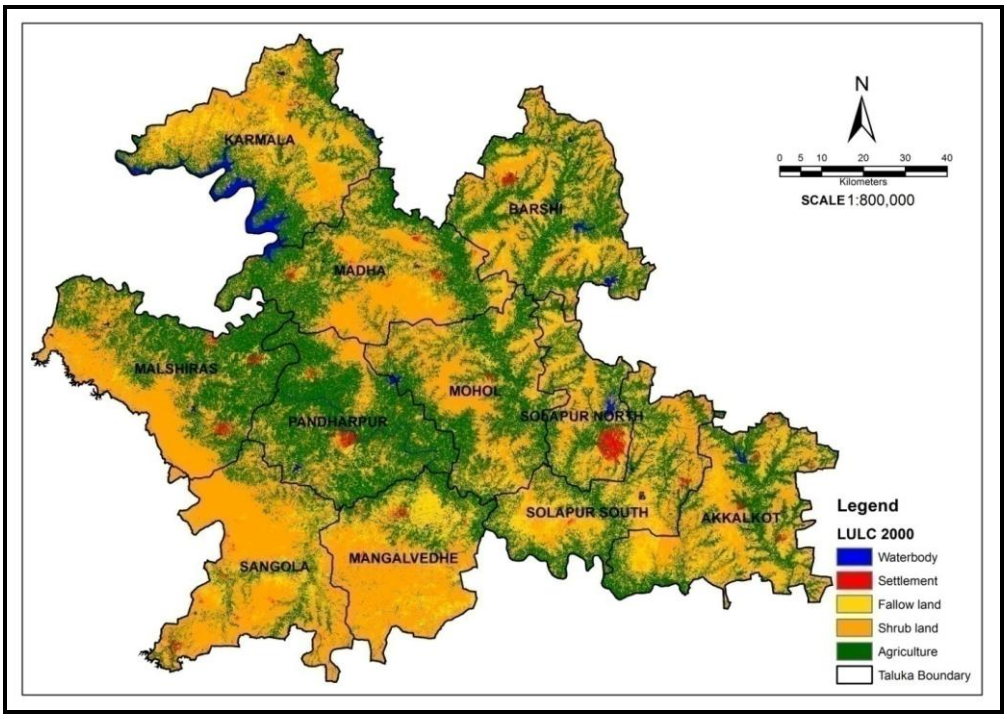

Figure 5: *Land Use / Land Cover of Solapur District Year 2000*

Table 3: *Taluka Wise Land Use / Land Cover of Solapur District Year 2000*

Taluka Name	Agriculture	Shrub land	Fallow land	Settlement	Water body	Total
Akkalkot	508	465	379	25	30	1407
Barshi	603	534	342	21	45	1545
Karmala	490	527	400	24	154	1595
Madha	594	496	361	22	32	1505
Malshiras	715	742	79	30	38	1604
Mohol	509	594	175	19	23	1320
N.Solapur	220	242	133	68	21	684
Pandharpur	822	294	96	36	43	1291
S.Solapur	402	365	370	29	25	1191
Sangola	357	810	290	18	42	1517

Mangalwedha	452	603	77	26	24	1182
Total	**5672**	**5672**	**2702**	**318**	**477**	**14841**

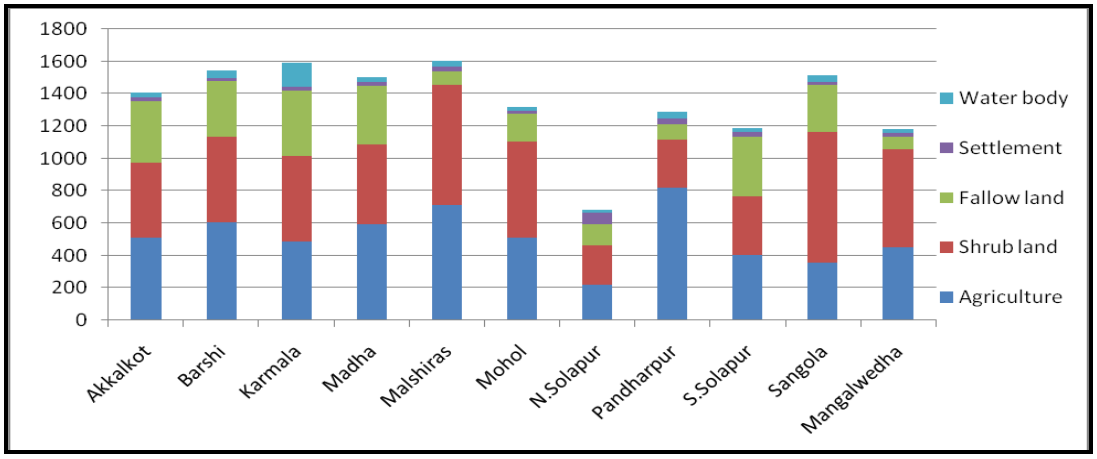

Figure 6: *Taluka Wise Land Use / Land Cover of Solapur District Year 2000*

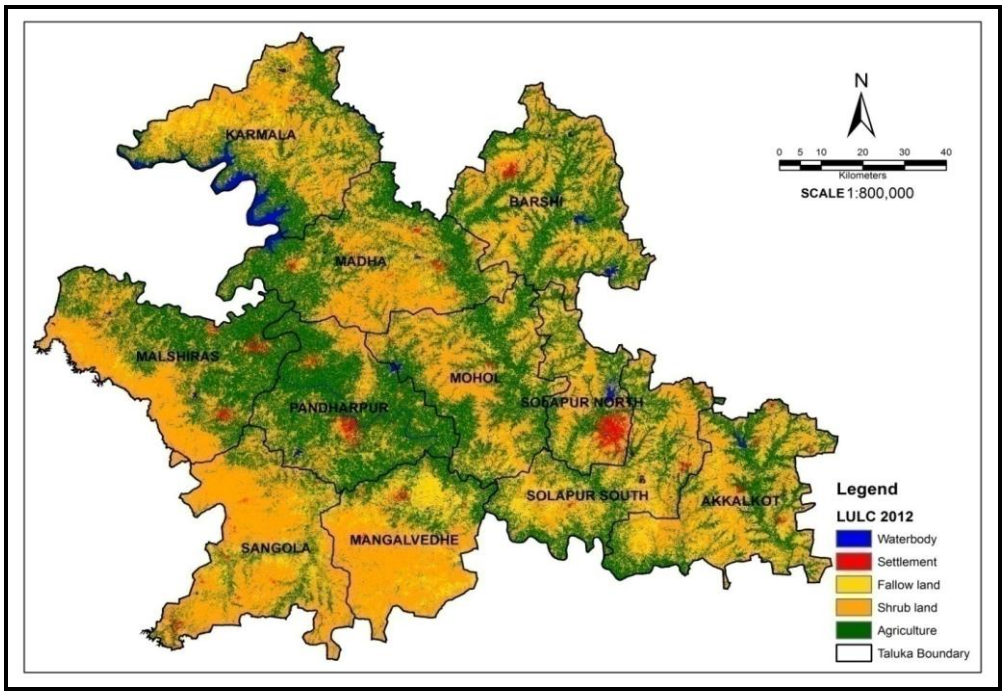

Figure 7: *Land Use / Land Cover of Solapur District Year 2012*

Table 4: *Taluka Wise Land Use / Land Cover of Solapur District Year 2012*

Taluka Name	Agriculture	Shrub land	Fallow land	Settlement	Water body	Total
Akkalkot	594	392	354	35	32	1407
Barshi	643	503	331	22	46	1545
Karmala	525	501	389	24	156	1595
Madha	641	461	349	19	35	1505
Malshiras	731	717	84	31	41	1604
Mohol	574	544	158	20	24	1320
N.Solapur	242	218	122	81	21	684
Pandharpur	843	279	78	49	42	1291
S.Solapur	414	349	365	38	25	1191

Sangola	393	785	275	19	45	1517
Mangalwedha	462	598	68	30	24	1182
Total	**6062**	**5347**	**2573**	**368**	**491**	**14841**

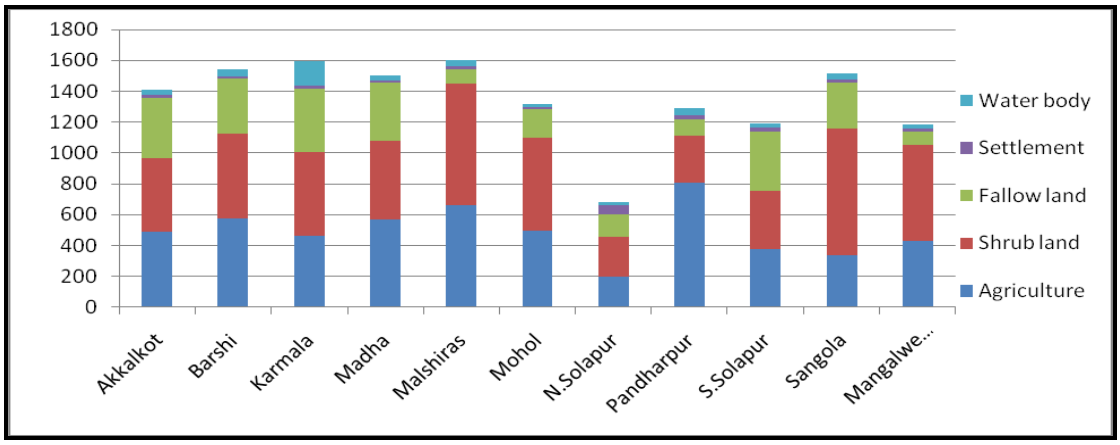

Figure 8: *Taluka Wise Land Use / Land Cover of Solapur District Year 2012*

5. Conclusion

In the present study, highlight the role of land use change modeling in providing the required information to plan and manage the study area. The data so generated land use/ land cover is essential for the planning and implementation of land use schemes based on human need and welfare. This study corroborate that Remote Sensing & Geographical Information System has the unique capability to detect land use changes quickly and accurately thus serves as dependable tool for managers or planner involved in developmental activity.

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