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Impact of Landuse and Landcover on Valuation using Geospatial Technology in Madurai District, Tamilnadu, India

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Abstract*: Analysis of urban sprawl is an issue that has been continuously attracting attention in the planning and research community. This paper presents the results of an analysis of the growth of the city of Madurai. Madurai is a city in the south part of Tamilnadu, commonly referred to as Temple City with many historical cultural places being safeguarded. The population of Madurai has grown tremendously and hence the need for more build up area has increased during the past 12 years. In our study, we analyze the development of urbanization in terms of Landuse, Landcover between 2007 and 2019 using GLR and PMR values. The growth of population is directly proportional to the value of the land which is evident by the growth in GLR and PMR values. GLR is the guideline value from the government sector for a land while PMR is the privilege market rate for the same land.

***Keywords* : Landuse and Landcover changes, GIS, PMR values.**

I. INTRODUCTION

Landcover is an indication of the physical land type like forest or open water whereas landuse tells us about how people are using the land. Land cover data defines which part of the region is covered by forests, wetlands, impervious surfaces, agriculture, and other land and water types. Landuse shows us how people use the land if they are being used for development, conservation, or mixed uses. Landcover can be determined by analyzing images taken from satellite and aerial view. Landuse cannot be determined from satellite images. To see the change that has happened over time, landcover maps taken during different years are needed. With this information, people can evaluate the past as well as gain insight into the possible effects of their current decisions before they are implemented (Seto et al. 2011). Landuse applications involve both baseline mapping and subsequently keeping an eye on monitoring, since timely information is required to realize what is the current land quantity available, what type of land is in use and to identify the land use changes from year to year. This knowledge will help develop strategies to have a balance conservation, conflicting uses, and developmental pressures. Some of the issues that drive landuse studies include the removal or disturbance of productive land, urban encroachment, and depletion of forests (Malleswara Rao et al. 2012). Our study analyses Landuse, Landcover between 2007 and 2019 using GLR and PMR values. The expansion of urban areas and the reasons for urbanization of Madurai city are covered.

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II. METHODOLOGY

A. Data Collection (Spatial & Field):

The Landsat 7 ETM+ instrument is designed to improve the ground resolution to 30 m. The first image was collected on May, 2007. After a period of 12 years, the second image was captured using Landsat8 which has a ground resolution of 23.5 m on June, 2019. We collected images which had 20% cloud-free data. GPS are generally used for positioning and navigation. GPS is increasingly used as an input for Geographic Information Systems particularly for precise positioning of geospatial data and the collection of data in the field. In our study, we used Garmin GPS for capturing the location in various parts of Madurai. While collecting GLR and PMR with the help of GPS, we were also able to collect the location of the land in Madurai (Longley et al. 2010).

After the location was taken using GIS, a questionnaire was distributed and details were collected from various localities in Madurai. The questionnaire contained information such as address of the resident, the ward details including the old and new ward no, latitude, and longitude information, the type of residence if it was residential or commercial or industrial. The questionnaire was given to the people and the process of filling was explained to the people and they were requested to fill them or in case if they are not able to fill, we got the answers from them and we filled it. The same set of data were collected in 2007 and in 2019. The following data were classified by the ENVI image processing software. We used supervised classification technique which contained nearest neighborhood algorithm for Level 1 classification such as Agriculture land, Settlement (Build-up Area), Forest, Wasteland including Fallowland and Waterbodies. The impact of change GLR and PMR values will be reflected in the landuse and landcover which can be visible in the above factors . The brief methodology is shown in fig.1

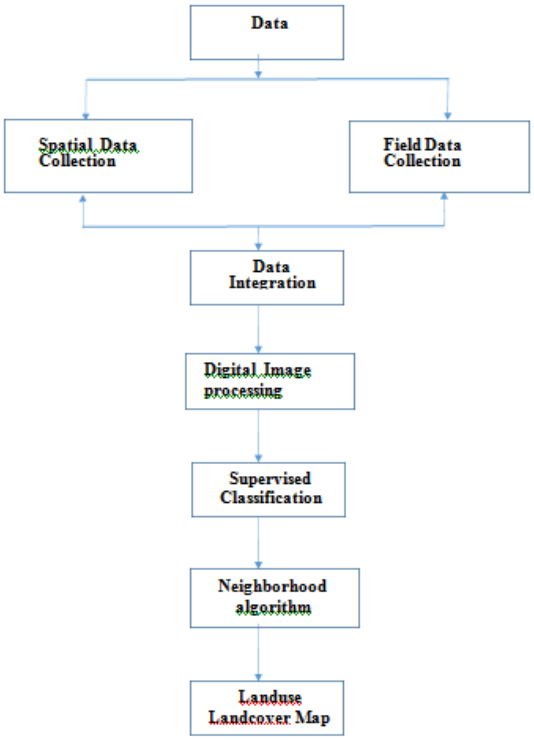

Fig.1 Methodology of flow chart

B. Data Integration with GIS and Mapping

These details we collated and presented in the form of attributes. After collecting these data, they we integrated with the GIS software using QGIS. The collected data were tabulated. The tabulated data were provided as input using inverse distance weighted (IDW) technique. With the help of IDW, an imaginary surface was designed with the GLR, PMR values and latitude and longitude details were also viewable and a cluster was formed from which we would be able to understand the land value and much more details. With the help of these process, we are able to derive a spatial distribution map for Madurai city. We divided the Madurai city area into 3 zones named A, B and C based upon the significance of GLR and PMR values. A is defined as area falling under low range lands values when B refers to area falling under medium range lands values and C refers to area falling under high range lands values.

III. SPATIAL ANALYSIS

For the year 2019, the landuse and landcover changes for Madurai was prepared using QGIS with the help of satellite images downloaded from the internet is shown in the fig.2. In this study area, distributed of various thematic layers is shown in the fig..3. The agri land is the maximum area square kilometer with 877.145 Sq.km. waste land comes in the second order with 800 Sq.km followed by settlement with 223 Sq.km, waterbody area with 220.441 Sq.km. Forest area is the least in Madurai city with 83 Sq.km is given in the table.1

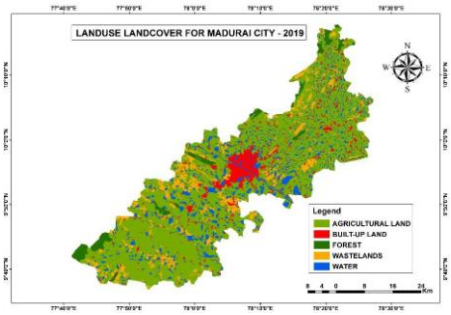

Fig.2: Landuse and Landcover for 2019

Table 1: Landuse Landcover for year 2019

2019	Area in Sq.km
AGRI LAND	877.145
SETTLEMENT	223
FOREST	83
WASTE LAND	800
WATERBODY	220.441

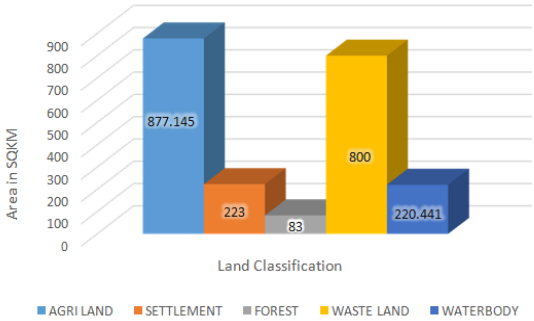

Fig. 3: Landuse Landcover for year 2019

For the year 2007, the landuse and landcover changes for Madurai was prepared using QGIS with the help of satellite images downloaded from the internet is shown in the fig.4. In this study area, wasteland is the maximum area square kilometer with 1200 Sq.km. Agricultural land comes in the second order with 535.859 Sq.km followed by waterbody with 237 Sq.km, settlement area with 148 Sq.km. Forest area is the least in Madurai city with 83 Sq.km. is given in the table.2

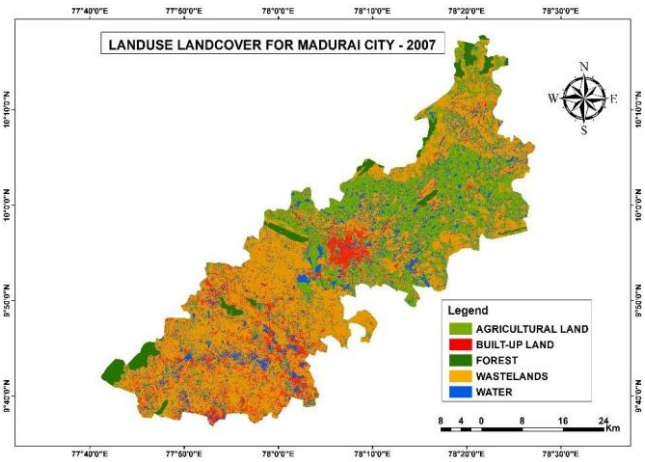

Fig. 4: Landuse Landcover Map for 2007

Table 2: Landuse Landcover for year 2007

2007	Area in Sq.km
AGRI LAND	535.586
SETTLEMENT	148
FOREST	83
WASTE LAND	1200
WATERBODY	237

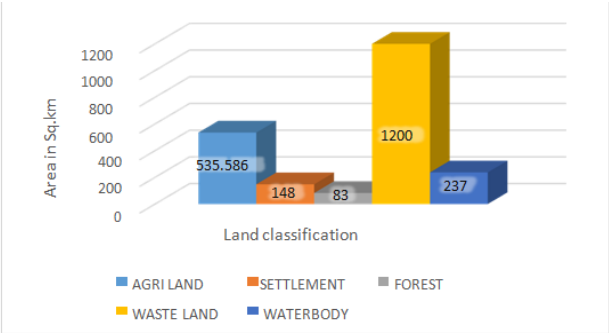

Fig. 5: Landuse Landcover for year 2007

From the table.3, shows the agricultural land has increased to 877.145 Sq.km. Waste land follows next with 800 Sq.km with settlement area increasing to 223 Sq.km and waterbody with 220.441 Sq.km and forest decreasing to 83 Sq.km

Table 3: Change detection of Landuse Landcover 2007 and 2019

	2007 (in Sq.km)	2019 (in Sq.km)
AGRI LAND	535.586	877.145
SETTLEMENT	148	223
FOREST	83	83
WASTE LAND	1200	800
WATERBODY	237	220.441

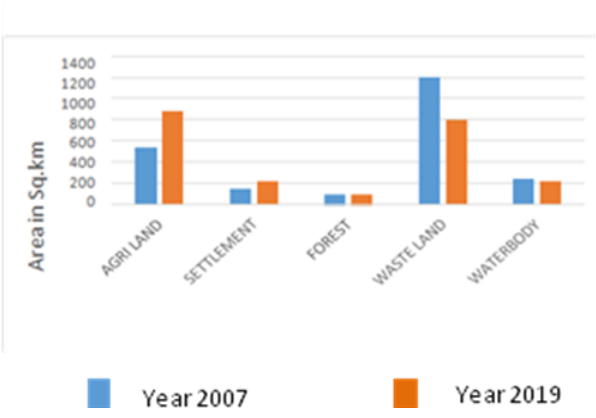

Fig. 6: Change detection of Landuse and landcover

From the above fig..6, the change detection of Landuse Landcover between 2007and 2019 shows agricultural land has increased from 535.586 Sq.km to 877.145 Sq.km. The Settlement areas has also grown wide in range from 148 Sq.km to 223 Sq.km. The forest range has not changed. The wasteland has decreased from 1200 Sq.km to 800 Sq.km. Waterbodies has shown a slight decrease to 220.441 Sq.km from 237 Sq.km in the given table.4

Table 4: Comparison between GLR values in 2007 and 2019

	A		B		C	
	Min	Max	Min	Max	Min	Max
GLR for the year 2007	1.4	316	316	1241	1241	2774
GLR for the year 2019	19	2200	2200	4000	4000	5450

From the table..4 shows GLR for A region increased from 1.4 to 19 within 12 years. The GLR for B and C region increased from 1241 and 2774 to 4000 and 5450.

Table 5: Comparison between PMR values in 2007 and 2019

	A		B		C	
	Min	Max	Min	Max	Min	Max
PMR for the year 2007	10	2719	2719	4348	4348	5433
PMR for the year 2019	119	3580	3580	7041	7041	8771

From the table.5,the PMR for A region increased from 10 to 119 within 12 years. The PMR for B and C region increased from 4348 and 5443 to 7041 and 8771, respectively

IV. RESULT AND DISCUSSION

1. In the year 2007 , wasteland is the maximum area square kilometer with 1200 Sq.km. Agricultural land comes in the second order with 535.859 Sq.km followed by water body with 237 Sq.km, settlement area with 148 Sq.km.
2. In the year 2019, the agricultural land is the maximum area square kilometer with 877.145 Sq.km. waste land comes in the second order with 800 Sq.km followed by settlement with 223 Sq.km, waterbody area with 220.441 Sq.km.
3. the change detection of Landuse Landcover between 2007and 2019 shows agricultural land has increased from 535.586 Sq.km to 877.145 Sq.km. The Settlement areas has also grown wide in range from 148 Sq.km to 223 Sq.km. The forest range has not changed. The wasteland has decreased from 1200 Sq.km to 800 Sq.km. Waterbodies has shown a slight decrease to 220.441 Sq.km from 237 Sq.km.
4. The GLR for A region increased from 1.4 to 19 within 12 years. The GLR for B and C region increased from 1241 and 2774 to 4000 and 5450.
5. The PMR for A region increased from 10 to 119 within 12 years. The PMR for B and C region increased from 4348 and 5443 to 7041 and 8771.

V. CONCLUSION

The percentage of increase of GLR and PMR values in 2007 varies from 49.10% to 92.63%. The increase percentage of GLR and PMR values in 2019 varies from 24.05% to 91.59%.

The percentage of increase in GLR and PMR values is an indication of the increase in land values as a result of growth of urbanization. The changes in landuse landcover are indicated by the increase in GLR and PMR. The build-up area has developed to a greater extent due to the growth in population. The population growth increases the need to build-up and settlement area.

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AUTHORS PROFILE

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