Abstract

In Maharashtra Pune is an important town from historical period. Pune is the 8th largest city in India and the 2nd largest in the state of Maharashtra. Pune has play an important role in politics, education and social changes. Pune Municipal Corporation is located in Pune District in western region in Maharashtra state between 17050′ North to 19024′ North latitude and 73019′ East to 75010′ East longitudes. The city is located to the South-East of Mumbai at an elevation of 560 m above mean sea level. The total area of PMC is 243.96 sq.km. Due to the uncontrolled urbanization in PMC, environmental degradation has been occurring very rapidly. Land use planning and the pattern of development, relationship between residential areas and industrial areas, commercial and office complex have a considerable impact on the environment.

Pune Municipal Corporation has shown the lots of change in land use from 1981 to 2011. In 1981 PMC has 24.92 sq.km area under built up. i.e. 10.24 % area was under built up in 1981. In 2005, built up area increase and 143.80 sq.km area of PMC was under built up i.e. 58.97%. The rate of change of built up was 43.8% from 1981 to 2005. In 2011, built up area captured maximum area of the city and in 2011, PMC has 192.53 sq.km area under built up, i.e. 78.92%, the rate of change of built up area was 92.53% from 2005 to 2011. The agricultural area decrease rapidly, barren land occupied by hilltop and hill slopes are captured by built up. Hence, productive land cover by built up and the quality of such land set out permanently. In 1981 PMC has 39.17 % area under the agriculture which was decreased and in 2011, 10.16% area was under agricultural area.

Key Words: General Land Use, Rate of Change, Built Up

1.1 Introduction:

Urbanization, in conventional terms, refers to the process through which society is transformed from rural to urban areas. It is broadly defined as a growth of towns and increasing ratio of rural to urban population of a country. Urbanization usually brings with it regional prosperity as the provision of infrastructure facilities. It stimulates the development of locally available resources, increasing regional income and the level of employment. Although, it provides new economic opportunities through providing several infrastructural facilities also responsible to create new problems.

Urbanization is one of the dynamic and serious issues at present because rapid urbanization results in haphazard and unplanned growth of cities. The pressure of an ever-growing population becomes a burden on the limited public facilities, which are virtually collapsing; there is the need to balance present requirements of land with available facilities while considering future needs. Urbanization is a process through which the productive agricultural land, forests and surface water bodies are being irretrievably decreasing. (Tali J.A., 2012, Korade, Jyotiram More 2015).

Land use is the human use of land. Land use involves the management and modification of natural environment or wilderness into built environment. It has also been defined as 'The arrangements, activities and inputs of people undertake in a certain land cover type to produce, change or maintain it.'

Remote Sensing (RS) and Geographic Information System (GIS) has an ability to assimilate divergent source of data spatial and non spatial. It is eventually has helped in analyzing data showing change in land use pattern of Pune Municipal Corporation (PMC) from 1981 to 2011. In last 30 years,
Pune has witnessed fast growth. The urban growth of the city has transformed most of the agricultural land, barren land of city into industrial, commercial and residential area. This analysis has helped in understanding and comparing the changes in the land use patterns in these years along with suggesting planning for utility services.

1.2 Study Area

Pune is the 8th largest city in India and the 2nd largest in the state of Maharashtra. Pune has played an important role in politics, education and social changes. Pune Municipal Corporation (PMC) lies between 18° 25’ to 18° 37’ N latitude and 73° 44’ to 73° 57’ E longitude. The total area of PMC is 243.96 sq. km. The city is bounded by Ahmednagar district to the north and north-east, Solapur district to the south-east, Satara district to the south, Raigad district to the west and Thane district to the north-west. The city is located at the confluence of Mula and Mutha rivers. Pune is well connected by road, rail and air network with almost all the important cities within Maharashtra and India. Pune Municipal Corporation is known as 'Oxford of the East', 'IT-BT Pune'. The administrative wing of PMC is divided into 14 administrative wards.
1.3 Aims and Objective
1. To find the change in General land Use of PMC from 1981 to 2011.
2. To find out the rate of change of land use categories.

1.4 Database and Methodology
To find out the various results of land use, various maps are collected like topographical map, satellite images. Topographical Map (47 F/14/2, 47 F/14/3, 47 F/14/6, 47 F/15/NE, 47 F/15/NW) was collected from Survey of India. Satellite Imagery – LIIS III (2005,2011) was obtained from Bhuvan. (National Remote Sensing Center, Hyderabad)

1.5 Results and Discussion
Pune Municipal Corporation shows rapidl changes from 1981 to 2011. In there three decades PMC generated its new identity. The journey of the city starts with Pensioners Pune and now it has reached and develop has its new identity i.e. IT Pune, Oxford of East, excellent Medical Facility provider city. People of SARC countries and all over the worlds come in this city for job, medical facility and education. Hence nature of land use changes rapidly.

Table No. 1 : General Land Use of PMC (1981 to 2011)

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>General Land Use</th>
<th>1981 in %</th>
<th>2005 in %</th>
<th>2011 in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Agricultural Land</td>
<td>39.17</td>
<td>24.47</td>
<td>10.16</td>
</tr>
<tr>
<td>2</td>
<td>Barren Land</td>
<td>41.76</td>
<td>10.67</td>
<td>6.06</td>
</tr>
<tr>
<td>3</td>
<td>Built Up Area</td>
<td>10.24</td>
<td>58.97</td>
<td>78.92</td>
</tr>
<tr>
<td>4</td>
<td>Forest</td>
<td>8.52</td>
<td>5.71</td>
<td>4.59</td>
</tr>
<tr>
<td>5</td>
<td>Water Bodies</td>
<td>0.31</td>
<td>0.18</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

(Source : Compiled by Researcher)
Table No. 1 and Fig. No. 1 shows the General Land Use of PMC from 1981 to 2011. From 1981 to 2011, major changes have occurred in the city. Built up area rapidly has consuming agriculture land, barren land and forest area. Agriculture area decreases rapidly, in 1981 PMC has 39.17 % agriculture area which has decreased and remain 24.47 % till 2005 and continuously declining the rate and reach at the 10.16 % in 2011. Likewise, about the barren land of the city, in 1981 barren land cover the maximum area of PMC i.e. 41.76 %, which decreased and in 2005 it reached on 10.67 % and in 2011 it was reach on 6.06 %. These rapid changes of land are force to decide the things, which are going on, are right or wrong. On one side of coin, the agricultural area decreases rapidly, barren land occupied by built up, hilltop and hill slopes are captured by built up. Hence, productive land cover by built up and the quality of such land set out permanently. But this built up area enclose the number of Educational Center, Research Center, Hospitals, IT sectors, Business Hub, Industries, Residential areas, Transportation facilities, Recreational centers, Public and semi-public areas. Built up area widen from 1981 to 2011. In 1981, PMC has 10.24 % area under the built up area, which was increase, and this class capture maximum area of the city. In 2005, PMC has 58.97 % area under the built up and in 2011 it was set on 78.92 %. In Pune Municipal Corporation, from 1981 to 2011 built up area increases rapidly, agricultural area decreases. Barren land capture by built up.

1.6 Change in General Land Use of PMC : 1981 to 2005

Table No 2 and Fig No 2 shows the Change in General Land Use of PMC from 1981 to 2005. Agricultural land decreases from 1981 to 2005. Total area under the agriculture was 39.17 % in 1981 which was decreases by 14.7 % and in 2005 it was found 24.47 %. Barren land was decreases by 31.09 % from 1981 to 2005. Area under the forest also decreases by 2.81 % from 1981 to 2005. In 1981, total area under the forest was 8.525 % and in 2005 it was found 5.71 %. In 1981, 0.31 % area was under Water Bodies which was decreases by 0.13 % and in 2005 it was found 0.18 %. Area under Built up was only one category which was increases from 1981 to 2005. Built up area increases by 48.73 % from 1981 to 2005. In 1981, area under built up was 10.24 % which was increases and found 58.97 % in 2005.

Table No. 2 : Change in General Land Use of PMC : 1981 to 2005

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>General Land Use</th>
<th>1981 in %</th>
<th>2005 in %</th>
<th>Change from 1981 to 2005 in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Agricultural Land</td>
<td>39.17</td>
<td>24.47</td>
<td>-14.7</td>
</tr>
<tr>
<td>2</td>
<td>Barren Land</td>
<td>41.76</td>
<td>10.67</td>
<td>-31.09</td>
</tr>
<tr>
<td>3</td>
<td>Built Up Area</td>
<td>10.24</td>
<td>58.97</td>
<td>48.73</td>
</tr>
<tr>
<td>4</td>
<td>Forest</td>
<td>8.52</td>
<td>5.71</td>
<td>-2.81</td>
</tr>
<tr>
<td>5</td>
<td>Water Bodies</td>
<td>0.31</td>
<td>0.18</td>
<td>-0.13</td>
</tr>
</tbody>
</table>

(Source : Compiled by Researcher)
Table No 3 and Fig No 3 shows the Change in General Land Use of PMC from 2005 to 2011. Area under agriculture activity decreased by 14.31\% from 2005 to 2011, in 2005, 24.47\% area was under the agriculture and in 2011 it was 10.16\%. Barren land decreases by 4.61\% from 2005 to 2011. Forest area was decreased from 2005 to 2011 by 1.12\%. In 2005 area under forest was 5.71\% which 4.59\% in 2011. Water bodies increases from 2005 to 2011 by 0.1\%, in 2005 area under water bodies was 0.18\% which was found 0.28\% in 2011. Built up area Show an increase by 19.95\%. In 2005, 58.97\% area was under built up which was 78.92\% in 2011.

**Table No. 3 : Change in General Land Use of PMC : 2005 to 2011**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>General Land Use</th>
<th>2005 in %</th>
<th>2011 in %</th>
<th>Change from 2005 to 2011 in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Agricultural Land</td>
<td>24.47</td>
<td>10.16</td>
<td>-14.31</td>
</tr>
<tr>
<td>2</td>
<td>Barren Land</td>
<td>10.67</td>
<td>6.06</td>
<td>-4.61</td>
</tr>
<tr>
<td>3</td>
<td>Built Up Area</td>
<td>58.97</td>
<td>78.92</td>
<td>19.95</td>
</tr>
<tr>
<td>4</td>
<td>Forest</td>
<td>5.71</td>
<td>4.59</td>
<td>-1.12</td>
</tr>
<tr>
<td>5</td>
<td>Water Bodies</td>
<td>0.18</td>
<td>0.28</td>
<td>0.1</td>
</tr>
</tbody>
</table>
1.8 Rate of Change of General Land Use of PMC: 1981 to 2011.

The rate of change of general land use of PMC has two results either increasing rate or decreasing rate. Table No 4 shows the Rate of Change of General land Use of PMC from 1981 to 2011. In 1981, PMC has 95.26 sq.km area under agriculture and in 2005 it reached to 59.66 sq.km, i.e. from 1981 to 2005 the rate of decrease of agricultural land was 40.34% and from 2005 to 2011 this rate of change increases i.e. from 2005 to 2011 agricultural land decreases and the rate of decrease of agricultural land was 75.22%. Rate of change of barren land decreases. From 1981 to 2005, rate of decrease of barren land was 73.98% from 2005 to 2011 it was found 85.22%. The total geographical area of PMC was 243.30 sq.km in 1981 and out of this 24.92 sq.km area was under built up. In 2005, built up area increased and 143.80 sq.km area of PMC. The rate of change of built up was 43.8% from 1981 to 2005. In 2011, built up area captures maximum area of the city and in 2011, PMC has 192.53 sq.km area under built up, i.e. the rate of change of built up area was 92.53% from 2005 to 2011.

<table>
<thead>
<tr>
<th>Year</th>
<th>Agriculture Land in sq.km</th>
<th>Barren Land in sq.km</th>
<th>Rate of Change in %</th>
<th>Built Up Area in sq.km</th>
<th>Rate of Change in %</th>
<th>Forest in sq.km</th>
<th>Rate of Change in %</th>
<th>Water Bodies in sq.km</th>
<th>Rate of Change in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>95.26</td>
<td>-</td>
<td>101.61</td>
<td>-</td>
<td>24.92</td>
<td>-</td>
<td>20.72</td>
<td>-</td>
<td>0.76</td>
</tr>
<tr>
<td>2005</td>
<td>59.66</td>
<td>-40.34</td>
<td>26.02</td>
<td>-73.98</td>
<td>143.80</td>
<td>43.8</td>
<td>13.92</td>
<td>-86.08</td>
<td>0.45</td>
</tr>
<tr>
<td>2011</td>
<td>24.78</td>
<td>-75.22</td>
<td>14.78</td>
<td>-85.22</td>
<td>192.53</td>
<td>92.53</td>
<td>11.19</td>
<td>-88.81</td>
<td>0.68</td>
</tr>
</tbody>
</table>

Table No. 4: Rate of Change of General Land Use of PMC: 1981 to 2011
When focused on rate of change of forest it is observed that from 1981 to 2005 the rate of decreases forest was 86.08 %. 2005 to 2011 the rate of decrease of forest was 88.81 %. Likewise forest area under water bodies also has decreasing rate from 1981 to 2011. In PMC, from 1981 to 2005 the rate of decreasing of water bodies was 99.55% where , from 2005 to 2011 the rate of change of water bodies was 99.32%.

**Conclusion :**
1. The agricultural area decreases rapidly, barren land occupied by built up, hilltop and hill slopes have been captured by built up. Hence, productive land cover by built up and the quality of such land set out permanently. In 1981 PMC has 39.17 % area under the agriculture which was decreases and in 2011, 10.16% area was under agricultural area.
2. Built up area increases by 48.73% from 1981 to 2005 and from 2005 to 2011 it was change by 19.95 %.
3. All categories of land use shows the various changes in rate of change, but only built up area has rate of increasing other categories has decreasing rate.

**Reference:**
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