CHAPTER 6
THE CHENNAI CITY’S ENVIRONMENTAL PERFORMANCE
ZONES AND SAMPLE AREA FOR ANALYSIS

6.1 INTRODUCTION

Tree’s services related to the air quality amelioration, maintaining the hydrological process and regulating the micro-climate are governing the urban environmental quality that determines the people’s health. As cities grow both intensively and extensively by swallowing the green-covered area, all three of these services become degraded and thus reduces the city’s environmental performance. Besides, availability of these services is not spatially uniform across the urban landscape, which is highly influenced by various local factors as well by the socio-economic factors. To overcome these prevailing situations, green-cover development needs planned approach.

The important basic step for any landscape planning is to comprehend the ecological objective and identify the required spatial strategies according to the scenarios (Harms et al 1993). Like any other urban area, the Chennai city is also spatially heterogeneous, each part has unique issues. Hence, neither it is possible to propose a common green-cover design for the entire Chennai city nor it is possible to design each and every site. Therefore, this part of the research classifies the Chennai city into different qualitative zone, based on the spatial availability of the three green-cover services. Subsequently, sample areas are identified to represent each zone.
Then each zones local scenario will be comprehended through analyzing these sample areas. Accordingly the green-cover planning intervention will be proposed for the entire Chennai city.

6.2 IDENTIFYING THE ENVIRONMENTAL PERFORMANCE ZONES OF THE CHENNAI CITY USING GIS TOOLS

To appraise the spatial scenario of available green-cover services in the Chennai city, an index has been proposed using four green-cover associated parameters. They are -

1. Area of the green cover: Higher the green space, better the environmental quality.
2. Change in the air purification services: Lower the change, better the environmental condition.
3. Change in the surface heat radiation: Lower the surface radiation, better the environmental condition.
4. Change in the hydrological services: Lower the change in the surface retention capacity, runoff and peak flow, higher the environmental quality.

Each of the above criteria is standardized to a scale of 0 to 100, ward with the value of 100 has the highest environment value compare to others. In order to derive the spatial index, individual scores are combined through assigning weightages for each of the criteria. While doing, more weightages given to the ‘area of green cover’ criteria, which determine the other three criteria, as well aesthetic quality of the urban environment. And equal weightages are given to other three criteria. That has been done using the following formula,

\[
SI = (GC*40\%) + (AP*20\%) + (SHR*20\%) + (HS*20\%)
\]
Where SI is the spatial index, GC is area of the green cover, AP is the air purification service change, SHR is surface heat radiation change and HS is the urban hydrological process change. This entire analysis is carried out in the spatial analysis of Arc GIS 9.0. The Index values are computed at each ward (the smallest administrative unit), higher the index value, better the environmental scenario.

Figure 6.1 Environmental Scenario of Chennai and representing sample areas
Using the natural classification method in the Arc GIS 9.0, the resulted layer is classified into five zones, representing, excellent, best, good, fair and worst scenario in terms of the available environmental services (Figure 6.1).

6.3 THE SAMPLE AREA TO STUDY EACH ZONE’S CHARACTER

In any landscape design, understanding the characteristic of the site is a pre-requisite to make the proposed landscape effective. However, elements that constitute the landscape and their interrelationships are varying spatially. Understanding them will help us to propose effective tree-cover, which requires less public expense for maintenance. Therefore, to study the characteristics of the Chennai city’s environmental performance zones, sample areas are selected based on the spatial index value. Through studying these sample area, the tree cover improvement strategies for each zone would be identified. The final proposal will be developed based on these strategies; subsequently the proposals will be demonstrated at the sample area. The sample area, which representing each zone are listed in the following Table 6.1.

Table 6.1 Sample areas for each zone

<table>
<thead>
<tr>
<th>Zone</th>
<th>Environmental quality</th>
<th>Vegetative cover</th>
<th>Built space</th>
<th>Sample area</th>
</tr>
</thead>
<tbody>
<tr>
<td>One (worst area)</td>
<td>More run off, more surface radiation.</td>
<td>Almost nil</td>
<td>Very dense, wall to wall constructed houses. Most of the ground surfaces are paved.</td>
<td>Umarpulav Nagar. (refer Figure 6.1)</td>
</tr>
</tbody>
</table>
### Table 6.1 (continued)

<table>
<thead>
<tr>
<th>Two (poor area)</th>
<th>Moderate surface runoff, more surface radiation, and poor air quality.</th>
<th>Little amount of greeneries.</th>
<th>Dense built space intercepted by some vacant lands.</th>
<th>Kumaran nagar south. (refer Figure 6.1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three (fair area)</td>
<td>Moderate surface runoff, moderate surface radiation.</td>
<td>Having reasonable amount of greeneries in a fragmented manner.</td>
<td>Moderately dense, in some parts buildings having good amount of set backs and greeneries.</td>
<td>Kalaivnar nagar. (refer Figure 6.1)</td>
</tr>
<tr>
<td>Four (good area)</td>
<td>Less runoff, less radiations, some areas having high pollution along the transportation corridors.</td>
<td>Having good amount of greeneries compare to above zones.</td>
<td>Built spaces are balanced with green spaces. Most of the houses having humble setbacks and good amount of greeneries.</td>
<td>Thiyagaraja nagar. (refer Figure 6.1)</td>
</tr>
<tr>
<td>Five (best area)</td>
<td>Very Less runoff, no surface radiation, generally air quality is good.</td>
<td>Very thick greeneries, mostly natural forests, wet lands, and coastal vegetations.</td>
<td>No or only few buildings are presented.</td>
<td>These areas needs mainly policy and guidelines, rather than micro level design, therefore, sample area is not selected.</td>
</tr>
</tbody>
</table>

Characteristics of each sample areas are elaborated below:
6.4 Umarpulavar Nagar is the case study area for Zone 1

Compared to all other zones, zone one has very dense built space and hardly has any vegetations. The Umarpulavar Nagar has been selected as the case study area to understand the characteristics of the zone one. The population of the Umarpulavar Nagar is 20921 within the area of 0.193 Sq.km (year 2001 census). The general characteristic of the built space is wall to wall constructed multi-story buildings. The streets are flanked by the continuous built space; buildings are just abutting the street. Most of the interior streets are lanes with haphazard sharp turnings. There is only two open spaces existing in the Umarpulavar Nagar, one is at church other one is at the school complex. The built space is so dense where the streets are mostly used for the permanent parking area for the two wheelers. The onsite observations are given in Figure 6.2 to Figure 6.7. All streets are having underground sewerage line in the middle of the road. There is no storm water line in the study area except at few places. The overhead electrical line is running all along the road. Nearly 95 percent of the Umarpulaver Nagar’s surface is either asphalt paved or concrete paved.

Figure 6.2 Most of the roads are narrow in Umarpulavar nagar.

Figure 6.3 In Umarpulavar nagar buildings are multistory wall to wall constructed structure.
6.5 Kumaran Nagar is the case study area for Zone 2

The zone two has very little amount of greenery and dense built spaces compared to zone three and four, most of the greens are either remnants of the woodlands or shrubs in the undeveloped plots. The Kumaran Nagar is the case study area selected to comprehend the characteristics of the zone two. The area of the Kumaran Nagar south is 0.152 Sq.km having population of 25756. From the onsite observation, two types of built morphology is existing at this case study area. That is, first one is wall to wall constructed buildings and second one is individual buildings having space around. In the Kumaran Nagar most
of the plot level green spaces are kitchen gardens, having shrubs and small trees either producing flowers or vegetables. There are few vacant lots, having bushes and shrubs sharing major part of the total greenery in the Kumaran Nagar. Many streets are narrow lanes flanked by wall to wall constructed buildings which just abutting the street, some of them having few trees. Sporadically the trees at the front set back of the some plots add some visual quality to the streets. The onsite observations are given in the Figure 6.8 to Figure 6.15.

The underground utility lines of the Kumaran Nagar are the sewerage line, water line, and storm water lines. The overhead utility lines are electrical lines, telephone lines and cable TV lines. Among the underground utility lines, only the sewer line is running all parts of the study area in the middle of the roads. There is no proper storm water line except in few places. The Kumaran Nagar doesn’t have any water line separately; it has the street side water storage tanks filled by mobile tankers. The major utility lines are shown in the Figure 6.16. Besides, the overhead electrical line is running across the study area. The study area doesn’t have properly paved pedestrian paths along the roads.

Figure 6.8 Some of the roads in the Kumaran Nagar is narrow.

Figure 6.9 In the Kumaran Nagar most of the greeneries are plot level gardens.
Figure 6.10 Space between the buildings and road is occupied by the service lines in the Kumaran Nagar.

Figure 6.11 Part of the built-up areas are wall to wall constructed houses.

Figure 6.12 Few lands are vacant in the Kumaran Nagar.

Figure 6.13 Occasionally streets are having few trees.

Figure 6.14 In the Kumaran Nagar commercial streets are completely missing trees.

Figure 6.15 In the Kumaran Nagar many houses are missing front setback.
Figure 6.16 Major service lines of Kumaran Nagar.
6.6 Kalaivanar Nagar is the case study area for Zone 3

Compared to zone 2, zone 3 has a moderate amount of tree cover, in a fragmented manner. To understand the characteristics of the zone 3, the Kalaivanaer Nagar is selected as a study area. It is primarily a residential area, having population of 23839 within the area of 0.707 Sq.km. It has a variety of development pattern ranges from plots having individual bungalows to wall to wall constructed dense development areas and in some parts slums also exist. Individual building plots have some amount of greeneries. Many of them are at the verge of converting into apartment buildings, due to population pressure. In the apartment plots, most of the areas are covered by the concrete surfaces, only very little amount of greeneries exist at periphery. Some streets are having good amount of greeneries, others having few or no greeneries. At few places people are growing greeneries in the space between their property line and road, due lack of space in their property. The Kalaivannar Nagar also has couple of parks and open spaces. Figure 6.17 to Figure 6.22 shows the scenario of the Kalaivanar Nagar.

The major under ground urban utilities of the Kalaiannar Nagar are sewer lines storm water line. The overhead utility lines are electrical lines, television and cable line. The major sewer lines are in the under ground, located in the middle of the roads. The storm water is generally connected with the sewer lines, at some places the storm lines are constructed separately at the margin of the road at one side. Often they are treated as platform for the pedestrian movements. Besides that, few roads are having pavements along the roads for the pedestrian movements. The pattern of existing urban utility lines of the kalaivannar Nagar are shown in the Figure 6.23.
Figure 6.17 In the Kalaivanar nagar some streets having good amount of vegetation.

Figure 6.18 The emerging apartment buildings are completely swallowing up the greeneries.

Figure 6.19 At few places the slums are encroaching on the potential plantable areas.

Figure 6.20 Kalaivaner Nagar also has wall to wall constructed houses at some places.

Figure 6.21 Though the plots are missing plantable space, some people are interested in maintaining plants in front of their house.

Figure 6.22 The pedestrian paths at many places are inadequate for movement, which can be used for plantation.
Figure 6.23 Major service lines in the Kalaivanar Nagar.
6.7 Thiyagaraja Nagar is the case study area for Zone 4

This is the second better zone of the Chennai city which has good amount of the tree cover balanced with built forms. Thiyagaraja Nagar is selected as a case study area to understand the characteristic of the zone four. It is popularly known as T. Nagar, one of the important commercial centers of the Chennai city, locating little off center of the city towards the south. T. Nagar, having population of 21521 within the area of 1.23 Sq.km. From the ground observation most of the developments are individual plot development, like bungalow type buildings, except the commercial streets. All those plots have good amount of open spaces as well greeneries on all sides of the buildings.

Many streets having good amount of tree-cover along the roads, few of them displaying the green vista effects. In some area due to pressure from the urbanization, individual house plots are converted into multi-storey apartments. Along the important roads, the residential buildings are transforming into commercial buildings, as a result plots are loosing the good amount of front areas as well the greeneries. Some of the pictures at various parts of T. Nagar area are given below in the Figure 6.24 to 6.29. The T. Nagar area also has good number of parks and play fields. The urban services of the Chennai city can be grouped under two categories namely, underground utility lines and overhead utility lines.
Figure 6.24 In many parts the plants from the setbacks of the abutting plots shades the street.

Figure 6.25 T.Nagar roads are having good amount of tree-cover.

Figure 6.26 Many of the streets are having avenue look in the T.Nagar.

Figure 6.27 At few places road side spaces are left as a vacant space.

Figure 6.28 Few streets in the T.Nagar are missing tree-cover.

Figure 6.29 Some commercial streets are don’t have adequate tree-cover.
Figure 6.30 Major service lines of the TNagar area.
The common underground utilities are water supply, sewerage lines and storm water drain lines. The overhead utilities are electrical lines and television, phone cable lines. From the ground observation it has been found that T. Nagar area having overhead electrical line all parts of the study area either at one side or both sides of the road, while the sewerage line runs underground in the middle of the road. The storm water drain is directly connected with the sewer line, at few places the storm line is constructed separately at the margin of one side of the road and some of them are treated as elevated paved areas for the pedestrian movement. The important utility lines in the T. Nagar area are shown in the Figure 6.30.

6.8 CONCLUSION

To comprehend the ecological objective and identify the required spatial strategies, this chapter has classified the entire Chennai city into five zones, according to the environmental performance. They are, 1. **Best Zone**, characterized by very less runoff, no surface radiation, generally air quality is good; 2. **Good Zone** characterized by less runoff, less radiations, some areas having high pollution along the transportation corridors; 3. **Fair Zone** characterized by moderate surface runoff, moderate surface radiation; 4. **Poor Zone** characterized by moderate surface runoff, more surface radiation, and poor air quality; 5. **Worst Zone** characterized by More run off, more surface radiation. Further it has also identified the sample area from each zone in order to study their characteristics. Through studying the sample area, each zone’s spatial conditions are appraised, in order to evolve appropriate green-cover improvement strategies for each zone.