CHAPTER 9
METHODOLOGY FOR MICRO-LEVEL TREE-COVER DESIGN

9.1 INTRODUCTION

Design of the micro-level plantation hold the key for the overall success of the city’s green improvement activity. A well-designed tree-cover will function over an extended period of time with the minimum input of resources. It will effectively fit within the urban system, which will reduce the conflicts between the tree and other urban activities. The proposed urban tree-cover plan could function effectively, only when the micro-level design is done properly by comprehending the onsite pattern and processes correlation.

The effective micro-level design should identify appropriate planting pattern, to meet the requisite of each plantable site, through which it should contribute to the enhancement of the city’s environmental performance. The entirety of the design process can be divided into five steps, namely, identifying the planting location, formulating the design goals, evolving the design criteria, identifying the plant list and proposing tree-cover design. The Figure 9.1 in the following page shows the link between various steps.

9.2 IDENTIFYING THE LOCATION

In the thickly dense Chennai city identifying the area for plantation is the cumbersome task. Besides, plantation at each site should meet the demands of its immediate surrounding. Such as, improve the visual
quality, meet up the recreation needs, accommodate the spillover activities like parking and gathering at physical level; restore the onsite natural processes, contribute to the biological diversity of the region and enhance the city’s environmental performance at process level. Therefore, selection of the appropriate site for the tree-cover is a multi-level task rather than a simple one. Specifically, importance of each site has to be understood in the context of the local level, ward level and city level (Figure 9.2).

9.2.1 Site should meet the city’s demands

Each plantable site should enhance the overall environmental performance of the Chennai city. That is, each site should be potential enough to make the ecological link with immediate surroundings to restore the flow of natural process (i.e. Flow of water, energy and species across the city). Since space is the major constraints, initially all the un-built spaces are taken into consideration. While doing so, areas which are not suitable will be excluded by means of exclusive factors. For instance, disturbance by the plant to the existing urban activities can be one such factor. The main objective of this stage is identifying more plantable locations so as to improve the environmental performance of the region. The four necessary tasks involve in this primary stage are:

a. Delineate the total search area

In this research the boundary of the search area is limited within the boundary of the sample area that has been identified in the previous chapter. Since each sample area directly representing the environmental performance zones of the Chennai city, same procedure could be applicable for other parts of the same zone.
Figure 9.1 Methodology for micro-level tree-cover design
b. Prioritizing the areas

Within the search area, the plantable sites are identified through prioritization. First and foremost, the areas that hinder other urban activities are given very low priority. Second, the site will cause potential disturbance either to the built structure or to the infrastructure are given less importance, which are delineated as areas that require special design. Third, site that won’t create much problems with other activity are grouped as desirable areas. Finally, the site that is free from other urban pressure are selected as potential area for green-cover improvement activities.

c. Identifying the limitations of each site

Once the potential sites are identified, the prevailing limitation to carry out plantation will be identified. Soil quality, space availability, amount of sun light, disturbance from near by activities, such as highways, main roads, railways and other proposed expansion of near by activities or city development proposal are some of the common hindrance for plantation.
d. **Identifying potential location**

Through analyzing the limitation, site that can potentially contribute to restoring the natural processes such as, ground water recharging, sustain the bio-diversity, and the site that can facilitate the linking of the isolated green spaces will be selected as potential location at the regional level.

**9.2.2 Site that could meet ward level demand**

Each site in the context of ward level is under huge pressure from the immediate surrounding. They are the one which determine the successes of the urban plantation. Due to that the potential sites that are suitable in the context of city level should be put into multi-criteria analysis, to examine their ability to meet the ward level demands. The criteria were broadly grouped under three categories, namely 1. Potential to enhance the ecological quality 2. Potential to strengthen the structure of the landscape 3. Potential to meet the social needs. The sub-criteria under each category are

**a. Potential to enhance the ecological quality.**

1. Degree of fragmentation from other green spaces within the ward.
2. Potential to link other green spaces.
3. Potential to become a part of the ecological corridor to serve as biological conduits between the wards.
4. Potential to protect the existing natural process.
5. Potential to restore the native ecosystems.

**b. Potential to strengthen the landscape structure.**

6. Potential to buffer the areas from nuisances.
7. Potential to enhance each land uses functions.
8. Potential to act as green-net work.
9. Potential to improve the visual quality of the area.
10. Able to complement the adjacent activities.
11. Ability to reduce the harshness of the urban areas.
12. Able to form blocks or hubs of natural area in the heavily built-up space.

c. Potential to meet the social needs.
13. Size and shape of the area.
14. Amount of hindrance from the adjacent activities.
15. Accessibility.
16. Number of inhabitants it could support.
17. Able to support the adjacent activities.
18. Capabilities to offer social benefits, such as to meet the recreational needs.

For the assessment scores on an ordinal scale ranging from 1 (not suitable) to 5 (most suitable) are assigned to the cell that representing the locations. Finally, in the overall analysis, the results of the different categories are added together. From the result most suitable area at neighborhood level are selected.

9.2.3 Site that meets the local demands

Finally, site that having enough space to accommodate the plantation, cause fewer disturbances to other activities and can provide physical, geological and biological support to the plant will be identified as plantable area. Finally, the design goals will be formulated to ameliorate onsite air quality, flood mitigation, stabilize the site climate and control the surface runoff.
9.3 FORMULATING THE DESIGN GOAL

The urban tree-cover should enhance the environmental performance of the city through restoring or reinstating the local process. The successful tree-cover should meet four requisites of the site; they are functional requisite, environmental requisite, spatial requisite and biological requisites.

a. Functional requisite

In a city, each site’s requisites are varying according to the prevailing condition at its location. To name a few, onsite and adjacent activities, visual and physical environmental conditions, urban built form and spatial structure, socio-cultural condition, land use, ownership and feasibility for plantation, etc. so the proposed plantation should take shape according to the conditions rather than confront with on and adjacent site functions.

b. Environmental requisite

Different environmental components of the site need different degree of treatment to enhance the overall environmental quality. For example, requisite to protect the surfaces from gaining the heat from the solar rays, reduce the runoff, increase the infiltration, and mitigate the air pollution, so on.

c. Spatial requisite

It is the demand of each site in terms of the desired size, shape and growth rate of the tree. It is to fit the plantation with the site’s limitations, in terms of the overhead and underground utilities.

d. Biological requisite

Requisite for the species which can withstand the site condition, land use, speed of the growth, capability to support the functions etc. In
addition, each site in the need of certain amount of green-covered area, species and age diversity to provide long-term stability.

9.4 EVOLVING DESIGN CRITERIA

The design criterion has been evolved as a framework to guide the local plantation in terms of identifying plants as well as to carryout the plantation. The objectives of the design criteria are to restore the natural processes through reestablishing the optimum tree cover. The design criteria intend to improve Chennai city’s environmental performance, by instigating appropriate planting in the available areas which can restore or protect the natural processes. The prime inputs required for design criteria development are detail information regarding plantable space, ecological sensitivity of that area, and the requisites of the sites. From that information design criteria will be evolved uniquely for each site within the green cover planning framework that is proposed in the previous chapter.

9.5 IDENTIFYING THE PLANT LIST

Selection and procuring the tree is the most challenging and important aspects of developing urban green space. Most of the tree related urban problems can be eliminated or reduced through selecting suitable species according to the local situation (functional requirement, environmental / ecological requirement, spatial requirement, and biophysical requirement). Towards this end, this part of the analysis proposes the plant selection method for a given location in the Chennai city. The process of plant selection method is divided into four steps namely goal, objective, means and criteria (Figure 9.3). Firstly, four basic goals are identified for the species selection criteria, they are 1.
Avoid the conflict between urban activities and trees 2. Get better performance from the tree. 3. Improve city’s environmental performance and 4. Maximize the tree cover. Then the goals are divided into number of objectives to meet the demands of the sites. From the objectives the means are identified for the species selection. Finally, the criteria for species selection are evolved from the means to meet the sites requirement. They are, the spatial suitability, the functional suitability, the biological-physical suitability, and the ecological suitability of the site. The spatial suitability is tree’s fitness for a given site in terms of it’s growth rate, it’s size and it’s shape and it’s adaptability to the site’s limitations; the biophysical suitability concerned with the tree’s aptness for a site with a given growth and physical constraints; the functional suitability evaluates the degree to which a tree can fulfill a site’s functional needs that can ameliorate the climatic or other local environmental conditions; ecological suitability is the ability of trees to restore the natural process.

9.6 DESIGN SCHEME

Once the set of plants are selected, the design schemes will be evolved according to the design criteria of the site. The design scheme mainly intends to improve the ecological condition of the study area. The major focus involved in the design schemes are:

1. Identify and connect the existing patch-corridor shape wooded areas to enhance the existing natural processes in the Chennai city.
Figure 9.3 Plant selection criteria
2. Create new patch-corridor shape ecological pockets through instigating planting in the vacant and waste lands and joining the fragmented wooden remnants.

3. Protect the existing vegetations from the development pressures particularly vegetation in the private property, in order to avoid upsurge in the current urban environmental problems.

4. Increase the canopy cover in areas having poor vegetation cover through planting in the gap sites, vacant lands, etc.

5. Minimize the built surfaces gaining heat from the solar rays. Reduce the surface runoff, through improving the permeability of the surfaces.

9.7 DESIGN PROPOSAL FOR THE LOCAL TREE COVER

There are two major underlying interests in the local tree cover design. The first one is increasing the local canopy covered area to reestablish the onsite natural processes in the cities. Second, is reducing the conflict between the tree cover and other urban functions. Mainly the tree-cover design is concerned with the physical arrangement of the trees as well as appropriate species selection for that specific location. The design proposal combines the short-term benefits for individual / the building owners with the long-term economic and ecological goals for the entire city. For instance improving the plantation at the local level can intervene appropriately the onsite natural processes and produce benefits such as, energy saving, improved air quality, ground water and increased physical comfort to the individuals / plot owners; thus improve the city’s environmental conditions, namely, pollution reduction, reduced heat island effects, and improved ground water level etc.