

Urban Greenery: Assessing Greeneries across Chennai, Tamil Nadu

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Abstract - Greenery has always played an important role in the liveliness of any city. The need for green spaces has been present since ancient times. **Due to undergoing urbanization trend worldwide, distance between city inhabitants and nature is increasing.** This will increase the exposure to certain environmental hazards, such as air and noise pollution. Many urban areas face increasing pressure from expanding populations, limited resources and growing impacts of climate change. These challenges must be addressed especially in cities to provide healthy and sustainable living environment. Urban design solutions should always consider both buildings and vegetation as being defining city's elements. **Urban greenery/forestry is one of the ways to bridge the gap between people and nature and to form a sustainable environment.** Most of the Indian cities are far behind in quality as well as quantity of urban forests than their counterpart in Europe and America. High population density is one of the reasons for underdevelopment of urban greenery sector. India can learn a lot from Chinese model of urban forestry development as both of them are the topmost populated countries of the world. Recently, some of the Indian cities like Chandigarh, Gandhinagar and Delhi have shown some improvement in this field. The benefits of green spaces in dense urban areas and their contribution for the sustainability of the cities are discussed below. This paper is also focused on Urban greeneries in Indian cities and steps taken to improve the green spaces. The paper concludes by discussing tree density in two areas of Chennai and suggesting recommendations to improve the same.

Key Words: Urban Greenery, Chennai, Sustainable environment, Climate Change, Urban Forestry.

1. INTRODUCTION

There are several types of green spaces in the city and all of them have their own role in the urban context. These different types of greenery are present in different urban scales which solves several functions in the city. Urban green infrastructure includes different types of blue-green spaces such as forests, wetlands, agricultural land, public parks, private gardens, single green elements (street trees, green roofs, etc.) or ponds and streams [1]. The presence of these green spaces encourages the use of outdoor spaces, increasing the interaction among citizens. India is urbanizing at a very fast pace. People move towards cities not only for employment but also for better education facilities provided in urban areas which could also be due to increase in annual income. All such activities cause urban sprawl, noise and air

pollution. The urbanization does not consider the importance of urban open spaces. This rapid urbanization is causing congestion and pollution in the cities [4]. It is clearly seen that the core urban area is heavily congested by concrete jungles and results in pollutions. The downtown of an area is densely populated and the total number of trees present there is totally reduced. These may cause several different effects in future. The enhancement of urban green spaces or urban forests is one of the ways, which has the potential to mitigate the adverse effects of urbanization in a sustainable manner, making cities more attractive and comfortable to live in. Conservation along with the development of green spaces have been used for a long as an essential strategy to reduce the conflict between retaining the environmental quality and rapid urbanization [5]. Central and state governments in India are realizing the importance of urban green spaces in cities/towns. Greeneries are considered only after a big climate change. It should be thought while planning before the city expands.

2. BACKGROUND

City is a cluster of people and each person need a common space for his leisure purpose and a green space to relax. Though the lifestyle of people in a city is developing a lot, the stress and tension is also equally increasing to them. One reason can be the lifestyle change and other main reason can be due to the losing of green spaces which are the main supplier of oxygen to humanity and lack of open spaces to relax oneself personally. Human is the main entity affected by lack of green spaces other than environment. Environment is facing severe impact due to losing of green spaces within the cities. Global warming, greenhouse gases, increase in urban heat island, increase in carbon footprint are the major effects to environment due to green cover loss. Currently many measures to increase and conserve green areas has been taken. The unsustainable consumption pattern of human had also led to scarcity of natural resources. The healthy living of urban community is getting worsen day by day.

Today 54% of the global population is living in urban areas [2] and the urban population is expected to cover more than two-thirds of the world population by 2025 [3]. The rapid increase in population, in conjunction with increase in the rate of urbanization, had led to unplanned and uncontrolled expansion of many towns. They have also resulted in the gradual loss of open spaces and green spaces in the city. The green space development is one of unplanned process in most part of the city.

Green space system plays a significant role in building up a low carbon city and ensuring sustainable development of a city. Although the loss of green cover is directly affecting the environmental quality, the land inadequacy and rapid urbanization process is also reducing the size of green space which makes the urban planning, management and construction a very serious problem in the future. Assuming that total amount of green space is certain, utilizing the limited green space for enhancing environmental quality becomes a paramount goal for urban green space planning. Besides, the recreational and aesthetic values of green spaces can attract tourists to the city and thereby can initiate employment and revenues [7].

The green space that is available in any city play a major role in buffering the human activity and all urban tensions. Green spaces provide numerous environmental services including noise reduction, air filtering, rainwater drainage, and microclimate regulation [6]. But the existing open spaces are struggling to meet the present need of both the human and environment. Hence consuming and preserving existing green spaces and proper planning of new open spaces is highly needed in the present context.

3. URBAN GREENERY

Urban greenery is a term that can mean everything, from city parks and traditional streetscaping to more modern adaptations like green roofs etc. The varied range of green spaces includes parks, urban forest, urban agriculture, street trees, residential lawns, garden, and yards that are either natural or human maintained [8]. There are countless ways that Urban Greenery can improve our urban areas. The most obvious benefit, of course, is more beautiful cities! But beyond aesthetics, urban greenery has been shown to result in cleaner air, safer neighborhoods and improved storm water management. Urban greenery can be used as a connecting corridor between the neighborhoods. Trees, flowers and other plants can be woven to give the area an overall feeling of a consistent urban fabric. Urban greenery can be used as a tool to distinguish it from surrounding neighborhoods and highlighting its unique character. This approach would be even more effective when done in conjunction with other connectivity strategies such as wayfinding, tourism and streetscape design. Green spaces refer to those land uses that are covered with natural vegetation in the built-up areas and planning areas.

The term urban greenery broadly defined as the role of urban vegetation including not only open spaces and parks but also residential gardens, roof gardens and any vegetation found in the urban environment (Michael Doherty,2005).

Green space system has a great effect on the urban feature. Only a good concordance between the man-made environment and natural environment can generate a human settlement. As a recycling organization of urban ecological system, greeneries have been prevalently concerned by the

society. People instinctively have unique psychology to green spaces at the beginning. Many scholars concern more on the quality of green space and their benefits. They emphasize on ecology, society and economy. This research will focus on the benefits of green spaces by using the major three classifications, including ecological benefits, social benefits and economic benefits.

3.1 Ecological Benefits

Trees can release oxygen and absorb carbon dioxide, thus balancing carbon and oxygen. It has been measured that 1-hectare broadleaves can consume 1 ton carbon dioxide and release 0.75-ton oxygen every day in the growing season. If an adult resident absorbs 0.75 kg oxygen and releases 0.90 kg of carbon dioxide every day, the balance between carbon and oxygen for one person will need 10 sq.m forestry or more than 25 sq.m lawn to maintain [9]. Based on this, some countries determined that green per capita should be 40 sq.m when planning the urban greeneries.

There are more and more toxic gases existing in the air with the improvement of industrial level. Under some concentrations many kinds of vegetation can absorb toxic gases into their bodies to transfer them into non-toxic gases or exclude those toxic gases out of their bodies.

Table -1: Few tree species and their Benefits

TREE SPECIES	POLLUTANTS ABSORBED	OTHER BENEFITS
English Oak	Nitrogen dioxide, Sulphur dioxide, Particulate matter	Provides habitat for wildlife
Eastern White Pine	Ozone, Nitrogen dioxide, Sulphur dioxide, Particulate matter	Reduces noise pollution
Red Maple	Ozone, Nitrogen dioxide, Particulate matter	Tolerates urban environments
Honey Locust	Particulate matter, Carbon monoxide	Provides shade and reduces energy consumption
Green Ash	Ozone, Particulate matter	Tolerates a wide range of soil types

As such, vegetation can play a cleaning function to air pollutions. Silver birch, Yew and elder trees are most effective at capturing particles with the hairs of their leaves contributing to reduction rates of 79%, 71% and 70% respectively. In contrast, nettles emerged as the least useful of the species studied, though they still captured a respectable 32%. Conifers, like pines and cypresses, are also good natural purifiers [10].

3.2 Social Benefits

Vegetation can reduce the fear of crime. The presence of tree or greeneries can lower stress and thus reduce crime. Comparing buildings with different levels of vegetation, those with high levels of vegetation recorded 52% fewer total crimes, 48% fewer property crimes, and 56% fewer violent crimes than buildings with low levels of vegetation [11]. Urban street trees create vertical walls that frame streets and provide a defined edge that can have an important effect on drivers and especially motorists to reduce speed, and give a better distinction between drivers and pedestrians. In addition, street trees can help reduce stress by relieving anxiety and depression. It can improve the mental health and quality of life among inhabitants. [11] Street trees also increase pedestrian safety because in the case of driving errors, they help to stop the driver from accidentally taking a human life.

3.3. Economic benefits

Greeneries can play a major role in generating economy through Tourism. Creation of new greeneries like forest, parks can attract new visitors. China, a country which is facing population explosion like India has given importance to urban greeneries. Cities in China like Changchun, Nanjing and Guangzhou has a green cover of more than 40%. China has a goal of expanding its green cover to 45% in 70% of their cities by 2050 [12]. Tourism is growing more in Chandigarh and Zakir Rose garden, an annual festival of gardens is planned in every February [13]. Tourists around nearby areas of Chandigarh enjoy this very much. These greeneries are used by many people for recreation purposes like active recreation such as skateboarding, sports, swimming etc., and passive recreation like watching a view, reading books, relaxing or interacting. This involves people to rest in a particular place or travel to a place which provides these benefits will increase tourism in any city.

4.URBAN GREEN STATUS OF INDIAN CITIES

New Delhi, capital of India has many restrictions in greeneries across the city. At present 20% of Delhi has its green cover making its per capita green space of 22m². City has good parks and gardens like Lodhi garden, Mughal Garden, Deer Park, Budha Jayanthi Smarak Park, Indraprashtha Park and the Grden of Five senses. Department of Environment and Forest of NCT, Delhi is responsible for increasing the green cover from 30km² to 300km² during last 10 years [14]. Gandhinagar project has a total area of 57km². By the year 2005, tree cover of Gandhinagar was 57.13% of around 32.56 km². Population of the city was 0.2 million in 2001, resulting in 160 m² per capita green space. Population of the city is 0.3 million in 2011. During this time, the varieties of tree species is low compared to Bangalore and Chandigarh. Semi- arid climatic conditions can be the major reason for this situation [15].

Table -2: Important Indian cities with Per capita green space

City	Population in million (Census, 2001)*	Forest and tree cover (km ²)	Per capita green space (m ² /inhabitant)
Gandhinagar	0.20	32.56	162.80
Chandigarh	0.90	49.00	54.45
Delhi	13.80	297.00	21.52
Bangalore	5.60	97.00	17.32
Jaipur	2.32	5.43	2.30

Chandigarh city has a geographical area of 35% under green cover which makes it a greenest city of India [16]. Population of the city was 0.9 million in 2001, making per capita green space as 55m² [Table 2]. Important parks are like Rose Garden, Bougainvillea Garden, Garden of fragrance, shanti Kunj, Hibiscus Garden, Botanical Garden and leisure Valley. Bangalore city is called as Garden city of India due to many private gardens, roadside and avenue trees and the magnificent Lalbagh and Cubbon Park. The city has a total of 705 parks. Besides these, there are around 200 open spaces and green areas which are planned to develop as parks and gardens [17]. Estimated crown cover of the city is about 19.9% of the geographical area. This amounts a per capita green space of 19.9% of the geographical area [Table 2]. But reports by Karnataka state remote sensing applications suggests a considerable decrease in the overall vegetation of the city. In Jaipur city, the area covered under parks is around 5.43km² for a population of 2.32 million, making per capita availability of 2.30 m² [table 2]. This is very low as per World Health organization norms of 9.0 m² green space per city dweller [18]. Most of the Indian cities except Gandhinagar and Chandigarh are far behind in per capita green space availability.

5.ASSESSING TREE DENSITY ACROSS CHENNAI

Chennai, the capital city of Tamil Nadu has a population of 11,235,018 [19]. Due to well-established industries and factories, it contributes the most to the economy of Tamil Nadu [20]. Due to population explosion and rapid urbanization, Chennai has a lot of pollution. This affects the greenery of the city. Chennai has an overall 0.50% of parks which is 9.3 sq.km in area and 0.06% of tree cover which contributes to 72.8 sq.km of its area [21] [Table 3].

Table -3: Percentage cover of buildings, parks, trees, temples, tanks in Chennai.

Chennai Municipal Corporation		
Name	Area Sq. Km	Percentage of area coverage
Buildings	241.5794	19.23%
Parks	9.2899	0.50%
Tanks	35.7288	0.13%
Temples	0.8449	5.49%
Trees	72.8157	0.06%
Others	104.194	0.04%

The percentage of trees, parks and tanks cover a total of less than 1% of the total area but buildings contribute to 19% of the total area. Chennai has more than 500 parks that comes under public green area, maintained by Greater Chennai Corporation. Among many national parks the well-known Guindy National Park is located in the city [22]. Other important parks include People’s Park, Huddleston Park, may day Park etc., Around 2000, Chennai has recorded more green cover [23]. Educational Institutions like Indian Institute of technology (IIT, madras), college of engineering, Guindy and madras Christian College, have a great green space and considered to be the green tanks of Chennai [24]. Botanical Park of Chennai built around 2010, Madhavaram Botanical gardens which is also a horticulture park is spread across 8 hectares. Around 2017, the green cover of Chennai has been considerably reduced compared to 2000 [25]. Mostly individual residential spaces, institutions and bigger parks only have the left-over greeneries.

Chennai has a variety of green spaces from landscapes around individual building, parks, gardens, wetlands and avenue of trees along the streets. When talking about tree density, Chennai has more of its trees along streets. According to a study in 2020, Chennai’s Teynampet has more green cover percentage of 22.78% which occupies 5.53 sq.km of the total area. The smaller number of green covers was found in Perungudi of 5.31% which covers 1.9 sq.km of the total area [26] [Table 4]. Green cover can be assessed between two areas in Chennai. Aminjikarai, the less green cover of Chennai and Anna Nagar, one of the areas with more green cover in Chennai. Both these areas come under the same Aminjikarai Taluk with a big difference in their green cover. Both these areas lie around the banks of River Cooum.

Aminjikarai known by its name as Amaindakarai is one of the oldest localities of Chennai. It was under the Madras district from 1946. Aminjikarai has its green cover along few roads and also along the Cooum river. Since this is a very old settlement, the buildings mostly are semi-attached wall to wall constructions with mostly buildings of two storey height. The amount of green cover percentage is around 2% with a vegetation of around 0.4 sq.km of the total area [26].

Table -4: Percentage of green cover and square kilometers of vegetation across Chennai.

Zone	Green Cover (percentage)	Vegetation (Sq. km.)
Thiruvottiyur	9.90	2.47
Manali	10.73	4.26
Madhavaram	16.21	5.42
Tondiarpet	8.57	1.82
Royapuram	13.09	2.79
Thiru Vi Ka Nagar	18.14	3.30
Ambattur	12.61	4.82
Anna Nagar	20.85	5.28
Teynampet	22.78	5.53
Kodambakkam	17.20	3.87
Valasaravakkam	12.78	2.60
Alandur	13.36	2.69
Adyar	30.10	12.06
Perungudi	5.31	1.90
Sholinganallur	12.17	5.13
Total	15.00	64.06

Anna Nagar, which can be known as Naduvakarai, which is located under Aminjikarai taluk. This is one of the residential areas of Chennai. Anna Nagar was developed by the Tamil Nadu Housing Board in the early 1970s following the World trade Fair in the area in 1968. The board developed residential plots, apartments, commercial spaces, wide roads, institutions, bus terminus and parks. All roads of Anna Nagar are covered by avenue of trees. Anna Nagar is a place where buildings are detached as in a plotted development. This is the major reason behind the tree density difference between nearby areas of Aminjikarai and Anna Nagar.

6.DISCUSSIONS AND CONCLUSION

Indian cities mostly face a serious issue of cutting down of trees mainly due to expansion of roads. Areas especially in Chennai also face the same issue. Trees can be transplanted into some other place before cutting especially the older trees. Trees are also damaged due to construction of buildings in any plots or in an area. Tree protection Zone (TPZ) is an area that is surrounding the tree to protect them from construction and development. TPZ is determined by the diameter of the tree at breast height, which is 1.4m above ground level. TPZ is calculated by multiplying DBH by 12, which gives the radius of TPZ [27]. This is important to protect the trees starting from their roots. Trees or greeneries should be protected by a strong fence.

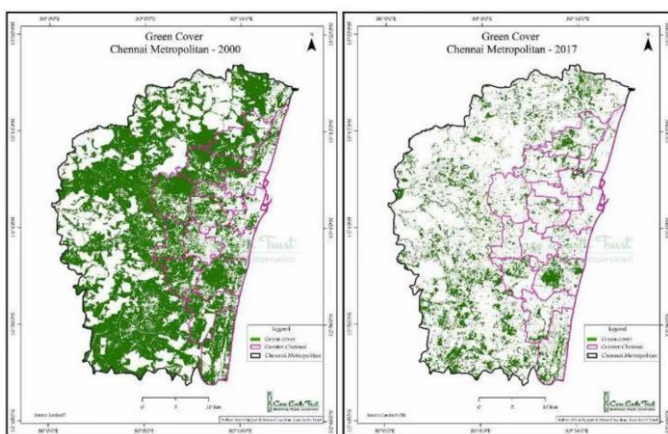


Fig-1: Green Cover status of Chennai in 2000 and 2017.

The presence of greenery in an area will increase its value by 4-15% depending on local conditions [28]. Reserving 10% areas in every plot can increase the greenery. Greenery makes an area more attractive and encourages residential and business to move into it. Crime will also be lesser in these areas. Green roofs and facades can be an important link to greener environments. City-dwellers who reside near green environments are away from the noise pollution. Urban greenery can be promoted in urban environments in the form of green roofs, green walls, courtyards, rooftop gardens. Trees and greeneries give many positive effects to cities today which faces many crucial challenges.

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