# Residents Preference and Perception of Street Trees of Different Neighborhood Areas in Visakhapatnam City, Andhra Pradesh, India.

Allu RevathiDevi<sup>1</sup>, Vijayalaxmi J<sup>2</sup>. Ramesh Srikonda<sup>3</sup>.

Department of Architecture, School of Planning and Architecture, Vijayawada, Andhra Pradesh India. Email: allurevathidevi@yahoo.com, vijayalaxmij@spav.ac.in, ramesh.srikonda@spav.ac.in

# Abstract

The street trees play an important role in the daily life of the urban resident and it is difficult to imagine life without trees. Lifestyles of urban residents and their habitats have undergone tremendous changes over the years and human population and pollution levels have increased abnormally. There is a knowledge gap in our understanding of conservation in urban green spaces since many metropolitan regions have a poor understanding of the importance of street trees to sustainable development. Street trees are planted for a number of reasons, and they provide a broad range of useful functions that benefit urban residents. In order to understand various aspects relating to street trees and the aesthetic and sustainable benefits, this paper compares residents' preferences for tree size, shape, and growth rate among six selected Visakhapatnam neighborhood areas. It also examines residents' perceptions of the benefits and annoyances that trees provide. Chi-square test is performed to see any significant difference in the importance of each sustainable factor given by the local neighborhood residents from different study areas in Visakhapatnam city. This gives us a better understanding of the public's opinion broadly and enables us to provide recommendations for decision-makers regarding potential new approaches for urban arboriculture and planning the street vegetation based on the results of the analysis.

Key words: street trees, perceptions, preferences, sustainable development and neighborhoods.

# Introduction

Street trees are defined as trees growing along public street right of-way and managed by the Local Municipalities. For people of all ages to engage in activities like walking, sitting, cycling, and doing business, streets are the most significant and widely dispersed urban public spaces (Jin et al., 2019). Urban vegetation is gaining more importance due to rapid urbanization in developing countries (United Nations Department for Economic and Social Affairs., 2003). However, numerous research studies indicate that urban greenspace provides a vast array of sustainable benefits to support, maintain, and enhance quality of life, and plays an essential function in maintaining sustainable cities. (Seiferling et al., 2017). Street trees influence the urban microclimate (Sanusi et al., 2017), mitigating the heat island effect (Lanza

& Stone, 2016), reduce air pollution (Harris & Manning, 2010) and block wind, provide cooling effect, shade and biological diversity (Li et al., 2018; Subburayalu & Sydnor, 2012), as well as influencing property values (Pandit et al. 2013). Street trees are the strongest determinants of the aesthetic quality of street scenes, according to research (Schroeder, 1989). Street vendors benefit from street trees because they provide shelter and thus some protection from the sun and rain (Nagendra & Gopal, 2010). To shape the visual and sustainable characteristics of city streets may be partially a public responsibility, but this necessitates an enhanced urban landscape. This type of planting is a significant element of the cityscape in most developed cities (Arnold, 1993). Preservation of street trees and green spaces improves the quality of life by providing residents with natural settings for recreation and leisure by safeguarding the quality of basic resources such as air and water. Urban environments can be significantly improved by the presence of trees. Urban planners can maintain the appropriate quantity of greenery in cities for both sustainability and human well-being with the help of assessments of green spaces in metropolitan areas. Miller's 1997 study proposes a model that includes parameters such as site factors, social factors, and economic factors to facilitate the selecting of suitable species for urban street trees. It may be difficult for street trees to survive and thrive in the city owing to the extreme conditions they face. Roadside tree species selection is thus one of the most important variables in offering remarkable advantages and tolerance of hard growth circumstances (Chen et al., 2017; Jim, 2003; Sjöman & Busse, 2010).

The study is based on a tree population count, in which all tree species are recorded, and various parameters are analyzed. Additionally, we examine the residents' opinions of street trees, perceptions of the benefits and annoyances trees provide, and preferences for tree size, shape, and growth rate in six different neighbourhoods within the Greater Visakhapatnam Muncipal Corporation (GVMC). The focus of this research is to explain the physical properties of street trees along certain selected streets, as well as their appropriateness, issues, and impacts on the surrounding area's physical, social, and economic environment, and to provide viable solutions to solve the problems.

# **Review of literature**

The term "perception" refers to the knowledge and comprehension of urban green areas and trees that are acquired via the senses (Coder, 1985; Kirkpatrick et al., 2013; Orland et al., 1992). A variety of different classifications have been devised for the opinions expressed by the locals. For a long time, researchers in the disciplines of design and sustainability on all fronts social, economic, and ecological have been curious about how people's tastes change through time (Yoon et al., 2001; Lee & Chang, 2008). The presence or absence of green spaces, the condition of these green spaces and trees, and the impacts they have either on the environment or on residents all play a role in shaping citizens' perceptions and attitudes towards urban trees and green spaces (Dilley & Wolf, 2013; Shackleton & Blair, 2013). The management of diverse types of urban green spaces must consider designing tools that allow for the analysis and designing of each one in a unique and specific manner, because the number of structures and problems in places like streets can be greater. Then, it must be accomplished to provide the environmental, social, economic, and aesthetic benefits associated with the presence of trees in urban areas (Kenney et al., 2011; Mullaney et al., 2015). Green areas with trees may influence people's tastes and social interactions (Coley et al., 1997; Kuo et al., 1998). It is necessary to assess public opinion while considering the likelihood of such a development. It's important to understand how people feel about street trees in general, but it's also fascinating to understand how people feel about how a street looks as a complete, including seating areas and tree maintenance practices.

People's perception and attitudes on tree values have been studied, given few international studies on street tree preferences; concerns concerning study generalizability are indicated. Attitude and perception studies are most common in the US, UK, Australia, and China. These studies have sought to understand inhabitants' preferences for urban green spaces, related values, and species preferences. Residents' views towards tree planting and upkeep have also been researched (Summit & Mcpherson, 1998). UK researchers are negative. Scottish citizens of treeless streets opposed street tree planting (Hitchmough & Bonugli, 1997). They also found that colder, less bright places like the northern UK value trees' shade more than sunnier regions like the midwestern the United States. "The majority of trees are removed as a result of complaints, or direct action, by the majority of those surveyed valued sunlight in their rooms, patios, washing lines, and gardens more than the presence of a nearby tree," according to Gilbert, 1996, but "A proportion of tree losses (3-35%) are a delayed result of damage incurred during construction." In 2003, (Flannigan, 2005) conducted a study in North Somerset and Torbay, southwest England, using a modified version of (Schroeder & Ruffolo, 1996)'s 1988–1990 Downers Grove survey. All three neighbourhoods were asked to rank their overall happiness with a street tree in front of their house, the significance of its advantages and annoyances, and the tree's size, shape, and growth rate. Fraser & Kenney (2000) discovered a wide variety of attitudes towards urban trees among participants from four distinct cultural backgrounds, which they linked to the historical landscapes of their cultural origins. He also discovered that Canadians from different regions of the world had significantly different preferences for the presence, size, and types of trees near their homes. When he surveyed Melbourne residents, he found that Australians prefer spherical and medium-sized trees over the larger street trees that are favored in the United States (Schroeder, & Cannon., 1983). In eastern Australian cities, (Kirkpatrick et al., 2012) found those residents' attitudes towards the planting and removal of various types of trees directly affected their behavior. "Residents have a strong influence on the presence and species of trees on public land between their property boundary lines in Australia, and it is discovered that attitudes towards trees had a direct impact on planting and removal behavior for both trees in general and specific types of trees" (Kirkpatrick et al., 2012). In a comparable telephone survey, Zhang et al. (2007) found that 75% of respondents agreed that urban greening is important in residential landscapes and that people prefer to live in homes with more trees. They also found that 98% of respondents in Alabama, a US state, recognized that trees provide people and their communities with positive values, including aesthetics, shade, and improved air quality. As a result, studies involving residents have looked at a variety of topics, such as residents' "attitudes to trees, negative experiences with trees, behavior in relation to trees" (Kirkpatrick et al., 2012) and preferences for trees with different sizes, origins, forms, foliage (size and texture), and canopy densities (Williams, 2002). Residents' opinions have been proven to be influenced by their income, education, gender, and age. On the other hand, inhabitants' opinions of trees are unaffected by the city in which they lived (Kirkpatrick et al., 2012). However, as people's support is crucial to the success of urban greening projects (Gorman, 2004; Williams, 2002), the information is also relevant to selecting and planting trees on public property, including street trees.

Thus, this study examines environmental, social, economic, visual, and related domains to comprehend the taxonomy of tree meanings and resolve their complicated linkages, benefits, and feelings. Trees are important because they preserve the environment and enhance urban life. They also appear appealing in cities. By giving a comprehensive understanding of residents' perceptions, attitudes, and preferences regarding street trees, the information

generated may assist city planners and administrators. It also enables us to make recommendations for a further choice of adaptable species and suitable tree and vegetation management techniques to preserve the existing green spaces and contribute to sustainable urban planning.

# **Study Area**

Visakhapatnam city (GVMC) coordinates are 17°41'18" north latitude, 83°13'07" east longitude, and 900 m altitude along the Bay of Bengal Sea coast (Fig. 1). This region is covered by hills ranging from 30 to 594 meters above mean sea level. Administratively, the city of Visakhapatnam is divided into six zones, with each zone containing 72 wards. There are 6 wards in zone 1, 12 wards in zone 2, 12 wards in zone 3, 19 wards in zone 4, 15 wards in zone 5, and 7 wards in zone 6. According to the 2011 census, the population of Visakhapatnam City (GVMC) is approximately 17,281,128, with a population density of 3,191 people per square kilometer. The reconstituted Greater Visakhapatnam Municipal Corporation has a total geographic area of 539.95 square kilometers. The study areas are located in the Visakhapatnam district, which is a backward region in terms of both economic growth and social development, and is a part of North Coastal Andhra Pradesh, which is a developing region in terms of both economic growth and social development. Due to the port and several large and medium-sized industries in and around the city of Visakhapatnam, which is located in the study region, many people from Srikakulam, Vizianagaram, and East Godavari, as well as Northern India, migrated there for a variety of reasons.



**Fig. 1:** Location of Study Area within the GVMC Limits and Location of selected Neighborhoods, Source: Author, 2023.

Six sample neighborhood areas are selected from each representative zone as highlighted in Figure 1. We obtained inventories of urban trees in the neighborhood sample units mostly plotted developments executed by the urban development authority, Visakhapatnam - Midhilapuri Colony, (zone 1); East Point Colony (zone 2); Official Colony (zone 3); Madhavadhara (zone 4); Pedhagentyada (zone 5); Simhapuri Colony (zone 6) and The areas of these colonies ranged from15- 20 Acres.

# Materials and Methodology

The methodology for data collection for this study is focused on collecting both qualitative and quantitative data from the site's physical environment, the local people, and governmental authorities. The major data collection is through the primary survey and Visual survey. Six sample neighborhood units were selected within six different administrative zones of Greater Visakhapatnam Municipal Corporation (GVMC). The analysis for this study only considered street trees. Data was gathered by self-administered questionnaire. The survey-type questionnaire method was chosen instead of interviews to reach a greater number of respondents. The questionnaire is designed as an online survey at Google Forms. It consisted of four sections of 47 questions. Each is briefly described below:

Respondents are asked to supply some basic demographic data as to their age, sex, level of education, Domicile status and whether how long have they been resident in that neighborhood area or city. The second part of the survey dealt with the satisfaction and residents attitude.in this part of the questionnaire included a series of questions regarding the knowledge of street trees, their benefits and visual aspects. The questionnaire included a list of 3 possible sustainable positive features (benefits) and visual features of street trees. Using simple checkmarks, benefits were to be rated: Very important, somewhat important, not very important, not at all important, no opinion and the evaluation of images was performed. The trees shown in the photo questionnaire are also presented. This analysis examined each of all photographs and classified each tree on a number of criteria: tree size, height, form, crown type, crown geometry, seasonal preferences and crown shape and pruning practices.

The third part of the questionnaire addressed annoyances of street trees. The questionnaire included a list of 11 possible Annoyances of street trees. These are determined using a similar rating scale. Finally, the fourth part of the survey dealt with the current policies and street maintenance and people's participation. A series of "yes" and "no" questions were used to determine if respondents would be willing to contribute money to a fund that would be used to maintain street trees in the research area as well as whether they would volunteer to assist maintain any street trees along the street where they reside. This paper considers these issues and undertakes a survey of the attitudes of Visakhapatnam urban residents to street trees using six neighborhood case study sites selected from within the greater Visakhapatnam Municipal Corporation limits. Data are then collated using online google form and convert into Microsoft Excel (2007) to transform the results obtained from the household questionnaire survey schedule into a percentage of respondents within each neighborhood of the city and after the quantification of data, statistical measures such as Chi-square test has been calculated with the help of Statistical Package for Social Sciences (SPSS). it is performed to evaluate whether there are significant differences in the mean across six distinct geographical areas based on percentages or categorical data. The level of significance considered is p < 0.05.

# **RESULTS AND DISCUSSION**

### Sociodemographic Features of the Respondents

A total of 600 respondents had responded to the questionnaires distributed to six selected neighborhood areas. According to figure 2, 308 (51%) are males and 292 (49%) are female. Most of the respondents are between 18 - 35 years old (44%). Other respondents are between above 60 years and below 18 years comprised of (8%) and (17%) respectively. The remaining percent (31%) is the age group between 35 - 60 years.



Fig. 2: Gender and Residential Status, - Socio demographic features of the Respondents, Source: Author, 2023.

The majority of 220 (36%) of the respondents attained bachelor's degrees. About 150 (25%) of the respondents had their Secondary education, 130 (8%) of the respondents had their Primary education and another 52 (22%) of the respondents attained Intermediate, only 48 (8%) of the respondents had above degree (master's degree). About 139 (23%) of the respondents are students whereas another 131 (22%) of the respondents are grouped under businesspeople, self-employed 88 (15%), housewife 75 (13%), unemployed 91 (15%) and other occupation 25 (4%) (Fig. 3).



Fig. 3: Educational qualification and occupation, Socio demographic Features of the Respondents, Source: Author, 2023.

#### Satisfaction with general appearance of street and trees

In this study, the general appearance of a street is taken as referring to all aspects that have to do with either the size of the street, the cleanliness of the street, the physical condition of the street and the appeal of the street to the eye. For most of the questions about popular perception and attitudes towards street trees, it is observed a significant difference among responses and that local resident are conscious about the beneficial effects provided by trees, whether environmental, social, economic, or visual. The findings enhanced and extended our understanding of the significance of street trees as an urban element in neighborhood landscapes. Residents' satisfaction with the overall appearance of their streets and the number of trees on their streets is also noted in this survey. This paper is intended to understand what residents thought made an ideal street for them in terms of both appearance and components. From Figure 4, observed that, of all respondents, 57(9.50%) of the respondents are not satisfied at all with the current situation regarding their neighborhood's street vegetation, whereas 111(18.50%) are rather not satisfied. Respondents from Madhavadhara (59 %)

are the most satisfied, while respondents from Midhilapuri colony (36 %) are the least dissatisfied (Figure 4). the obtained Chi-Square value (33.98) is higher than the table value and the p-value is < 0.05 which is significant at 0.05 level. These percentages indicate the need to improve urban plans, focusing on adding more green spaces. there is no Differences are observed in the level of satisfaction with gender category respondents of men and women are analyzed using the chi-square test for the frequency of responses given for each aspect between the two category respondents at a significance level of p>0.05.



Fig. 4: Satisfaction with general appearance of street trees and the number of trees on their street, Source: Author, 2023.

However, out of all neighborhood respondents, 331(55.17%) of the respondents are satisfied with the number of trees on their street compared to other streets, whereas 269(44.83%) are not satisfied (Figure 5). More respondents from Simhapuri colony (70%) than all other neighborhoods are satisfied with the number of trees on the street, while Midhilapuri colony (35%) had the least number of respondents who are dissatisfied. There are significant differences between the proportion of satisfied respondents within the selected neighbourhoods and the obtained Chi-Square value (35.57) is higher than the table value and the p-value is < 0.01 which is significant at 0.01 level. Most respondents expressed dissatisfaction with the general appearance of their street, addressing the undesirable state of the street infrastructure, cleanliness, and lack of drainage systems. Respondents from both Midhilapuri colony and east point colony neighbourhoods are the least satisfied with the general appearance of trees on their streets.

# Preferences for trees in urban neighborhood areas

# Importance of Trees in Urban Neighborhood Areas

Although most respondents felt that it is important to have trees on the street, and that trees are important for quality of life in cities, not all respondents had trees on their street (Figure 6). It is observed that, out of total 600 respondents, 406(67.67%) of the respondents consider trees to be an important part of their everyday life, whereas 128 (21.33%) are never thought about it and 66 (11.00%) are not liked. about it and 5 (0.83%) are not liked. Figure 6 shows that the obtained Chi-Square value (21.98) is higher than the table value and the p-value is < 0.05 which is significant at 0.05 level.



Fig. 6: Importance of Trees on their Neighborhood Street, Source: Author, 2023.

when asking about how important do you think it is to have trees on your street, of total all respondents, 45(7.50%) of the respondents thought that, the trees in their street are not at all important, whereas 82 (13.67%) are not very important, 146 (24.33%) are not expressed any opinion, 103 (17.17%) are somewhat important and 224 (37.33%) are very important. With the exception of Midhilapuri colony, more than half of respondents from each neighborhood believe that it is greatly important or somewhat important to have trees on the street. Results show that the obtained Chi-Square value (36.45) is higher than the table value and the p-value is < 0.05 which is significant at 0.05 levels. Both females (292) and males (308) across all neighbourhoods equally acknowledged the great importance of street trees. Results show that the obtained Chi-Square value (29.07) is higher than the table value and the p-value is < 0.01 which is significant at 0.01 levels.

# Street trees, their benefits and problems

It is observed that, out of total 600 respondents, 407(67.83%) of the respondents are expressed that, there are benefits from having trees in their street, whereas 84(14.00%) are never thought about it and 109(18.17%) are expressed that, there are no benefits from having trees in their street. The obtained Chi-Square value (22.03) is higher than the table value and the p-value is < 0.05 which is significant at 0.05 level. Out of 308 male category respondents, 208(34.67%) of the respondents are expressed that, there are benefits from having trees in their street, whereas 41(6.83%) are never thought about it and 59(9.83%) are expressed that, there are no benefits from having trees in their street. Out of 292 female category respondents, 199(68%) of the respondents are expressed that, there are benefits from having trees in their street, whereas 43(15%) are never thought about it and 50(17%) are expressed that, there are no benefits from having trees in their street and the obtained Chi-Square value (13.29) is higher than the table value and the p-value is < 0.05 which is significant at 0.05 level.

When we asked to rate the possible benefits of street tress, of all neighborhood respondents, 280(46.67%) of the respondents expressed that, they are having environmental benefits from the street trees, whereas 90(15.00%) are having ecological benefits, 107(17.83%) are having social/psychological benefits, 65(10.83%) are having economic benefits and 58(9.67%) are having visual benefits. most respondents cited the environmental and social/psychological benefits of street trees, whereas the visual benefits are minimally addressed.



Fig. 6: Environmental and Social benefits from the street trees, Source: Author, 2023.

According to figure 6, It is noticed that most of the respondents (24%) preferred that, street trees are very important to provide shelter for birds and other city fauna, whereas (18%) are reducing air pollution, (17%) are reducing noise, (14%) are temperature reduction, (14%) are minimize the rainwater in the streets and (13%) are reducing the wind velocity. It is concluded that, majority 524 (24%) of the respondents expressed that, street trees are very important to provide shelter for birds and other city fauna. The most of the respondents (35%) preferred that, street trees are very important for giving shade, whereas (27%) are stress relief and mood, (20%) are environment to children for play, and (18%) are cultural and spiritual fulfilment.it was conclude that, majority 524 (24%) of the respondents expressed that, street trees are very important to provide shelter for birds and other for play, and (18%) are cultural and spiritual fulfilment.it was conclude that, majority 524 (24%) of the respondents expressed that, street trees are very important to provide shelter for birds and other city fauna. It is concluded that, majority 475(35%) of the respondents expressed that, street trees are very important for giving shade (figure 6).



Fig. 7: Economical and visual benefits from the street trees, Source: Author, 2023.

However, most of the respondents (65%) preferred that, street trees are very important for increasing the Property Value, whereas (35%) are Attract new business to our community. Based on the results, it can be concluded that increasing the property value is the most preferred benefit, showing the highest ratio in the first and second preferences (figure 7),.

According to figure 7, most of the respondents (32%) preferred that, street trees are very important for enhancement of community appeal, whereas (26%) are blocking ugly views, (22%) are beautify the street and (20%) are emphasizing nice viewing corridors. It is concluded that, a majority 423 (70.50%) of the respondents expressed that, street trees are very important for enhancement of community appeal.

Figure 8 display that, out of total 600 respondents, 269(44.83%) of the respondents expressed

that, they are facing some problems with having trees in their street, whereas 62(10.33%) are never thought about it and 269(44.83%) are not facing any problems with having trees in their street. Out of 308 male category respondents, 144(24.00%) of the respondents expressed that, they are facing some problems with having trees in their street, whereas 34(6%) are never thought about it and 130(22%) are not facing any problems with having trees in their street. Out of 292 female category respondents, 125(21%) of the respondents expressed that, they are facing some problems with having trees in their street, whereas 28(4.00%) are never thought about it and 139(23%) are not facing any problems with having trees in their street.



Fig. 8: Annoyances from the street trees, Source: Author, 2023.

Respondents from all six neighborhood areas were also asked to rate the annoying features of trees near their street using the same scale as that used with benefits. With regard to problems with street trees, the mean perceptual scores of respondents based on their living area, (8%) of the respondents strongly agreed that, hide traffic signage, whereas (8%) are blocks sun into home, (8%) are host bad spirits and attract lightening,(8%) are dead tree leaves blocks to drains , (8%) are sap / sticky liquid dripping from tree, (8%) are make the street look messy and dirty and (8%) are blocks street lights .'Hide traffic signage and Blocks sun into home' are the most highly rated annoyance in all six neighborhood areas. 'Host bad spirits and attract lightning' and 'dead tree leaves blocks to drains' are also highly rated. The least preferred tree annoying features are the tree roots damaging the pavement (1%), the tree crowns growing into power lines/street lights (5%), the attract insects and other scary animals (6%), the branches sometimes fall on people (6%), the fallen leaves in autumn (6%), the criminal hide behind them (7%), the use up a lot of space (7%) and the cause allergies (7%).

# Visual preferences street trees

We compared residents' opinions of street trees, 402(67.00%) of the respondents liked the trees in their street, whereas 91(15.17%) have never thought about it and 107(17.83%) have not liked. Results show that the obtained Chi-Square value (30.83) is higher than the table value and the p-value is < 0.01 which is significant at 0.01 levels. Most of both males (33.50 %) and females (32.67 %) would prefer to have trees in their street. Similarly, significant differences in the proportion of males compared to females who would prefer to have trees in

their streets (p-value is < 0.05 which is significant at 0.05 level). Most of the respondents liked the trees in their street and the results clearly demonstrate that there is also a great difference in preference for different neighborhood areas.

This analysis focuses on preferred tree characteristics. The Statistical analysis compares preferences for trees with specific characteristics: tree size, form, shape, good growth rate, height, and crown geometry. 53 quantitative studies on preferences for forested landscapes from Norway, Finland, and Sweden are examined by Gundersen and Frivold (2008). They came to the conclusion that the preferences of respondents increased with increasing tree size and advanced stage of stand development. The results concerning visual preferences in relation to tree height showed that the majority of respondents 255(42.50%) prefer medium height trees. With the sets where height is one of several varying features, 191 (31.83%) of respondents chose taller trees, 81(13.50%) preferred low height type of trees and 73 (12.17%) preferred very low height type of trees in their street. Based on these results, Trees of a medium size were significantly preferred over larger and smaller trees (Chi-Square Value = 40.19, df = 15, p< 0.01). Tree crown geometry was also important: Trees with a roundhead type were significantly preferred over trees with pyramidal, horizontal branching and asymmetric crown type (Chi-Square Value = 31.14, df = 15, p< 0.01).

However, the majority of Respondents preferred far greater numbers of medium evergreen (81.17%) than Semi-deciduous (12.50%) and deciduous trees (6.33%). When asked what tree species you would like to have on their street, respondents showed a clear preference for shading trees and tendency to keep them away from rapid growth trees. Overall, residents had a high satisfaction with the growth rate of the trees in their street. Out of all neighborhood areas, 95(15.83%) of the respondents felt that the trees in their street are growing too fast, whereas 174(29.00%) are grow too slow, 276(46.00%) are grow good rate and 55(9.17%) are not given any response. The majority of all residents were satisfied that their tree grew at a 'good rate' and no residents thought their tree grew 'too slowly'. Results show that the obtained Chi-Square value (24.99) is higher than the table value and the p-value is < 0.05which is significant at 0.05 level. When we asked do you feel that the look of the trees in your street is generally, of all respondents, 107(17.83%) of the respondents felt that the trees in their street are very unattractive, whereas 99(16.50%) somewhat unattractive, 261(43.50%) are very attractive, 101(16.83%) are somewhat attractive and 32(5.33%) are not given any response. Most of the residents had a high satisfaction with the look of the trees in their neighborhood streets. Chi-Square value (57.92) is higher than the table value and the p-value is < 0.01 which is significant at 0.01 level.

Seasonal changes are crucial for the species utilized in streetscape design since they greatly affect the appearance of trees and neighborhoods, especially deciduous trees. Based on the results, 191 (31.83%) of the respondents preferred summer season for living with trees in their street, whereas 154 (25.67%) preferred autumn season, 163 (27.17%) are preferred winter season and 92 (15.33%) are preferred spring season. Although there is a substantial difference in preference ratings for the four seasons, summer, which was ranked as the favorite season for living near street trees, is more likely to represent a highly variable preference among the four seasons. Climate changes vary across cities, affecting recommended planting seasons. Trees planted in autumn or winter have more opportunity to establish strong root systems and survive the warm, dry summers typical of the coastal cities like Visakhapatnam. Planting trees in the spring or summer reduces their chances of thriving and surviving to maturity. The result shows that most of the respondents preferred summer season for living with trees in their street has great significant difference with that in the other three seasons. Therefore, in order

to keep the beauty of street vegetation all year round, planting the trees with a high preference in winter or autumn in urban green space is recommended. On the other hand, Silvennoinen et al. (2001) found that a beneficial effect of tree height variation on the public preferences. Trees of a medium height are significantly preferred over larger and smaller trees (Chi-Square Value = 40.19, df = 15, p< 0.01).

Out of all neighborhood areas 158 (26.33%) of the respondents are liked shading trees to have on their street, whereas 138 (23.00%) are liked flowering or ornamental trees, 111 (18.50%) are liked fruit or nut trees, 116 (19.33%) are liked low maintenance trees, 47 (7.83%) are liked minimal nuisance and damage trees and 30 (5.00%) are liked rapid growth trees. The majority of residences have shade and flowering or ornamental trees in their neighborhood streets, which show that people value the direct and tangible benefits such trees provide. We observed that the most planted trees in neighborhood streets were fruit and ornamental trees. This may be the reason as "promoting trees in public places is not just a sustainable agenda, but also desired for the provision of a variety of tangible and intangible benefits".



Fig. 9: The response of residents regarding the preferred pruning for the trees, Source: Author, 2022.

The results concerning visual preferences regarding trees with varying crown geometry showed that trees with a roundhead and dense crown are considered more attractive. it is observed from results, 239(39.83%) of the respondents are preferred roundhead type of trees in their street, whereas 124(20.67%) are preferred pyramidal type of trees, 114(19.0%) are preferred horizontal branching type of trees and 123(20.50%) are preferred asymmetric type of trees in their street. urban residents prefer a more spherical tree canopy shape than an artificial looking/shaped tree. According to figure 9, it is observed that, out of total 600 respondents, 203(33.83%) of the respondents are preferred spherical shape of trees in their street, whereas 111(33.83%) are preferred columnar shape of trees, 67(11.17%) are preferred cubical shape of trees, 123(20.50%) are preferred lopped pruning of trees, and 96(16.00%) are preferred elevated crown type of trees in their street. The fact that a spherical shape got relatively close to being the favorite, is interesting. Unfortunately, the main trend of knowledge and understanding tree maintenance and pruning types is negative – cutting the trees was considered mostly just reckless and careless. Trees with a spherical shape was significantly preferred over trees with conical/columnar or upright/open form, cubical, elevated crown and lopped pruning (Chi-Square Value = 21.37, df = 20, p< 0.05). The respondents gave relatively low preference for cubical shape pruning. This can be considered

surprising, since columnar tree form should be one of the best options to solve conflict between narrow street space and the wish to have street trees. In addition to asking respondents what could improve your street, of total all neighborhood respondents, 88(14.67%) of the respondents expressed that, street without any vegetation should improve their street, whereas 255(42.50%) are expressed that, street with a row of trees + walkable metal grates, 186(31.00%) are street with trees and shrubs and 71(11.83%) are street with only shrubs should improve their street. the obtained Chi-Square value (61.95) is higher than the table value and the p-value is < 0.01 which is significant at 0.01 level as a result of investigating the preferable street outlook, it is found that people perceive street space as the most attractive when there are shrubs and a row of trees + walkable metal grates added to the street trees.

#### Tree maintenance and attitude to tree pruning

Compared to all other neighborhood areas, 241(40.17%) of the respondents are expressed that, there are maintenance issues with the trees in their street, whereas 359(59.83%) are expressed that, there are no maintenance issues with the trees in their street. Chi-Square value (1.53) is smaller than the table value and the p-value is > 0.05 which is not significant. Residents are asked to give their opinion about the local authority's Council maintains the trees in their street. We observed that, out of six neighborhood areas, 20(3.33%) of the respondents thought that the council maintains the trees very poor in their street, whereas 83(13.83%) are poor, 207(34.50%) are neutral, 178(29.67%) are good and 112(18.67%) are thought that the council maintains the trees very good in their street. Although many respondents felt that there are insufficient trees in their streets and that it is poorly maintained, relatively few had raised their concerns with either elected local councilors or with municipal officials. A large proportion of respondents are willing to contribute time to help improve or maintain the condition of neighbourhood street trees. Compared to all other neighborhood areas, 337(56.17%) of the respondents are willing to volunteer with help planting and maintaining trees on their street, whereas 263(43.83%) are not willing. Recognizing that the municipality is neither doing enough to plant or maintain trees in streets, there are significantly more respondents across all neighborhoods who would be willing to volunteer to help plant and maintain trees on their street compared to those who would not be willing. Chi-Square value (44.71) is higher than the table value and the p-value is < 0.01 which is significant at 0.01 level.



**Fig. 11**: The response of residents regarding the responsibility to plant and maintain street trees and the city's tree preservation policies in their neighbourhood area, Source: Author, 2022.

Out of total 600 respondents, 132(22.00%) of the respondents thought that, community is the responsible to plant trees on the street and maintain them, whereas 197(32.83%) are

Municipality is the responsible, 54(9.00%) are NGO are the responsible, 195(32.50%) are Individual is the responsible and 22(3.67%) are thought that no one is responsible about it. Many respondents believe that every individual person and their local municipality are responsible for the planting and maintenance of street trees. It is evident that citizens are becoming more and more interested in public services, with street tree maintenance being one of the most essential in an urban setting. For the further steps in improving urban planning, street tree placement and maintenance, it is necessary for planners to work with public opinion, not against it. Most research participants felt that the responsibility to plant and maintain trees in their neighbourhood and city lay with the municipality, rather than individuals or any other stakeholders outside of the municipality. This is mostly due to their perception that the property they occupy as well as the neighbourhood itself belong to the municipality, the municipality has the necessary resources for planting and maintaining street trees, and it was in responsible for offering services.

Residents are asked to give their opinion about the City's tree preservation policies. Of all respondents, 88(14.67%) of the respondents are very familiar with the City's tree preservation policies, whereas 189(31.50%) are somewhat familiar, 115(19.17%) are not at all familiar, 145(24.17%) are unfamiliar and 63(10.50%) are not given any response. Chi-Square value (270.51) is higher than the table value and the p-value is < 0.05 which is significant at 0.05 level.



**Fig. 11**: Resident's willingness to assist in planting and maintaining trees on their street and opinion about the type of measures they prefer in street trees, Source: Author, 2022.

When asked what type of measures you prefer in street trees, most of the respondents showed a clear preference for tree maintenance and trees must be preserved. Out of total 600 respondents, 177(29.50%) of the respondents preferred that, the trees has to be preserved in their street, whereas 70(11.67%) are preferred that the trees has to be cut, 202(33.67%) preferred that, the trees maintenance is necessary, 68(11.33%) preferred that, the trees pruning is necessary, 31(5.17%) preferred that the trees has to be detailed investigation of the tree is necessary, 40(6.67%) preferred that, the trees has to have root protection, 12(2.00%) preferred further measures. obtained Chi-Square value (1570.25) is higher than the table value and the p-value is < 0.01 which is significant at 0.01 level. In order to improve residents' satisfaction with the level of vegetation around them, we should consider their perceptions and preferences while designing street trees. This will help to strengthen and develop both the aesthetic and sustainability benefits that trees provide to communities.

#### Conclusion

The benefits of trees to society and urban environments are numerous. The purpose of this study is to elicit responses from the residents of the neighbourhoods towards the features of street trees like their physical characteristics, suitableness, problems, and effects on the neighborhood in terms of environmental, physical, social, aesthetic, and economic conditions, as well as any potential remedies to these issues. However, most respondents felt that street trees make their communities better places to live. The environmental benefits of the trees are scored highest, but the fact that they hide traffic signs and prevent sunlight from entering homes is considered the most annoying aspect. It is evident that research in the field of street trees evaluation and people's preferences is needed to support better practices which are sustainable and promote valuable information for future planning policies.

# **Reference:**

Arnold, H.F. (1993). Trees in Urban Design. Landscape Journal, 13(1), 64-65.

- Chen, Y., Wang, X., Jiang, B., Wen, Z., Yang, N., & Li, L. (2017). Tree survival and growth are impacted by increased surface temperature on paved land. Landscape and Urban Planning, 162, 68–79.
- Coder, R. D. (1985). Identified Benefits of Community Trees and Forests.
- Coley, R.L., Kuo, F.E. & Sullivan, W. C. (1997). Where does community grow? The social context created by nature in urban public housing, Environment & Behavior, Vol 29, pp 468-492. Hispanic Journal of Behavioral Sciences, 9(2), 183–205.
- Dilley, J., & Wolf, K. L. (2013). Homeowner Interactions with Residential Trees in Urban Areas, 39(November), 267–277.
- Flannigan, j. (2005). Arboricultural journal : the international journal of urban forestry an evaluation of residents ' attitudes to street trees in, (october 2014), 37–41
- Fraser, e. D. G., & kenney, w. A. (2000). Cultural background and landscape history as factors affecting perceptions, (january 2000).
- Gilbert, O. L. (1996). Retaining trees on construction sites. Arboricultural Journal, 20(1), 39–45.
- Gorman, J. (2004). Residents' opinions on the value of street trees depending on tree allocation, Journal of Arboriculture.
- Harris, T. B., & Manning, W. J. (2010). Nitrogen dioxide and ozone levels in urban tree canopies. Environmental Pollution, 158(7), 2384–2386.
- Hitchmough, J. D., & Bonugli, A. M. (1997). Attitudes of residents of a medium sized town in south west Scotland to street trees. Landscape Research, 22(3), 327–337.
- Jim, C. Y. (2003). Protection of urban trees from trenching damage in compact city environments. Cities, 20(2), 87–94.

- Jin, H., Liu, S., Jin, H., Liu, S., Kang, J., Human, R., ... House, C. (2019). Thermal comfort range and influence factor of urban pedestrian streets in severe cold regions, 198(February), 197–206
- Kenney, W. A., Van Wassenaer, P. J. E., & Satel, A. L. (2011). Criteria and indicators for strategic urban forest planning and management. Arboriculture and Urban Forestry, 37(3), 108–117
- Kirkpatrick J.B., Davison, A., & Daniels, G. D. (2012). Resident attitudes towards trees influence the planting and removal of different types of trees in eastern Australian cities. Landscape and Urban Planning, 107(2), 147–158.
- Kuo, F. E., Bacaicoa, M., & Sullivan, W. C. (1998). Transforming inner-city landscapes: Trees, sense of safety, and preference. Environment and Behavior (Vol. 30).
- Lanza, K. and Stone Jr, B., 2016. Climate adaptation in cities: What trees are suitable for urban heat management? Landscape and Urban Planning, 153, pp.74-82.
- Lee, C.-C., & Chang, C.-P. (2008). Tourism development and economic growth: A closer look at panels. Tourism Management, 29(1), 180-192.
- Li, X., Ratti, C., & Seiferling, I. (2018). Quantifying the shade provision of street trees in urban landscape: A case study in Boston, USA, using Google Street View. Landscape and Urban Planning, 169(February 2017), 81–91.
- L. Sandberg, A. Bardekjian, and S. Butt (2015) In Urban Forests, Trees, and Greenspace: A Political Ecology Perspective, Florence, Routledge.

McPherson & Rowntree, (1989), Using Structural Measures to Compare.

- Miller, R. W., Hauer, R. J., & Werner, L. P. (2015). Urban forestry: planning and managing urban greenspaces. Illinois, Waveland Press.
- Mullaney, J., Lucke, T. and Trueman, S.J., (2015). A review of benefits and challenges in growing street trees in paved urban environments. Landscape and urban planning, Volume 134.
- Nagendra.H, Divya.Gl, Street trees in Bangalore, (2010) Density, diversity, composition and distribution, Urban Forestry & Urban Greening, Volume 9, Issue 2,2010, Pages 129-137.
- Orland, B., Vining, J. & Ebreo, A. (1992). The effect of street trees on perceived values of residential property, Environment & Behavior, Hispanic Journal of Behavioral Sciences, 9(2), 183–205.
- Pandit, R., Polyakov, M., Tapsuwan, S., & Moran, T. (2013). The effect of street trees on property value in Perth, Western Australia. Landscape and Urban Planning, 110(1), 134–142.
- Rae, R. A., Simon, G., & Braden, J. (2011). Cities and the Environment (CATE) Public Reactions to New Street Tree Planting Public Reactions to New Street Tree Planting, 3(1).

- R.W. Day (1991) Damage of structures due to tree roots Journal of Performance of Constructed Facilities.
- Sanusi, R., Johnstone, D., May, P. and Livesley, S.J., 2017. The microclimate benefits that different street tree species provide to sidewalk pedestrians relate to differences in Plant Area Index. Landscape and Urban Planning, 157, pp.502-511.
- Schroeder, H. W., & Ruffolo, S. R. (1996). Householder evaluations of street trees in a Chicago suburb. Journal of Arboriculture, 22(1), 35–43.
- Seiferling, I., Naik, N., Ratti, C., & Proulx, R. (2017). Green streets Quantifying and mapping urban trees with street-level imagery and computer vision. Landscape and Urban Planning, 165(May), 93–101.
- . Sjöman, H., & Busse Nielsen, A. (2010). Selecting trees for urban paved sites in Scandinavia A review of information on stress tolerance and its relation to the requirements of tree planners. Urban Forestry and Urban Greening, 9(4), 281–293.
- Shackleton, C. M., & Blair, A. (2013). Landscape and Urban Planning Perceptions and use of public green space is influenced by its relative abundance in two small towns in South Africa. Landscape and Urban Planning, 113, 104–112.
- Subburayalu, S., & Sydnor, T. D. (2012). Assessing street tree diversity in four Ohio communities using the weighted Simpson index. Landscape and Urban Planning, 106(1), 44–50.
- Sullivan, W. C., & Lovell, S. T. (2006). Improving the visual quality of commercial development at the rural-urban fringe. Landscape and Urban Planning, 77(1–2), 152–166.
- Summit, j., & mcpherson, e. G. (1998). Residential tree planting and care: a study of attitudes and behavior in sacramento, california, 24(march), 89–97.
- United Nations Department for Economic and Social Affairs. (2003). Long range population projections. United Nations, New York, USA: Proc: UN Technical Working Group on LongRange Population Projections, 30 June. Development, (August).
- Williams, K. (2002). Exploring resident preferences for street trees in Melbourne, Australia, Journal of Arboriculture, 28(4), 16.
- Yoon, Y., Gursoy, D., & Chen, J. S. (2001). Validating a tourism development theory with structural equation modeling. Tourism Management, 22(4), 363-372.
- Zhang, Y., Hussain, A., Deng, J., & Letson, N. (2007). Urban Trees and. Environment and Behavior, 39(6), 797–814.