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# Composition of trees and population characteristics in the Lote MIDC industrial zone

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## ABSTRACT

Urban tree cover delivers an array of ecosystem services, including air pollutant reduction, stormwater runoff reduction, building energy savings from reduced heating and cooling costs, and the associated avoided carbon emissions from reduced energy use, and carbon dioxide sequestration. The study aims to inventory all the tree species with their common name, botanical name, tree height, girth at breast height, canopy spread and origin of the tree species found in Lote MIDC and perform diversity analysis. Tools like Ravi altimeter and measuring tape were used for measuring tree height, girth at breast height and crown width. Urban forestry has shown that they are very important in mitigation of the environmental degradation while the assessment of these trees remains low. The trees were identified by analyzing morphological characteristics (Leaf structure, trunk texture, seeds/fruits) and further analysis was done in PAST 4.13 software for diversity indices. A total of 625 trees were recorded which comes under 56 different species and 25 plant families. Native species found were 67.52% whereas exotic species were 32.48%. The Shannon–Wiener Index (H′ = 3.159) indicates moderate to high tree diversity, low Dominance index (D = 0.0702) and high Simpson's Diversity index (1–D = 0.9298) suggest low species dominance, though moderate Mango, False Ashoka and Gulmohar. Overall the study highlights that species composition supports the urban sustainability by providing different range of ecological services.

## KEY WORDS

Urban forestry; Tree species composition; Diversity indices; Ecosystem services

## ARTICLE HISTORY

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## Introduction

Urban forestry provides many ecosystem services including soil erosion, stabilizing the microclimate, generating oxygen, reducing noise, improving air quality by reducing air pollution, carbon sequestration and preserving biodiversity [1]. The urban green spaces are reducing day by day because of developing cities and industries, on one hand, struggle to keep the green space or grow new trees is increasing while on other hand how land is supposed to be used by people keeps on changing over time and new construction keeps on increasing [2,3]. The lack of up to date data such as number of trees present in an area, their types, health conditions are few of the problems and it is a painstaking job to inventory all the trees [4]. The knowledge gap on urban planning over time makes it a bit harder to protect the green spaces ultimately causing damage to the environment, it may slows down the work to improve and manage the parks and other such areas [5].

The other studies revealed knowing different conservation practices may help in picking the best method, filling the gaps if the fallow land is present or to create outreach programmes [2]. But without standardized data gathering procedure the progress tracking is blocked and weakens the understanding of effect of environment on urban trees. The previous studies showed techniques like identifying the trees by their leaf structure, trunk, fruits or seeds and marking the exact spot with the help of GPS tools while spotting common and rare types and checking their health condition were broadly used [6,7]. However, information such as the current count of total trees and the species which are growing in that area along with the health conditions and their relation with the ecosystem and urban stresses are still not known. This study might also help in showing the trends and causes of diversity patterns or the state of the trees which will provide the evidences for future comparison and to strategies the management plans and policies [8,9]. The goal of current study is to gather sufficient information about the trees in the Lote MIDC area present in Khed taluka for planning ecological decisions, the data collecting is crucial to accurately portraying the state of urban vegetation in emerging nation, where urbanization is occurring at an alarming rate and large campuses such as MIDC area offers ample space for tree planting which may help in mitigation of the climate change by storing carbon and sequestering it.

## Materials and Methods

### Study area

The Lote MIDC is present in Khed taluka near Khed railways station in Ratnagiri district of Maharashtra, served as the study site. The average temperature is between 26-27℃ and experiences 3280 mm-3804 mm of precipitation on average per year.

### Tree census

For the present study, the tree census data was carried out by physical enumeration of all the trees present in the study area and the data was collected, only trees with 2 meters of vertical height and a girth of 10 centimetre, the girth at breast height (GBH) were strictly measured at a standard height of 1.37 m from the ground level and were considered in the census while noting tree height, GBH, crown width, common/local and scientific name [9]. The tree height was measured with Ravi altimeter with a 20 m and 30 m scale, for measuring the girth at breast height and crown width , a

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flexible measuring tape was used, the crown width was measured in two directions i.e. north-south and east-west and average was taken. The survey was a single census and took place for 2-month period from 18th November 2024 to 16th January 2025.

Books like 'Trees of Sahyadri' and insights from locals helped naming the species correctly and help from plant taxonomist was taken to assist in identifying the tree specimens that could not be recognized from the study area, the plant taxonomist analyzed morphological traits such as leaf structure, trunk texture and reproductive parts (fruits/seeds). For recording the family of tree species, International Plant Name Index (IPNI) website was used.

### Statistical analysis

The collected data was fed to the Microsoft excel for further examination and diversity analysis was performed using PAST (Paleontological Statistics) 4.13 software.

## Results

### Species composition

The number of different trees recorded in the area are given in Figure 1 and a combination of ecological characteristics and functional categories can been seen. Fruit bearing species such as Artocarpus heterophyllus, Syzygium cumini, Mangifera indica and Cocos nucifera increases the site's ecological value by providing food to animals as well as for human use, Ornamental trees like Roystonea regia, Polyalthia longifolia and Delonix regia enhances the visual attractiveness while maintaining urban aesthetics, few species like Casuarina equisetifolia, Acacia auriculiformis and Gliricidia sepium helps in improving soil fertility and fixes nitrogen. The significance of designed green infrastructure in residential environments is illustrated by this variation, which supports several ecosystem functions like rain water control, habitat providing and microclimate regulations which is the result of community preferences, purposeful planting decisions and perhaps even natural generation in some areas.

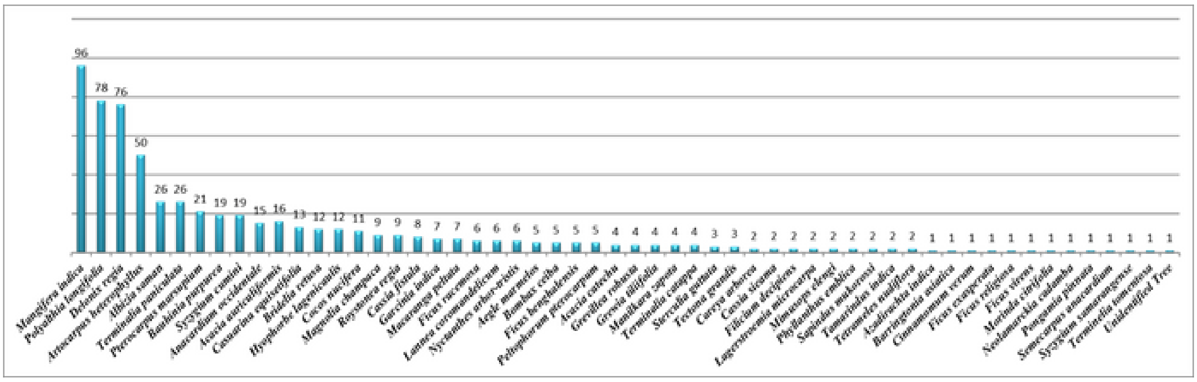


**Figure 1.** Species wise distribution and abundance of 625 trees recorded in Lote MIDC area.

### Species diversity indices

The diversity analysis performed using the PAST 4.13 software as given in Table 2 showed the presence of balanced variety of species which is suggested by the moderate to high level of diversity indicated by Shannon Wiener Index (H') value of 3.159. The Strong biodiversity is supported by Simpson's Diversity Index (1-D) of 0.9298 which indicates that there is low probability of two randomly chosen tree will belong to the same species. On the other hand, the Dominance Index (D = 0.0702) remains low signifying no single species has an overwhelming presence. Species such as Mangifera indica, Polyalthia longifolia and Delonix regia dominate numerically, the Evenness Index ($e^{H'}/S$ = 0.44) indicates a slight imbalance in species abundance.

**Table 1.** Diversity indices of tree species in gharda industrial housing complex .

| Indexes | Values |
|---|---|
| No. of species (S) | 56 |
| Individuals | 625 |
| Dominance (D) | 0.07021 |
| Simpson (1-D) | 0.9298 |
| Shannon (H') | 3.159 |
| Evenness ($e^{H'}/S$) | 0.4398 |

### Individual wise tree data

The data of all the tree species with their common name, botanical name, tree height, girth at breast Height and canopy spread is given in Annexure 1. A total of 625 trees were identified out of which Mango (Mangifera indica) showed up most often and the total count was 96 followed by Gulmohar (Delonix regia) and False Ashoka (Polyalthia longifolia) which had 78 and 76 each (Figure 3 and 4). These three species covered 40 percent of all trees witnessed during the study as shown in Table 2.



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**Table 2.** Composition of Tree species in Lote MIDC.

| Common Name | Botanical Name | Family | Count | Percentage (%) | Origin |
|---|---|---|---|---|---|
| Mango | *Mangifera indica* | Anacardiaceae | 96 | 15.36 | Native |
| False Ashoka | *Polyalthia longifolia* | Annonaceae | 78 | 12.48 | Native |
| Gulmohar | *Delonix regia* | Fabaceae | 76 | 12.16 | Exotic |
| Jackfruit | *Artocarpus heterophyllus* | Moraceae | 50 | 8 | Native |
| Rain Tree | *Albizia saman* | Fabaceae | 26 | 4.16 | Exotic |
| Kinjal | *Terminalia paniculata* | Combretaceae | 26 | 4.16 | Native |
| Malabar Kino | *Pterocarpus marsupium* | Fabaceae | 21 | 3.36 | Native |
| Kanchan | *Bauhinia purpurea* | Fabaceae | 19 | 3.04 | Native |
| Jamun | *Syzygium cumini* | Myrtaceae | 19 | 3.04 | Native |
| Cashew | *Anacardium occidentale* | Anacardiaceae | 15 | 2.4 | Exotic |
| Ear-Leaf Acacia | *Acacia auriculiformis* | Fabaceae | 16 | 2.56 | Exotic |
| Suru | *Casuarina equisetifolia* | Casuarinaceae | 13 | 2.08 | Exotic |
| Asana | *Bridelia retusa* | Phyllanthaceae | 12 | 1.92 | Native |
| Bottle Palm | *Hyophorbe lagenicaulis* | Arecaceae | 12 | 1.92 | Exotic |
| Coconut | *Cocos nucifera* | Arecaceae | 11 | 1.76 | Native |
| Soanchafa | *Magnolia champaca* | Magnoliaceae | 9 | 1.44 | Exotic |
| Royal Palm | *Roystonea regia* | Arecaceae | 9 | 1.44 | Exotic |
| Karnikar | *Cassia fistula* | Fabaceae | 8 | 1.28 | Native |
| Kokam | *Garcinia indica* | Clusiaceae | 7 | 1.12 | Native |
| Chand Vad | *Macaranga peltata* | Euphorbiaceae | 7 | 1.12 | Native |
| Umber | *Ficus racemosa* | Moraceae | 6 | 0.96 | Native |
| Mohot | *Lannea coromandelicum* | Anacardiaceae | 6 | 0.96 | Native |
| Parijatak | *Nyctanthes arbor-tristis* | Oleaceae | 6 | 0.96 | Native |
| Bel | *Aegle marmelos* | Rutaceae | 5 | 0.8 | Native |
| Sawar | *Bombax ceiba* | Malvaceae | 5 | 0.8 | Native |
| Vad | *Ficus benghalensis* | Moraceae | 5 | 0.8 | Native |
| Sonmohar | *Peltophorum pterocarpum* | Fabaceae | 5 | 0.8 | Exotic |
| Khair | *Acacia catechu* | Fabaceae | 4 | 0.64 | Native |
| Silver Oak | *Grevillea robusta* | Proteaceae | 4 | 0.64 | Exotic |
| Dhaman | *Grewia tiliifolia* | Malvaceae | 4 | 0.64 | Native |
| Chiku | *Manilkara zapota* | Sapotaceae | 4 | 0.64 | Exotic |
| False Almond | *Terminalia catappa* | Combretaceae | 4 | 0.64 | Exotic |
| Goldada | *Sterculia guttata* | Malvaceae | 3 | 0.48 | Native |
| Teak | *Tectona grandis* | Lamiaceae | 3 | 0.48 | Native |
| Kumba | *Careya arborea* | Lecythidaceae | 2 | 0.32 | Native |
| Kassod | *Cassia sieama* | Fabaceae | 2 | 0.32 | Exotic |
| Japanese Fern Tree | *Filicium decipiens* | Sapindaceae | 2 | 0.32 | Exotic |
| Nana | *Lagerstroemia microcarpa* | Lythraceae | 2 | 0.32 | Native |
| Bakul | *Mimusops elengi* | Sapotaceae | 2 | 0.32 | Native |
| Aonla | *Phyllanthus emblica* | Phyllanthaceae | 2 | 0.32 | Native |
| Reetha | *Sapindus mukorossi* | Sapindaceae | 2 | 0.32 | Native |
| Imli | *Tamarindus indica* | Fabaceae | 2 | 0.32 | Native |
| Bhend | *Tetrameles nudiflora* | Tetramelaceae | 2 | 0.32 | Native |
| Neem | *Azadirachta indica* | Meliaceae | 1 | 0.16 | Native |
| Samudraphal | *Barringtonia asiatica* | Lecythidaceae | 1 | 0.16 | Exotic |
| Dalchini | *Cinnamomum verum* | Lauraceae | 1 | 0.16 | Exotic |
| Karvat | *Ficus exasperata* | Moraceae | 1 | 0.16 | Exotic |
| Pipal | *Ficus religiosa* | Moraceae | 1 | 0.16 | Native |
| Payar | *Ficus virens* | Moraceae | 1 | 0.16 | Native |
| Noni | *Morinda citrifolia* | Rubiaceae | 1 | 0.16 | Exotic |
| Kadamb | *Neolamarckia cadamba* | Rubiaceae | 1 | 0.16 | Native |
| Karanj | *Pongamia pinnata* | Fabaceae | 1 | 0.16 | Native |
| Bhela | *Semecarpus anacardium* | Anacardiaceae | 1 | 0.16 | Native |
| Jaam | *Syzygium samarangense* | Myrtaceae | 1 | 0.16 | Exotic |
| Ain | *Terminalia tomentosa* | Combretaceae | 1 | 0.16 | Native |
| Unidentified tree | - | - | 1 | 0.16 | Exotic |



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## Native-wise tree data

From the dataset, 422 trees turned out to be local types accounting for 67.5 % which shows many indigenous trees grow there. Meanwhile, the rest 203 or the 32.5% were tagged as exotic species (Figure 2).

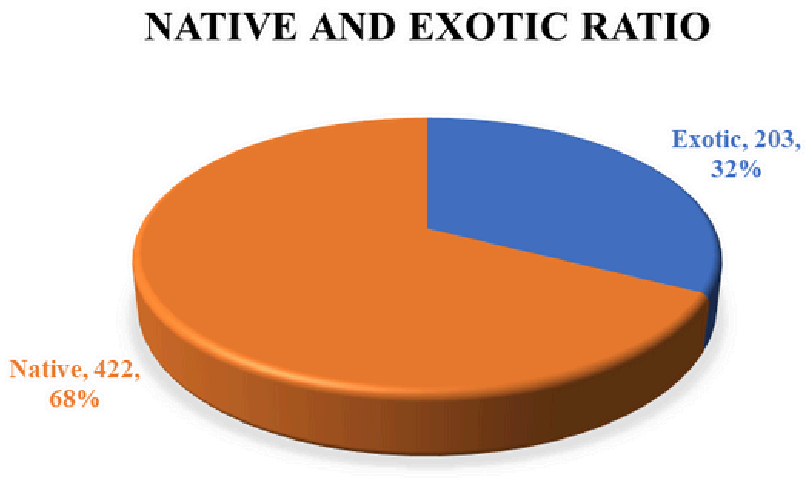


**Figure 2.** Ratio of Native and Exotic species present in MIDC Lote.

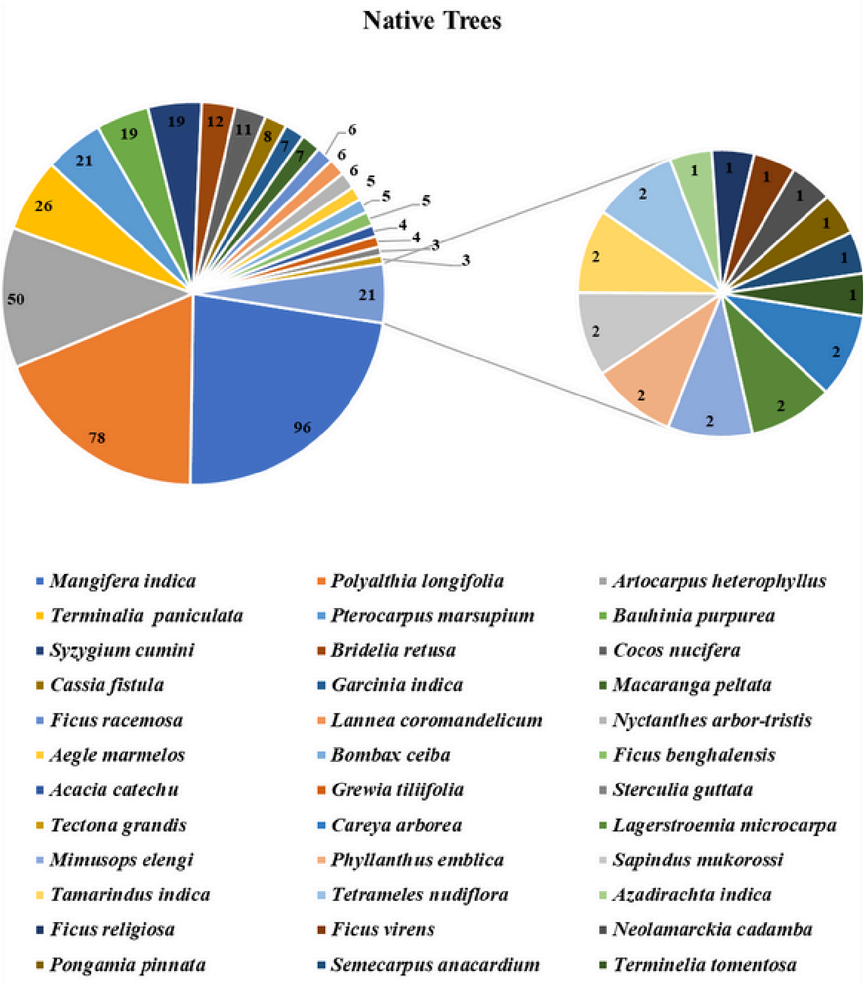


**Figure 3.** Indigenous trees species found in Lote MIDC.



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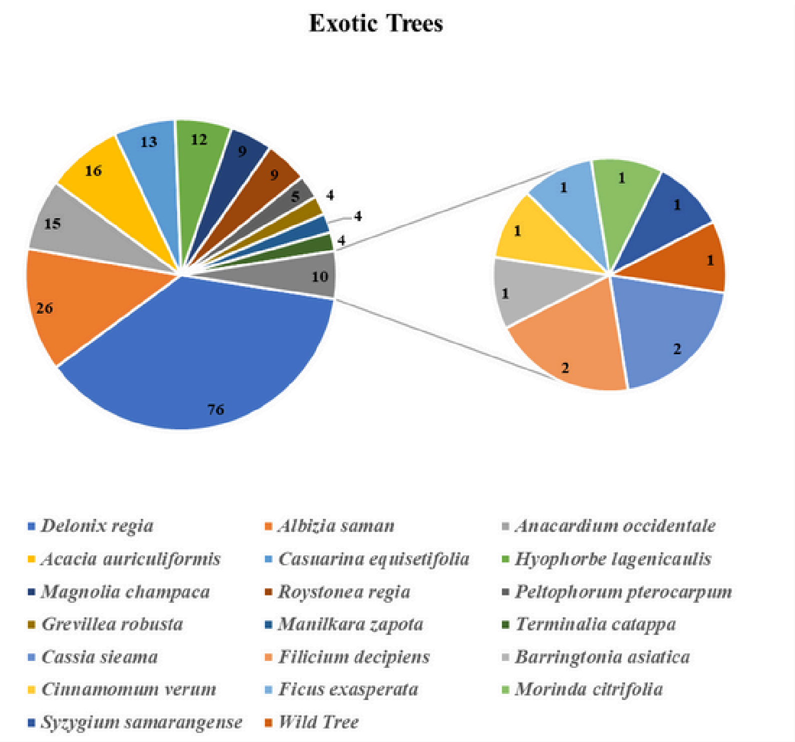


**Figure 4.** Exotic trees species found in Lote MIDC.

## Family wise tree data

The trees recorded belonged to 56 different species which were distributed across 25 tree families. One tree remained unidentified with its corresponding family and was tagged as wild tree highlighting need for further investigation by an expert plant taxonomist (Figure 5).

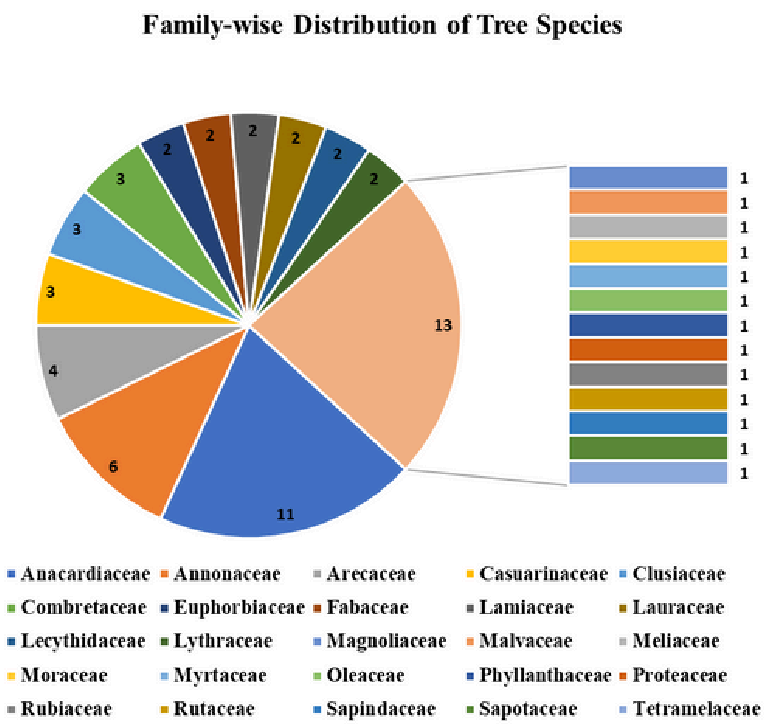


**Figure 5.** Family wise species distribution of the trees found in Lote MIDC.



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## Discussion

After a through survey a total of 625 trees were documented belonging to 56 species and 25 tree family and every single species were measured for girth at breast height (GBH), tree height and crown width for inventory purpose. The present study calculated different diversity indices such as Dominance (D = 0.0702) signifying no single species dominates overwhelmingly, Simpson (1-D = 0.93) which tells us that no two species when randomly chosen belong to the same species, Shannon (H' = 3.172) shows the variety of species availability on the research area and Evenness ($e^{H'}/S$ = 0.44) indicating a slight imbalance in species abundance. *Mangifera indica*, *Polyalthia longifolia* and *Delonix regia* were the dominant species which covered 40% of the total trees which tells us that the area lacks evenness. The reason behind the species dominance might be purposeful planting of *Polyalthia longifolia* and *Delonix regia* for their aesthetic value and dust-trap property.

The previous study showed that industrial area has less variety of species indicating lower Shannon value and the evenness values also declined near industrial area showing species are unevenly distributed with few tolerant species dominating the community increasing the Simpson's Diversity Index (10).

The urbanization often leads to species extinction yet, the urban trees are important for moderating microclimates, conserving local biodiversity and mitigating climate change specially in industrial zones and the tree family helps in recording the historical linkage [11]. The repeated tree census helps in finding the trends and mortality rate of trees in the area. Tree enumeration initiatives as previously done in Gujarat state to design appropriate urban forestry programmes were effective and can be adopted by other states as well [12].

The data was collected on paper during the field visit and transcription error were introduced during the data entry which were not evaluated by anyone. Furthermore, the Ravi altimeter used for measuring tree height was not digital and the data came in multiple of 5 rather than the exact value. Finally, the trees were not geotagged which would have helped in planning the future plantation drives where pollution resistant, nitrogen fixation and fast-growing species can be used and policies related to conservation of existing stand can be made.

## Conclusion

The dominance of multipurpose and ornamental species reflects both ecological function and aesthetic value. The diversity indices suggest a relatively healthy distribution of the species though some species were more abundant than the others. Overall, species composition supports the urban sustainability by providing different range of ecological services. The study provides raw data which can be helpful for further studies such as biomass estimation, assessment of carbon stock and carbon dioxide equivalent which can be used by industries in carbon credit programmes.

## Authors' contribution

Conceptualization of research (Chahande V. Dikshant.; Narkhede S. S.; Rane D. A.; Tripathi D. V.); Designing of the experiments (Chahande V. Dikshant; Narkhede S. S.); Execution of field/lab experiments and data collection (Chahande V. Dikshant); Analysis of data and interpretation (Chahande V. Dikshant; Narkhede S. S.); Preparation of the manuscript (Chahande V. Dikshant).

## Declaration

The authors do not have any conflict of interest.

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