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RESEARCH ARTICLE

ASSESSING URBAN DENDROFLORA IN RANAVAV CITY, GUJARAT, INDIA

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ABSTRACT

Urban arboreal and pedological systems exert significant influence in mitigating nutrient pollution and airborne contaminants within urban settings. They also contribute to carbon sequestration, alleviate urban heat islands, and enhance water purity. Urban trees offer a wide range of ecosystem services, economic benefits, and support in densely populated urban areas. Ranavav showcases an impressive array of trees, including both native and cultivated ornamental species, despite the coexistence of industrial and natural elements. The study area was divided into Seven zones to conduct a systematic tree census, utilising local flora for taxonomic identification. A comprehensive investigation documented 63 tree species from 27 botanical families, including notable families such as Moraceae, Fabaceae, and Annonaceae. Trees possess the capacity to mitigate air pollution by altering microclimates and inhibiting the formation of secondary pollutants. Moreover, they serve as natural barriers, reducing noise from traffic and construction activities, thereby enhancing the aesthetic appeal and livability of urban environments.

Key words: *Number of trees, Dendroflora, Ranavav city.*

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INTRODUCTION

Urban tree and soil systems have the potential to play a significant role in reducing the concentration of nutrient pollution in runoff within urban areas. Additionally, urban areas are often focal points for atmospheric pollution arising from mobile and stationary sources (Garty *et al*., 1996; Johnson *et al*., 1982; Sawidis *et al*., 2011). Trees have long been recognized as a means to decrease levels of gaseous and particulate pollutants (Dochinger, 1980; Nowak *et al*., 2006). Nevertheless, the impact of specific tree species emitting volatile organic compounds on ozone formation remains an ongoing research focus, particularly in urban environments (Calfapietra *et al*., 2013; Chameides *et al*., 1992; Nowak *et al*., 2006). Apart from their role in absorbing air pollutants, urban green infrastructure, especially the tree component, can significantly influence the capacity for carbon sequestration in urban areas (Edmondson *et al*., 2012; Pataki *et al*., 2006). Green infrastructure, defined as vegetation systems intentionally designed to promote environmental quality, can reduce the intensity of heat islands by providing shade and evapotranspirational cooling Urban trees are arguably the most effective and economical approach to mitigating and adapting to urban heat islands (Norton *et al*., 2015; Solecki *et al*., 2005). Their potential to remove nutrient pollutants and certain heavy metals from stormwater can be further harnessed to enhance water quality and reduce pollution (Denman *et al*., 2016). Urban trees provide a range of ecosystem services, including provisioning, regulating, cultural, and supporting services (Escobedo *et al*., 2011; Salmond *et al*., 2016; Säumel*et al*., 2016), which offer diverse economic, social, and health benefits (Roy *et al*., 2012). Despite requiring relatively small ground surface areas, urban trees effectively utilize vertical space to provide vegetative surfaces, making them easier to integrate into cities, even in densely populated neighbourhoods. Therefore, the planting and management of trees are crucial for ensuring, preserving, and supporting the delivery of ecosystem services and their associated benefits in cities where space is inherently limited (Haaland and van den Bosch, 2015; Vogt *et al*., 2017). The rapid growth of urban areas, coupled with climate change, gives rise to various issues such as air and noise pollution, the urban heat island effect, increased stress levels, habitat loss, and flash floods (Ahlfeldt and Pietrostefani, 2017; Bazaz *et al*., 2018; Berghauser Pont *et al*., 2020; Gren *et al*., 2018). Ranavav, located in the Porbander district of Saurashtra, holds immense ecological significance owing to its close proximity to the Barda hills, where the Barda Wildlife Sanctuary is nestled. The presence of the Barda Hills and their wildlife sanctuary has fostered a thriving and diverse environment within Ranavav. The city is adorned with an impressive array of trees, encompassing not only native and wild species but also meticulously cultivated ornamental trees. These trees not only add to the city's natural charm but also create a harmonious blend of ecological sustainability and aesthetic appeal. However, Ranavav's landscape is not solely shaped by its natural elements. The city is also home to a significant mining and mineral-based industrial sector due to the presence of rich minerals like limestone and chalk, which have undeniable implications for the local climate. The industrial activities in Ranavav exert an influence on factors such as air quality, temperature levels, and precipitation patterns, thereby affecting the overall climatic conditions experienced by its residents. Nevertheless, amidst the interplay of industries and natural surroundings, the diverse range of tree species in Ranavav stands out as a valuable asset. These trees serve as an essential component in maintaining the ecological balance of the city, contributing to its overall environmental well-being, and serving as a source of pride for its inhabitants. In this study, a comprehensive tree census was conducted, encompassing the scientific identification and counting of each tree species. The survey was meticulously conducted, covering every street and road within the city limits of Ranavav.

Study sites: Ranavav is a city located in the Porbandar district of Gujarat, India. Situated in the western part of the country, Ranavav is positioned on the Saurashtra Peninsula, which extends into the Arabian Sea. Ranavav is located at 21.68°N, 69.75°E (Fig. 1). It has an average elevation of 40 metres (130 feet). It has an approximate area of around 2.5 square kilometres and is divided into seven zones. As of the 2011 Indian census, this city had a population of 46,018. Geographically, Ranavav is characterised by a diverse landscape. The region features a mix of plains, hills, and coastal areas. There is also one historical place called Jambuvant's Caves from the time of the Ramayana. Ranavav experiences a typical coastal climate, influenced by its proximity to the Arabian Sea. The summers are generally hot and dry, with temperatures reaching high levels. The monsoon season brings rainfall to the region, typically occurring between June and September. Winters in Ranavav are relatively mild, with cooler temperatures.

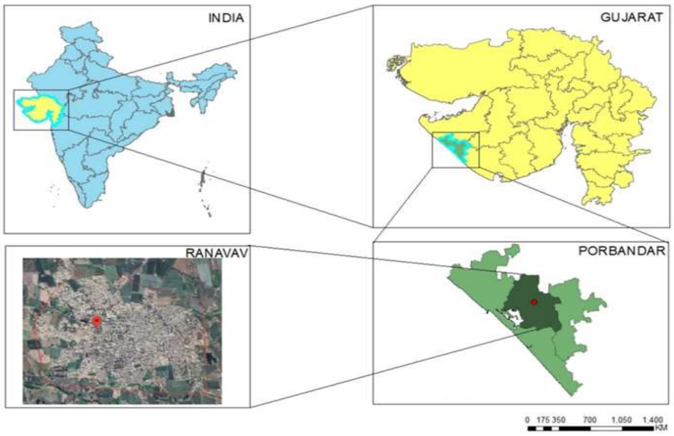

Fig. 1. Location of the study site

Survey: The study area is divided into seven zones (Fig. 2), and the counting of trees was done zone-wise. Plant species were identified using local flora. The survey was conducted meticulously in the year 2022, covering every street and road within the city limits of Ranavav.

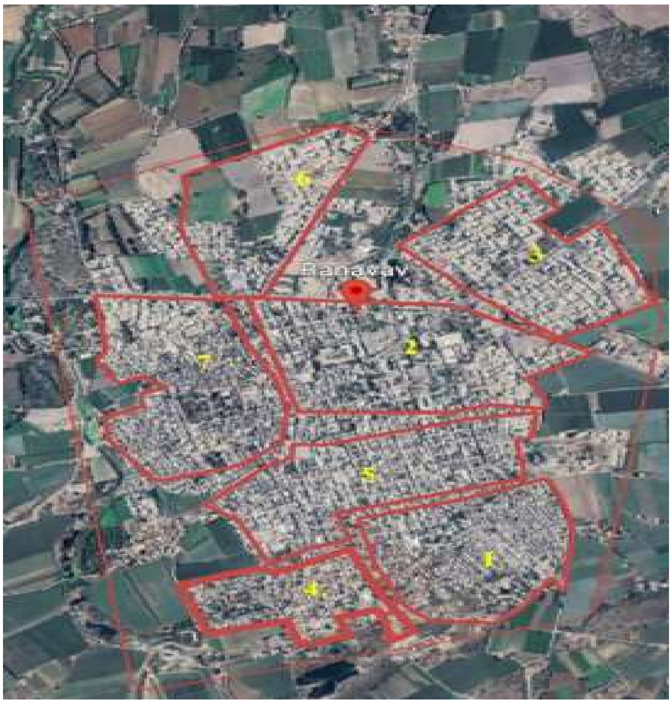

Fig. 2. Zonation of the city

RESULT AND DISCUSSION

A total of 1944 individual trees were recorded during the study, representing 63 different species from 31 families. Among these, 62 species belong to the Angiosperm category, while one species belongs to the Gymnosperm category. The highest number of trees was recorded in zone 7, while the lowest number of trees was recorded in zone 6 (Table 1).

The species with the lowest number of trees recorded include *Albizia lebbeck*, *Annona muricata*, *Annona reticulata*, *Caryota urens*, *Ficus elastica*, *Mitragyna parvifolia*, *Morinda citrifolia*, *Araucaria columnaris*, *Mimusops elengi*, *Prosopis cineraria*, and others (Table 2). On the other hand, some of the major tree species encountered during the study were *Moringa oleifera*, *Tamarindus indica*, *Delonix regia*, *Senna siamea*, *Alstonia scholaris*, *Ficus benghalensis*, *Ficus religiosa*, *Polyalthia longifolia*, *Cocos nucifera*, and *Azadirachta indica* (Table 3).

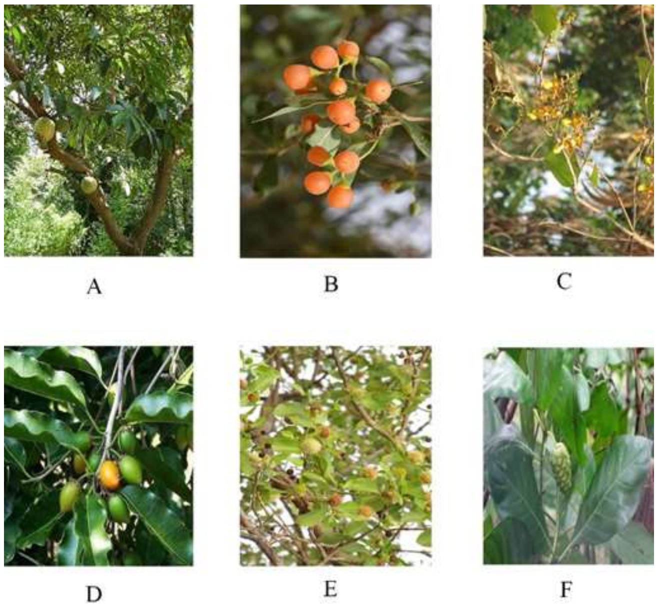

Fig. 3 Some tree species of Ranavav city (A.*Annona muricata* L., B.*Cordia sinensis* DC., C.*Gmelina arborea* Roxb., D. *Manilkara hexandra* Dubard, E.*Mitragyna parvifolia* Korth., F.*Morinda citrifolia* L.).

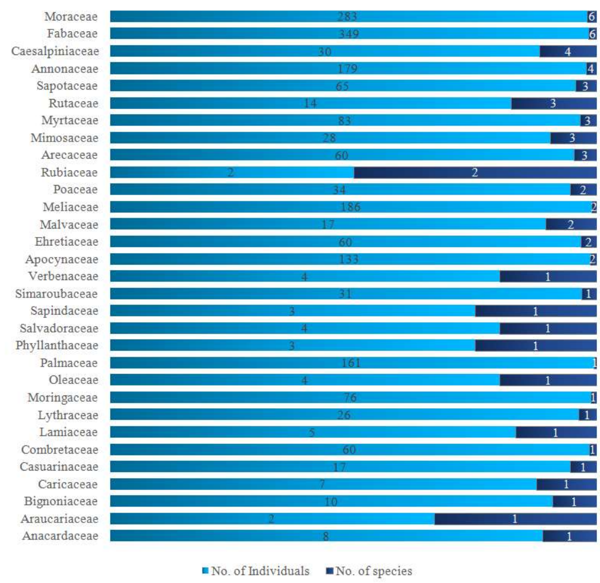

Fig. 4. Families with their numbers of species and individuals in Ranavav city limits

Table 1. Tree species with their numbers in Ranavav city limits

Sr. No.	Scientific Name	Common Name	Family	Zones							Total
				1	2	3	4	5	6	7	
1	*Aegle marmelos* (L.) Correa	Bili	Rutaceae	1	-	1	-	-	1	2	5
2	*Ailanthus excelsa* Roxb.	Arduso	Simaroubaceae	2	-	1	-	-	1	3	7
3	*Albizia lebbeck* (L.) Benth.	Sarasado	Fabaceae	10	-	-	8	-	-	13	31
4	*Alstonia scholaris* (L.) R.Br.	Saptaparni	Apocynaceae	-	-	-	-	-	1	-	1
5	*Annona muricata* L.	Hanuman Fal	Annonaceae	23	17	1	12	22	9	27	111
6	*Annona reticulata* L.	Ramfal	Annonaceae	-	-	1	-	-	-	-	1
7	*Annona squamosa* L.	Sitafal	Annonaceae	1	-	-	-	-	-	-	1
8	*Araucaria columnaris (G. Forst.) Hook*	Christmas Tree	Araucariaceae	-	-	-	-	24	-	18	42
9	*Azadirachta indica* A.Juss.	Kadvo Limdo	Meliaceae	-	-	-	-	-	2	-	2
10	*Bambusa vulgaris* Schrad. ex J.C.Wendl.	Vans	Poaceae	25	37	31	15	30	11	34	183
11	*Bauhinia purpurea* L.	Kasundro	Fabaceae	3	-	-	-	-	9	-	12
12	*Carica papaya* L.	Papaiya	Caricaceae	1	-	2	-	-	4	-	7
13	*Caryota urens* L.	Shiv Jata	Arecaceae	-	3	-	-	2	-	2	7
14	*Cascabela thevetia* (L.) Lippold	Pili Karen	Apocynaceae	-	-	1	-	-	-	-	1
15	*Casuarina equisetifolia* L.	Zuri	Casuarinaceae	4	2	-	3	1	5	7	22
16	*Ceiba pentandra* (L.) Gaertn.	Kapok	Malvaceae	-	-	-	12	5	-	-	17
17	*Citrus X limon (L.) Osbeck*	Limbudi	Rutaceae	-	3	-	-	-	-	-	3
18	*Cocos nucifera* L.	Nariyedi	Arecaceae	-	-	1	-	1	-	1	3
19	*Cordia dichotoma* G.Forst.	Gundo	Cordiaceae	22	32	27	11	28	10	31	161
20	*Cordia sinensis Lam.*	Gundi	Cordiaceae	-	-	3	-	6	2	6	17
21	*Dalbergia latifolia* Roxb.	Sismadi	Fabaceae	-	-	20	-	11	-	12	43
22	*Delonix elata* (L.) Gamble	Sandesaro	Fabaceae	3	-	4	-	-	4	2	13
23	*Delonix regia* (Bojer ex Hook.) Raf.	Gulmohor	Fabaceae	1	-	1	3	-	-	-	5
24	*Dendrocalamus strictus (Roxb.) Nees*	Nakor Vans	Poaceae	13	17	18	8	18	3	14	91
25	*Eucalyptus globulus* subsp. globulus	Nilgiri	Myrtaceae	-	-	9	6	-	7	-	22
26	*Ficus amplissima* Sm.	Pipar	Moraceae	10	2	2	9	5	1	10	39
27	*Ficus benghalensis* L.	Vad	Moraceae	4	-	6	3	7	2	9	31
28	*Ficus carica* L.	Anjeer	Moraceae	20	20	14	9	23	8	23	117
29	*Ficus elastica* Roxb. ex Hornem.	Rubber Tree	Moraceae	-	3	-	-	-	-	-	3
30	*Ficus religiosa* L.	Pipdo	Moraceae	-	-	1	-	-	-	-	1
31	*Gmelina arborea Roxb. ex Sm.*	Shevan	Lamiaceae	24	18	12	9	24	9	30	126
32	*Hyophorbe lagenicaulis* (L.H.Bailey) H.E.Moore	Bottle Palm	Arecaceae	-	3	-	2	-	-	-	5
33	*Mangifera indica* L.	Aambo	Anacardiaceae	19	6	9	-	8	-	15	57
34	*Manilkara hexandra (Roxb.) Dubard*	Rayan	Sapotaceae	8	-	-	-	-	-	-	8
35	*Manilkara zapota* (L.) P.Royen	Chiku	Sapotaceae	-	7	-	1	-	-	-	8
36	*Melia azedarach* L.	Bakayan Limdo	Meliaceae	15	11	6	5	5	5	8	55
37	*Mimusops elengi* L.	Borsali	Sapotaceae	1	-	-	1	-	1	-	3
38	*Mitragyna parvifolia (Roxb.) Korth.*	Kalam	Rubiaceae	-	2	-	-	-	-	-	2
39	*Polyalthia longifolia (Sonn.) Thwaites*	Aasopalav	Annonaceae	-	-	1	-	-	-	-	1
40	*Morinda citrifolia L.*	Aal	Rubiaceae.	21	21	20	10	27	7	29	135
41	*Moringa oleifera* Lam.	Saragvo	Moringaceae	-	-	-	-	-	-	1	1
42	*Morus alba* L.	Shetur	Moraceae	8	12	15	7	14	8	12	76
43	*Murraya koenigii* (L.) Spreng.	Mitho Limdo	Rutaceae	1	1	1	1	-	1	-	5
44	*Nyctanthes arbor*-tristis L.	Paarijatak	Oleaceae	4	-	-	-	-	-	-	4
45	*Parkinsonia aculeata* L.	Ram Baval	Fabaceae	-	-	2	1	-	-	1	4
46	*Peltophorum pterocarpum* (DC.) Backer ex K.Heyne	Son Mahor	Fabaceae	1	-	2	-	-	-	1	4
47	*Phoenix dactylifera* L.	Khajuri	Arecaceae	5	-	2	-	-	4	3	14
48	*Phyllanthus acidus* (L.) Skeels	Aamra	Phyllanthaceae.	1	-	-	-	-	1	-	2
49	*Pithecellobium dulce* (Roxb.) Benth.	Bakhay Aambli	Fabaceae	-	-	-	1	1	-	1	3
50	*Prosopis cineraria* (L.) Druce	Khijado	Fabaceae	11	7	8	5	13	5	15	64
51	*Prosopis juliflora* (Sw.) DC.	Gando Baval	Fabaceae	-	-	1	1	-	-	-	2
52	*Psidium guajava* L.	Jaamfal	Myrtaceae	2	3	6	3	1	5	1	21
53	*Punica granatum* L.	Daadam	Lythraceae	-	8	8	2	12	2	10	42
54	*Salvadora oleoides* Decne.	Mithijaar, Motipilu	Salvadoraceae	-	-	5	11	10	-	-	26
55	*Sapindus mukorossi* Gaertn.	Aritha	Sapindaceae	1	-	1	-	-	1	1	4
56	*Senna siamea* (Lam.) H.S.Irwin & Barneby	Kassod	Fabaceae	-	-	-	3	-	-	-	3
57	*Syzygium cumini* (L.) Skeels	Jaambu	Myrtaceae	-	22	-	15	33	12	21	103
58	*Tamarindus indica* L.	Aambli	Fabaceae	-	2	-	-	-	-	-	2
59	*Tecoma stans (L.) Juss. ex Kunth*	Vasant	Bignoniaceae	7	14	13	3	16	7	17	77
60	*Terminalia catappa* L.	Deshi Badam	Combretaceae	2	-	3	2	-	3	-	10
61	*Thespesia populnea (L.) Sol. ex Corrêa*	Paras Pipalo	Malvaceae	9	10	4	4	15	5	13	60
62	*Vachellia nilotica (L.) P.J.H.Hurter & Mabb.*	Tatikyo Baval	Fabaceae	-	-	7	5	2	-	-	14
63	*Vitex negundo* L.	Nagod	Lamiaceae	-	2	-	-	1	1	-	4
Total				283	285	270	191	365	157	393	1944

Table 2. Minor tree species with their numbers in Ranavav city limits

Sr. No.	Scientific Name	Total No of Individuals	% of Total Individuals
1	*Albizia lebbeck* (L.) Benth.	1	0.05
2	*Annona muricata* L.	1	0.05
3	*Annona reticulata* L.	1	0.05
4	*Caryotaurens*L.	1	0.05
5	*Ficus elastica*Roxb. ex Hornem.	1	0.05
6	*Mitragynaparvifolia*Korth.	1	0.05
7	*Morindacitrifolia L.*	1	0.05
8	*Araucaria columnaris*Hook.	2	0.1
9	*Mimusopselengi*L.	2	0.1
10	*Prosopis cineraria* (L.) Druce	2	0.1

Table 3. Major tree species with their numbers in Ranavav city limits

Sr. No.	Scientific Name	Total No of Individuals	% of Total Individuals
1	*Moringa oleifera* Lam.	76	3.90
2	*Tamarindus indica* L.	77	3.96
3	*Delonix regia* (Bojer ex Hook.) Raf.	91	4.68
4	*Senna siamea*(Lam.) H.S.Irwin&Barneby	103	5.2
5	*Alstoniascholaris* (L.) R.Br.	111	5.70
6	*Ficus benghalensis*L.	117	6.01
7	*Ficus religiosa* L.	126	6.48
8	*Monoonlongifolium*(Sonn.) B.Xue&R.M.K.Saunders	135	6.94
9	*Cocos nucifera* L.	161	8.28
10	*Azadirachta indica* A.Juss.	183	9.41

The families Fabaceae and Moraceae had the highest number of species, each with thirteen and six species, respectively. Within these families, the Fabaceae family had the largest number of individual trees recorded (407), followed by the Moraceae family (283), and then the Meliaceae family (186). On the other hand, the families Araucariaceae, Phyllanthaceae, and Oleaceae had the lowest number of individuals recorded, with 2, 3, and 4 individuals, respectively. Furthermore, several families, namely Araucariaceae, Bignoniaceae, Caricaceae, Casuarinaceae, Combretaceae, Lamiaceae, Lythraceae, Moringaceae, Oleaceae, Palmaceae, Phyllanthaceae, Salvadoraceae, Sapindaceae and Simaroubaceae, each had one species represented in the recorded data (Fig. 4).

Urban Trees: Enhancing Prosperity and Quality of Life: The presence of trees in urban areas offers economic benefits in addition to their aesthetic appeal. They can increase property values, attract businesses, and enhance the overall marketability of neighbourhoods, thereby contributing to economic development and prosperity. Urban trees play a crucial role in reducing energy consumption through their provision of shade and improved thermal comfort, consequently diminishing the reliance on air conditioning. Furthermore, trees have the capacity to mitigate air pollution by modifying the microclimate and preventing the formation of secondary pollutants. The extent of air pollution reduction depends on the quantity of vegetation and prevailing weather conditions in a given locality. Access to green spaces with tree cover has been associated with improved mental well-being, reduced stress levels, and an overall enhancement of the quality of life for urban residents. Trees possess the ability to absorb and deflect sound waves, mitigating noise pollution. They act as natural barriers, buffering and muffling unwanted noise from traffic, construction, and other urban activities. They also soften the harshness of built environments by creating green spaces for relaxation and recreation and contributing to the overall aesthetic value of the city. By supporting urban biodiversity, trees help to maintain ecological balance and contribute to the overall health of the urban ecosystem. Urban trees' canopies also help to slow down rainfall, minimising erosion and flooding while allowing water to infiltrate into the soil, contributing to groundwater recharge. Trees also improve air quality by absorbing pollutants from the atmosphere and removing particulate matter (PM) and ozone (O3) from the air. These pollutants can cause respiratory problems, heart disease, and cancer. Overall, trees help to create a more comfortable microclimate in urban areas, making them more livable and enjoyable for residents. The incorporation of urban trees has become increasingly recognised as an effective approach to enhancing the visual appeal and livability of cities.

CONCLUSION

Every tree holds immense value for humankind, and their presence in urban areas carries even greater significance. Ranavav city, despite its vast expanse, harbours a limited number of trees, amplifying the worth of each individual tree. It is crucial to make concerted efforts towards tree plantation and conservation of existing trees to enhance environmental well-being and improve the quality of life for the city's residents. This endeavour is pivotal for the preservation and sustenance of the city's ecosystem.

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