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Evaluating plant diversity: an in-depth analysis of flora in Ahmedabad's oxygen park

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Abstract

The biodiversity of urban green spaces is crucial for ecological balance & public well-being. this study focuses on the Ahmedabad Monte Carlo Oxygen Park, an innovative urban green area created to improve air quality & raise environmental awareness. The major goal of this research is to investigate & describe the plant species composition of the park, thereby providing insights into the ecological relevance & biodiversity of this urban sanctuary.

Plant species variety, density & abundance were documented by systematic field surveys carried out in different park zone. The result shows a wide variety of foreign & native plant species, each of which makes a distinct contribution to the ecosystem services provided by the park. Additionally, the study investigates how plant species" symbiotic relationships effect soil quality, water retention, & microclimate regulation.

This study investigates the plant species composition in Ahmedabad Monte Carlo Oxygen Park, a significant urban green space designed to combat pollution & promote wellness. The park, located in Sindhu Bhavan Road, spans 28,000 square meters & features over 59,000 trees &111 plant species. We noticed the variety of plant species found in the park by conducting through field surveys & species identification.

Keywords: Public Open Space; Data Collection; Oxygen Parks; Plant Diversity

1. Introduction

Public open space (POS) is open, public & freely accessible & represent one of the basic types of land use that provides opportunities for people to engage in "conservation, recreation & contact with nature"[1].POS manifests in different forms such as green spaces, pocket parks, corner garden, pedestrian streets & Gray space outside architectures for people to stayed.[2,3,4,5,6].POS has widely been considered as an important contributor to promoting people's physical &mental health & emerged as one of the focal points of ecology[7,8].As one type of public investment ,POS is expected to serve communities in a fair way[9].

The open spaces in Indian cities can be seen as public & private spaces which can be differentiated based on the ownership & accessibility. The public open spaces are the spaces which are open &accessible for the common people for the recreational &leisure facilities [10] Public open spaces not only provide a respite from the built environment but also play a crucial role in fostering a sense of community, encouraging outdoor activities &offering a platform for cultural & social events [11].

Oxygen Park are specifically designed to incorporate natural element, such as green spaces, water features & air-purifying plants, to create a unique ecosystem that promotes air quality improvement & environment sustainability. These parks not only provide recreational spaces for urban residents but also serve as a tool for environmental

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education &community engagement. The design of Oxygen Park integrates natural & artificial elements to create a sustainable urban oasis that mitigates the harsh climatic conditions of the region. The park's unique landscaping, which includes Shaded walkways & a central water feature, help reduce the urban heat island effect & improve air quality.

This study investigates the plant species composition in Ahmedabad Monte Carlo Oxygen Park, a significant urban green space designed to combat pollution & promote wellness. The park is located at Sindu Bhavan Road, spanning 28,000 square meters & features over 59,000 trees & 111 plant species found in the park by conducting through field surveys & species identification.

Montecarlo is a diverse company headquarter in Ahmedabad, Gujarat with pan India presence. Its operation spans across various verticals of highways, Railways & Metro, Building & Factories, Minning Energy infrastructure & water & irrigation. Montecarlo is an infrastructure conglomerate with a long & rich history of service to the national & partnership in its growth. This park is Developed & Maintained by Ahmedabad Municipal Corporation. In this park there is some concept is used for making it eco-friendly like Rammed Earth Walls, Gabion Walls & Miyawaki Plantation

2. Methodology

The Monte Carlo Oxygen Park is located in Sindhu Bhavan Road area of Ahmedabad city. Within 28,000 square meters & features over 59,000 trees & 111 plant species found in the park. The park was found in 1995, By Shri Manubhai M. Patel. This park is Developed & Maintained by Ahmedabad Municipal Corporation.

Figure 1 Study area

The identification of the plant was done as much possible in the park. With the help of standard floras & voucher specimen photographs were also taken. In some rare case if we can't identify the plant they were brought in the laboratory & identified with the help of available Herbarium & other available publications. Also used of E-herbarium.

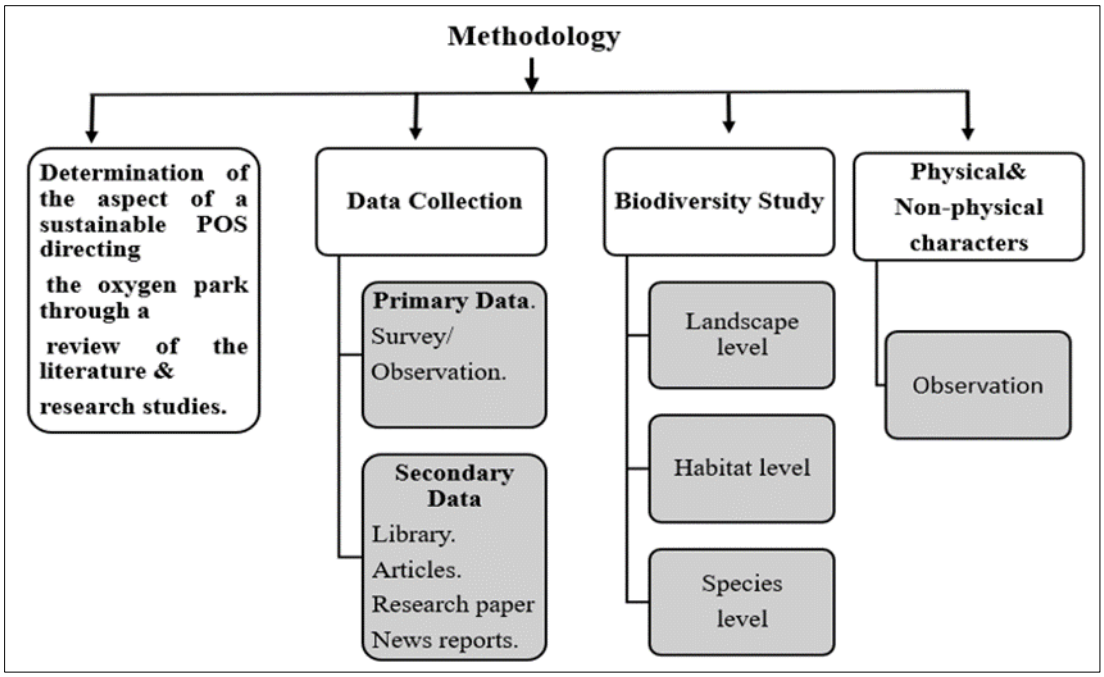

Figure 2 Research method used for this study

The study explores the POS of Oxygen Park through a particular focus on studying. This needs to be driven by POS design provides sustainable POS. Aspects & thus comfort, health & well-being. In fulfilling this purpose, the overall method has adopted few steps.

Determination of the aspect of a sustainable POS directing the oxygen park through a review of the literature & research studies.

Method of Data Collection is divided into two parts: Primary Data: These are first-hand original data collected by research through various method. Survey/Observation.

- Secondary Data- These are second- hand readymade data collected by some other agency but not by the researcher. Library, Articles, Research paper, News reports.
- Biodiversity Study divided into three parts
- Landscape level: - Focus on large-scale patterns & processes that affect ecosystems.
- Habitat level: Research examines specific environments & their characteristics, such as vegetation structure, soil composition & microclimate.
- Species level: Research focuses on individual species & their interactions with their environment.

2.1. Physical & Non-physical Characters

Physical Observation: involves directly observing & recording behaviours, actions & interactions in natural setting. This method allows researchers to gather detailed, context- rich data without manipulating any variables

Non-physical Observation: It involves analysing existing data or artifacts without direct interaction with the subjects. It is useful when direct observation isn't feasible or ethical.

3. Result and Discussions

24 families found in Monte Carlo Oxygen Park & surrounding area. Plant belonging to Fabaceae family dominated the study area, with 111 species, followed by the plant of Lamiaceae, Malvaceae, Poaceae, Moraceae, Meliaceae, Verbenaceae, Rutaceae, Rubiaceae, Rhamnaceae etc. (Fig. 3)

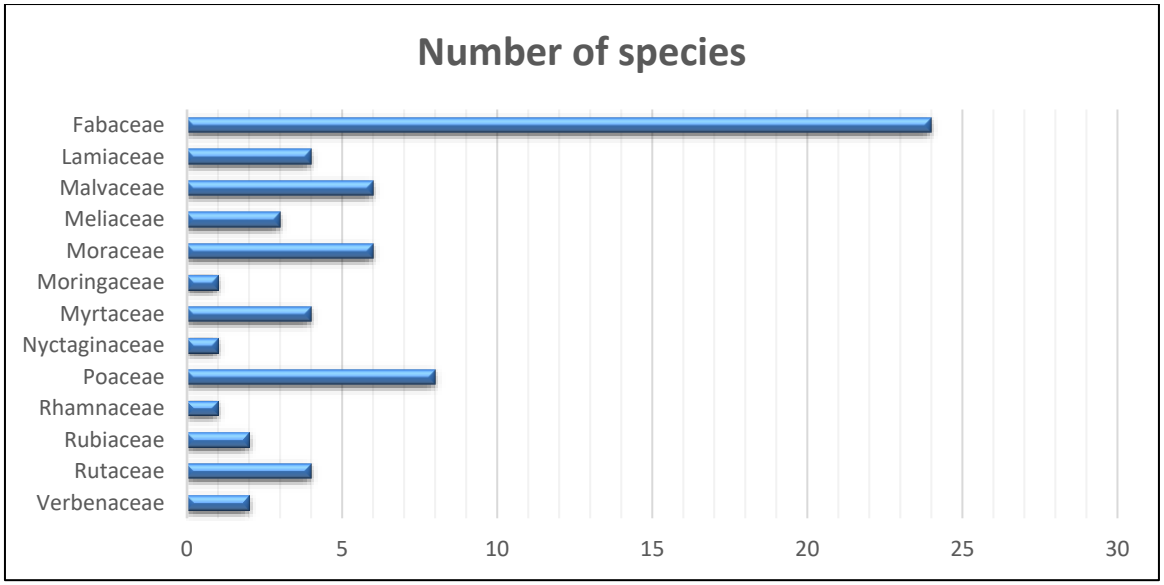

Figure 3 Dominant plant families in the study area

The plants recorded in the study were broadly divides into grass, herbs, shrubs, trees, climber. The trees dominated in the parks (47%), followed by the grass, herbs, shrubs climber (Fig. 4). The higher percentage of trees in the study area can be attributed to edaphic & climatic conditions, such as reduced rainfall & high temperature. During summers the temperature becomes severe & the soil becomes intolerable for the plants, as a result, only short-living plants, like annual herb are favoured, as they can complete their life cycle before the commencement of the dry season & set seed during summer.

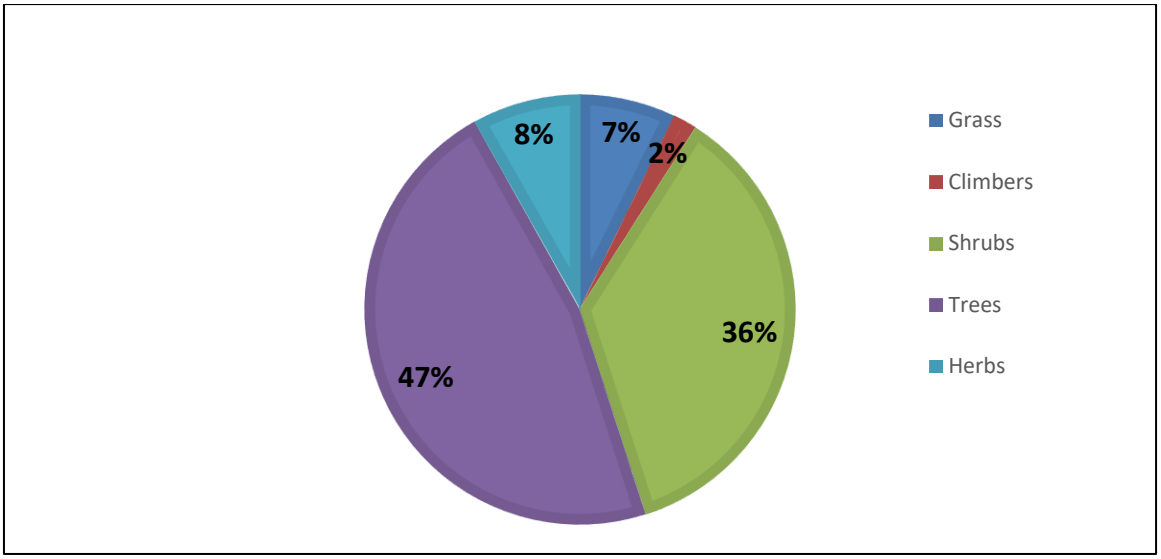

Figure 4 Different plant habits in the study area

The plants of the Monte Carlo Oxygen Park were further divided into Raunchier 's biological life forms. Raunchier (1934) proposed the term "Biological Spectrum" to express the life form distribution in a flora & the phytoclimatic, under the influence of which these life forms evolved. Among the four life forms represent in the study area, Phanerophytes. Were dominant with 83%, followed by chamaephytes & therophytes, geophytes (Fig. 5).

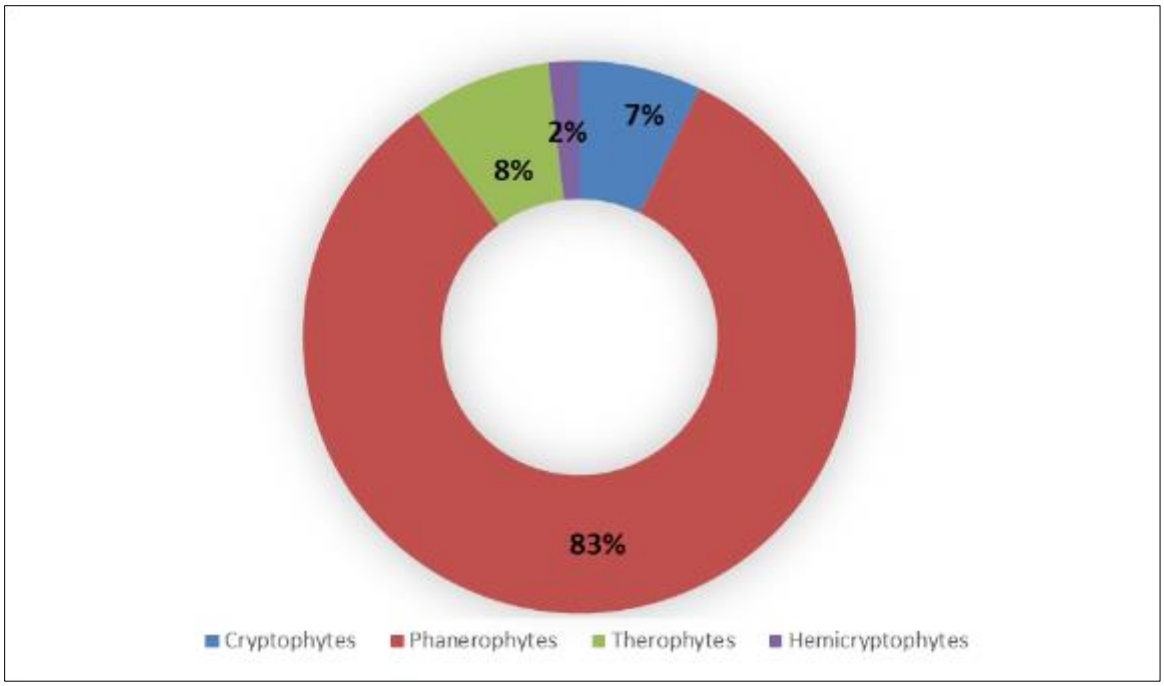

Figure 5 Percentage distribution of Raunkier's life forms in the study area

The Phanerophytes are drought evaders & the whole plant sheds during the unfavourable conditions. The higher percentage of therophytes & phanerophytes compared to other life form in the study area, seem to be a response to the hot & dry climate, topographic variations & human interferences. The cryptophytes & geophytes were poorly represented in the study area. On comparing the percentage of the life -form classes in Monte Carlo Oxygen Park with that of the Normal Biological spectrum of Raunkier. We observed that the percentage of Phanerophytes is formed higher as compared other. The therophytes formed the second largest class, with 8% in the study area in contrast to the normal biological spectrum, overall, the biological spectrum of Monte Carlo Oxygen Park indicated having a therophytes &phanerophytes, phytoclimatic, as these two classes show the greatest divergence from the normal biological spectrum proposed by C. Raunkier.

Many plants, especially trees & shrubs were present in the parks, which enhance the beauty of the area, with their beautiful flower & they also provide nutritious fruits the important fruit trees in the park include *Limonia acidissima* (Wood apple), *Moringa oleifera* (Drumstick tree), *Tamarindus indicus* (Tamarind tree), *Mangifera indica* (Mango tree), *Psidium guava* (Guava tree), *Phyllanthus emblica* (Amla), *Punica granatum* (Pomegranate tree) etc., some of the important plant which enhance the beauty of the park with their colourful & scented flower. Moreover, values are also distributed in various parts of the study area the plantation of trees on a large scale is also practiced on various occasions in order to sensitize the people about the importance of green spaces, especially in mega cities like Ahmedabad. Care is also being taken to monitor the growth of the plants in the parks & protect them from any kind of disturbance or destruction by outsiders.

Table 1 Some important and well represented plants of Monte Carlo Oxygen Park

Sr No	Botanical Name	Family	Common Name	Habita
1	*Abutilon indicum (L.) Sweet*	Malvaceae	Indian Mallow	Shrub
2	*Acacia*	Fabaceae	Mimosa	Shrub
3	*Acacia nilotica (L.) Willd. ex Delile*	Fabaceae	Desi Baval	Tree
4	*Acros calamus L.*	Acoraceae	Buch\Calumus	Herb
5	*Albizia lebbeck (L.) Benth.*	Fabaceae	Shirish	Tree
6	*Alstonia muelleriana Domin*	Apocynaceae	Hard MilkWood	Tree

7	*Alstonia scholaris (L.) R.Br.*	Apocynaceae	Black Board	Tree
8	*Alternanthera sessilis (L.) R.Br. exDC.*	Amaranthaceae	Carpet Weed	Herb
9	*Amorpha fruticose L.*	Fabaceae	False Indigo Bush	Shrub
10	*Andropogon glomeratus (Walt.) Britton, Sterns & Poggenb.*	Poaceae	Bushy Blue Stem	Grass
11	*Azadirachta indica L.*	Meliaceae	Neem	Tree
12	*Bambus vulgaris L.*	Poaceae	Bamboo	Grass
13	*Bauhinia variegata (L.) Benth.*	Fabaceae	Orchid Tree	Tree
14	*Bougainvillea alba*	Nyctaginaceae	White glory	Shrub
15	*Bougainvillea glabra Choisy*	Nyctaginaceae	Paper Flower	Shrub
16	*Butea monosperma (Lam.) Taub.*	Fabaceae	Dhak	Tree
17	*Caesalpinia pulcherrima (L.) Sw.*	Fabaceae	Peacock Flower	Shrub
18	*Callistemon citrinus (Curtis) Skeels*	Myrtaceae	Bottle Brushes	Shrub
19	*Calophyllum inophyllum L.*	Clusiaceae	Oil Tree	Tree
20	*Calotropis procera (Aiton) W.T. Aiton*	Apocynaceae	Apple of Sodom	Shrub
21	*Canna tuerckheimii*	Cannaceae	Arrow Root	Herb
22	*Canna coccinea Mill.*	Cannaceae	Indian Shoot	Herb
23	*Canna indica L.*	Cannaceae	Indian Shoot	Herb
24	*Carissa carandas L.*	Apocynaceae	Karamda	Shrub
25	*Cascabela thevetia (L.) Lippold*	Apocynaceae	Yellow Oleander	Shrub
26	*Cassia fistula L.*	Fabaceae	Golden Shower	Tree
27	*Casuarina equisetifolia L.*	Casuarinaceae	Saru	Tree
28	*Catharanthus roseus (L.) G. Don*	Apocynaceae	Periwinkle	Herb
29	*Ceiba pentandra (L.) Gaertn.*	Malvaceae	Kapok	Tree
30	*Chlorophytum comosum (Thunb.) Jacques*	Asparagaceae	Spider Plant	Herb
31	*Cocculus hirsutus (L.) W. Theob.*	Menispermeace	vevdi	Shrub
32	*Combretum indicum (L.) DeFilipps*	Combretaceae	BurmaCreeper	Climber
33	*Cordia dichotoma G. Forst.*	Boraginaceae	Indian Cherry	Tree
34	*Cordia myxa L.*	Boraginaceae	Gunda	Tree
35	*Cordia sebestena L.*	Boraginaceae	Bunal	Shrub
36	*Cymbopogon citratus (DC.) Stapf.*	Poaceae	Lemon Grass	Grass
37	*Cynodon dactylon (L.) Pers.*	Poaceae	Quick Grass	Grass
38	*Dalbergia sissoo Roxb.*	Fabaceae	Sissoo	Tree
39	*Datura stramonium*	Solanaceae	Jimsonweed, Devil's Trumpet	Shrub
40	*Delonix regia (Hook.) Raf.*	Fabaceae	Flame Tree	Tree
41	*Dendrocnide meyeniana (Walp.) Chew*	Urticaceae	Lipa	Shrub
42	*Dichrostachys cinerea Wight et Arn.*	Fabaceae	Sickle bush	Tree

43	*Eragrostis curvula (Schrad.) Nees*	Poaceae	Wire Grass	Grass
44	*Euphorbia tithymaloides L.*	Euphorbiaceae	Devil Backbone	Shrub
45	*Excoecaria cochinchinensis Lour.*	Euphorbiaceae	Chines Croton	Shrub
46	*Ficus benghalensis L.*	Moraceae	Banyan	Tree
47	*Ficus elastica Roxb. ex Hornem.*	Euphorbiaceae	Rubber Pant	Tree
48	*Ficus racemosa Roxb.*	Moraceae	Umro	Tree
49	*Ficus religiosa L.*	Moraceae	Peepal	Tree
50	*Ficus viren Aiton.*	Moraceae	White Fig	Tree
51	*Glycyrrhiza glabra L.*	Fabaceae	Licorice	Herb
52	*Gmelina arborea Roxb.*	Lamiaceae	Gamhar	Tree
53	*Hibiscus moscheutos L.*	Malvaceae	Rosemallow	Shrub
54	*Hibiscus rosa-sinensis L.*	Malvaceae	China Rose	Shrub
55	*Holoptelea integrifolia (Roxb.) Planch.*	Ulmaceae	Indian Elm	Tree
56	*Hymenocallis littoralis (Jacq.) Salisb.*	Amaryllidaceae	Beach Spider Lily	Herb
57	*Ixora coccinea L.*	Rubiaceae	Jungle Flame	Shrub
58	*Jacaranda mimosifolia D. Don*	Bignoniaceae	Fern Tree	Tree
59	*Jatropha integerrima Jacq.*	Euphorbiaceae	Spicy Jatropha	Shrub
60	*Justicia adhatoda L.*	Acanthaceae	Ardushi	Shrub
61	*Leucophyllum frutescens (Berland.) I.M. Johnst.*	Scrophulariacea	Purple Sage	Shrub
62	*Levcaena leucocephala (Lam.) de Wit*	Fabaceae	Subabal	Shrub
63	*Limonia acidissima L.*	Rutaceae	Wood-Apple	Tree
64	*Mangifera indica L.*	Anacardiaceae	Mango	Tree
65	*Manihot esculenta Crantz*	Eurphorbiaceae	Cassava	Shrub
66	*Maytenus boaria Molina*	Celastraceae	Mayten	Shrub
67	*Melia azedarach L.*	Meliaceae	Chinaberry	Tree
68	*Millingtonia hortensis L.f.*	Bignoniaceae	Indian Cork	Tree
69	*Mimusops elengil L.*	Sapotaceae	Borsalli	Tree
70	*Moringa oleifera Lam.*	Moringaceae	Sargvo	Tree
71	*Morus alba L.*	Moraceae	Setur	Tree
72	*Murraya paniculata (L.) Jack.*	Rutaceae	Orange Jasmine	Shrub
73	*Murraya koenigii (L.) Spreng.*	Rutaceae	Curry Tree	Tree
74	*Nerium oleander L.*	Apocynaceae	Kaner	Shrub
75	*Nyctanthes arbortristis L.*	Oleacese	Parijata	Tree
76	*Pachypodium baronii Costantin & Bois*	Apocynaceae	Bontaka	Shrub
77	*Peltophorum pterocarpum (DC.) K. Heyne*	Fabaceae	Peltophorum	Tree
78	*Pennisetum orientale Rich.*	Poaceae	White Fountain Grass	Grass
79	*Pennisetum setaceum (Forssk.) Chiov.*	Poaceae	Purple Fountain Grass	Grass
80	*Phyllanthus emblica L.*	Phyllanthaceae	Amla	Tree

81	*Phyllostachys aurea Riviere & C. Riviere*	Poaceae	Golden Bamboo	Grass
82	*Pithecellobium dulce (Roxb.) Bth.*	Fabaceae	Madras Thorn	Tree
83	*Plumera pudica Jacq.*	Apocynaceae	Bridal Bouquet	Shrub
84	*Plumeria alba L.*	Apocynaceae	White Frangipani	Shrub
85	*Podranea ricasoliana (Tanfani) Sprague*	Bignoniaceae	Pink Trumpet Vine	Climber
86	*Pongamia pinnata (L.) Pierre*	Fabaceae	Kanji	Tree
87	*Prosopis velutina Wooton*	Fabaceae	Velvet Mesquite	Shrub
88	*Psidium guajava L.*	Myrtaceae	Guava	Tree
89	*Punica granatum L.*	Lythraceae	Pomegranate	Shrub
90	*Rhododendron maximum L.*	Lauraceae	Great Laurel	Shrub
91	*Rosa gallica*	Rosaceae	Rose	Shrub
92	*Samanea saman (Jacq.) Merr.*	Fabaceae	Rain Tree	Tree
93	*Senegalia catechu (L.f.) P.J.H. Hurter & Mabb.*	Fabaceae	Black Catch	Tree
94	*Senna alata (L.) Roxb.*	Fabaceae	Candle Bush	Shrub
95	*Senna alexandrina Mill.*	Fabaceae	Indian Senna	Shrub
96	*Senna didymobotrya (Fresen.) Irwin & Barneby*	Fabaceae	Popcorn Senna	Shrub
97	*Senna siamea (Lam.) Irwin et Barneby*	Fabaceae	Kashid	Tree
98	*Spathodea companulata P. Beauv*	Bignoniaceae	African Tulip	Tree
99	*Sphagneticola trilobata (L.) Pruski*	Asteraceae	Creeping Daisy	Herb
100	*Stachytarpheta urticifolia Sims*	Verbenaceae	Blue Snake	Shrub
101	*Sterculia foetida L.*	Malvaceae	Java Olive	Tree
102	*Syzygium cumini (L.) Skeels.*	Myrtaceae	Black Plum	Tree
103	*Tamarindus indica L.*	Fabaceae	Tamarind	Tree
104	*Tecoma stans (L.) Juss ex Kunth.*	Bignoniaceae	Yellow Elder	Shrub
105	*Tectona grandish L.f.*	Lamiaceae	Saag	Tree
106	*Terminalia arjuna (Roxb.) Wight & Arn.*	Combretaceae	Arjun	Tree
107	*Thespesia populnea (L.) Sol. exCorrea*	Malvaceae	Parash Pipdo	Tree
108	*Vitex negundo L.*	Verbenaceae	Nagod	Shrub
109	*Vitex rotundifolia L.f.*	Lamiaceae	Beach Vitex	Shrub
110	*Vitexagnus-castus L.*	Lamiaceae	Abraham Balm	Shrub
111	*Ziziphus jujuba Mill.*	Rhamnaceae	Bor	Tree

4. Conclusion

The rich diversity of plant life found in Monte Carlo Oxygen Park & its adjacent areas positions it as a significant green belt within Ahmedabad city, contributing substantially to the maintenance of a pollution-free environment. However, the challenges posed by unplanned & unchecked urban expansion have led to the fragmentation of natural ecosystems, resulting in a scattered distribution of both small & large green areas to create cohesive green corridors. Furthermore, engaging the public in activities that promote environment awareness & protection, as well as the development of urban green spaces, in crucial. Such initiatives, when integrated with sustainable urban planning, will enhance biodiversity within cities & elevate the overall quality of life for all inhabitants.

Compliance with ethical standards

Disclosure of conflict of interest

The author declare that they have no conflict of interest.

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