

Research

Rapid Assessment of Floral Diversity in Green Spaces within Mumbai City, MS, India

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Citation:

Stalin, D., Mhaske, C., Patil, P. and Patil, V. (2024). Rapid assessment of floral diversity in green spaces within Mumbai city, ms, India. *Biophilia Insights*, 2 (1), e202421002.
<https://doi.org/10.52679/bi.e202421002>

Received: 15 May 2024
Accepted: 20 June 2024
Published: 30 June 2024

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Abstract

Forests are one of the most biologically active terrestrial ecosystems. They are known to provide varied ecological services and play an important role in maintaining ecological balance. Especially in a metropolitan city like Mumbai, the last remaining tracts of green help in maintaining the microclimate, enriching the groundwater table, and curbing pollution levels. Despite these valuable services provided by forests, deforestation has become rampant in the present era, causing several environmental problems. Urgent steps are required to identify and protect the remaining green areas to maintain ecological balance and slow the pace of climate change. The present study deals with the identification and assessment of the floral diversity of green spaces within Mumbai city and suburban areas. The floristic survey was carried out from June 2021 to October 2022. A total of 111 plant species from 43 families, encompassing 5 herbs, 14 shrubs, 3 climbers, 1 grass, 1 fern, and 87 angiospermic trees, were identified. Through our report, we attempt to shed light on these important green spaces to ensure that they are not treated as isolated spaces but as spaces that complement our daily lives and well-being.

Keywords: Floral diversity, Green spaces, Mumbai City, Flora, Biodiversity, Conservation, Micro-climate regulation, Floristic survey

Introduction

Since the emergence of life on Earth, vegetation has been a crucial component of the ecosystem. Life is directly or indirectly reliant on vegetation for its survival. Forests stand as pivotal bastions of biodiversity and ecological stability within terrestrial ecosystems, wielding an array of vital services crucial for sustaining life on Earth (Brockerhoff et al., 2017). Particularly in urban landscapes like Mumbai, characterized by diminishing green spaces, the significance of forests transcends mere aesthetics, encompassing pivotal roles in micro-climate regulation, groundwater enrichment, and pollution mitigation. Despite their undeniable ecological value, contemporary times witness a distressing surge in deforestation, exacerbating environmental perils. Urgent interventions beckon to safeguard extant forested enclaves, pivotal for preserving ecological equilibrium and ameliorating the pace of climate change.

In a broader context, Maharashtra boasts a forest cover spanning 50,798 sq. km., constituting approximately 16.51% of its total geographical expanse. Remarkably, major Indian cities, including Mumbai, collectively harbour 509.72 sq. km. of forest cover, representing a critical yet diminishing fraction of their total geographic footprint. Alarming statistics reveal a 42.5% decline in Mumbai's green spaces over three decades, underscoring the urgent need for conservation efforts (Ministry of Environment, Forest and Climate Change, 2021). Moreover, Maharashtra ranks fourth nationally in forest land diversion for non-forest uses, exacerbating the vulnerability of Mumbai's forests, compounded by a surge in wildfires from 702 in 2014 to 3,487 in 2017.

Despite the knowledge of the extent of forest cover available to the government, little or no effort has been made to identify and protect these green patches since 1996. We are at a crossroads in time and history where delay can no longer be accepted. The vulnerabilities and challenges presented by population outbursts, climate variability, and massive human-induced alterations of the terrestrial landscape (Alkama & Cescatti, 2016; Steffen et al., 2015), particularly in the context of forests, water, and their interaction, necessitate a much faster response to and resolution of this debate than has previously been possible. In the past few decades, there has been increased concern about the management and fate of our remaining forest lands (Lund, 2018).

The present study undertakes the critical task of identifying and evaluating the floral diversity across 18 sites housing vulnerable and often overlooked green spaces within Mumbai City. The study serves to illuminate the rich tapestry of plant resources nestled within these green spaces from a conservationist standpoint. Our endeavour extends beyond mere enumeration, striving to underscore the profound interconnectedness between these green spaces and our collective well-being. Through first-hand observations and in-depth research, we aim to illuminate not only the ecological significance but also the historical and contextual relevance of these green spaces, alongside the communities intricately intertwined with them. Against this backdrop, our study endeavours to shed light on the intrinsic value of these imperiled ecosystems, advocating for their holistic preservation and integration into urban planning paradigms. By unraveling the botanical wealth hidden within these green spaces, we aspire to catalyze concerted efforts towards their conservation, ensuring their perpetuation as vital repositories of biodiversity and ecological resilience.

Material and methods

Areas in Mumbai with green spaces larger than 1 hectare were identified using Google Earth satellite imagery. Field surveys were carried out to assess the plant diversity prevailing in the selected locations. A checklist of the floral diversity was prepared during the field surveys along with the field notes. Specimens and photographs of unidentified plant species were collected during the field visits for review. The collected specimens were identified using existing literature (Bentham & Hooker, 1862–83; Cooke, 1901–08) and preserved in the form of photographs.



Figure 1: Satellite Image of the study area

Study area

The city of Mumbai, renowned as both the capital of Maharashtra and the financial capital of India, has a population of approximately 20 million, ranking it as the eighth most populous urban centre globally according to the United Nations. Nestled within the Konkan region along the western coast of India, Mumbai encompasses seven islands clustered on a narrow peninsula southwest of Salsette Island. Embraced by the Arabian Sea to the west, Thane Creek to the east, and Vasai Creek to the north, Mumbai's topography showcases a mosaic of features, ranging from hills and mountains to creeks and estuaries.

Within Mumbai's confines lie two significant protected areas: the Sanjay Gandhi National Park and the Thane Creek Flamingo Bird Sanctuary. These verdant sanctuaries, often revered as the "Lungs of Mumbai," boast extensive tree cover. Beyond these vital forests, Mumbai hosts numerous green spaces harbouring a diverse array of life forms, including terrestrial trees, as well as mangroves lining the coastline. Recognizing and conserving these potential green areas is imperative for maintaining Mumbai's ecological equilibrium. Consequently, through a comprehensive study, 18 sites within the city have been identified.

Result and discussion

The focus of this study is to document the green spaces within Mumbai and conduct a comprehensive analysis of their flora. Utilizing GIS, 18 locations with substantial greenery accounting for an area of more than 1 hectare, were surveyed, revealing diverse topographies across the city. This topographical variation has led to a rich array of plant life, including grasses, herbs, shrubs, and angiosperms, totaling 111 species. Among these, there were 5 herbs, 14 shrubs, 3 climbers, 1 grass, 1 fern, and 87 angiospermic trees, representing 42 families.

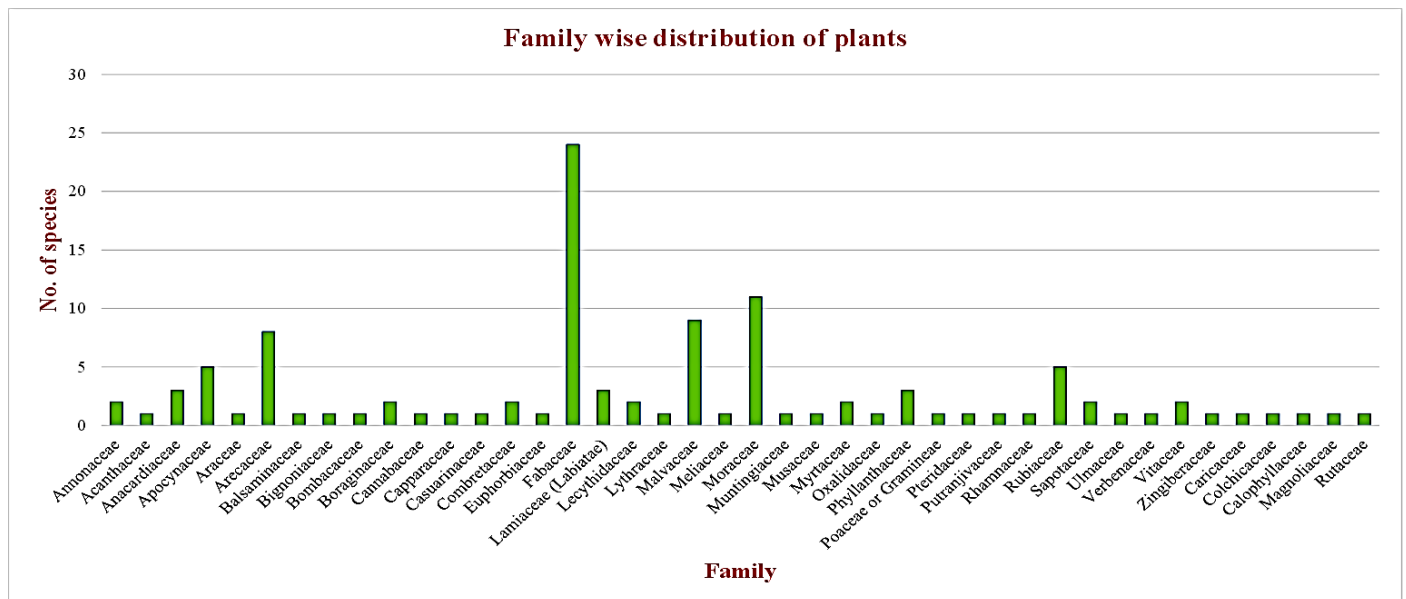


Figure 2: Family-wise distribution of Plants

India boasts a rich botanical heritage, with approximately 47,513 plant species (Singh & Dash, 2014), contributing significantly to global flora. Within India, there are about 257 plant families, with 213 dicotyledonous and 44 monocotyledonous families. The study area encompassed plants from 42 families. There are approximately 257 plant families in India, of which 213 are dicotyledonous and 44 are monocotyledonous. The 42 families into which the plants in the study area belonged are Annonaceae, Acanthaceae, Anacardiaceae, Apocynaceae, Araceae, Arecaceae, Balsaminaceae, Bignoniaceae, Bombacaceae, Boraginaceae, Cannabaceae, Capparaceae, Casuarinaceae, Combretaceae, Euphorbiaceae, Fabaceae, Lamiaceae (Labiatae), Lecythidaceae, Lythraceae, Malvaceae, Meliaceae, Moraceae, Muntingiaceae, Musaceae, Myrtaceae, Oxalidaceae, Phyllanthaceae, Poaceae or Gramineae, Pteridaceae, Putranjivaceae, Rhamnaceae,

Rubiaceae, Sapotaceae, Ulmaceae, Verbenaceae, Vitaceae, Zingiberaceae, Caricaceae, Colchicaceae, Calophyllaceae, Magnoliaceae and Rutaceae families respectively. The dominant families were Fabaceae (24 species), Moraceae (11 species), Malvaceae (9 species), Aracaceae (8 species), Apocynaceae (5 species), Rubiaceae (5 species), Phyllanthaceae (3 species), Lamiaceae or Labiatae (3 species), Anacardiaceae (3 species), Vitaceae (2 species), Sapotaceae (2 species), Myrtaceae (2 species), Lecythidaceae (2 species), Combretaceae (2 species), Boraginaceae (2 species), Annonaceae (2 species) and the remaining families showed single member belonging to them.

Despite Mumbai's total geographical area being 603.4 sq. km, only 110.77 sq. km are designated as forests in the 2021 State of Forest Report. The study accounted for 13.78 sq. km, indicating a notable 12.34% increase in green cover within the city. Among the surveyed locations, Trombay Hills and Bhabha Atomic Research Centre had the largest geographical extents, followed by IIT Mumbai, Dindoshi Dongri, and Hiranandani Helipad Hill. Royal Palm in Aarey exhibited the highest species diversity with 73 plant species, followed by IIT Mumbai and Gorai Essel Parking Hill. Noteworthy plant diversity was observed in several areas, emphasizing the importance of conserving these green spaces amidst urbanization pressures.

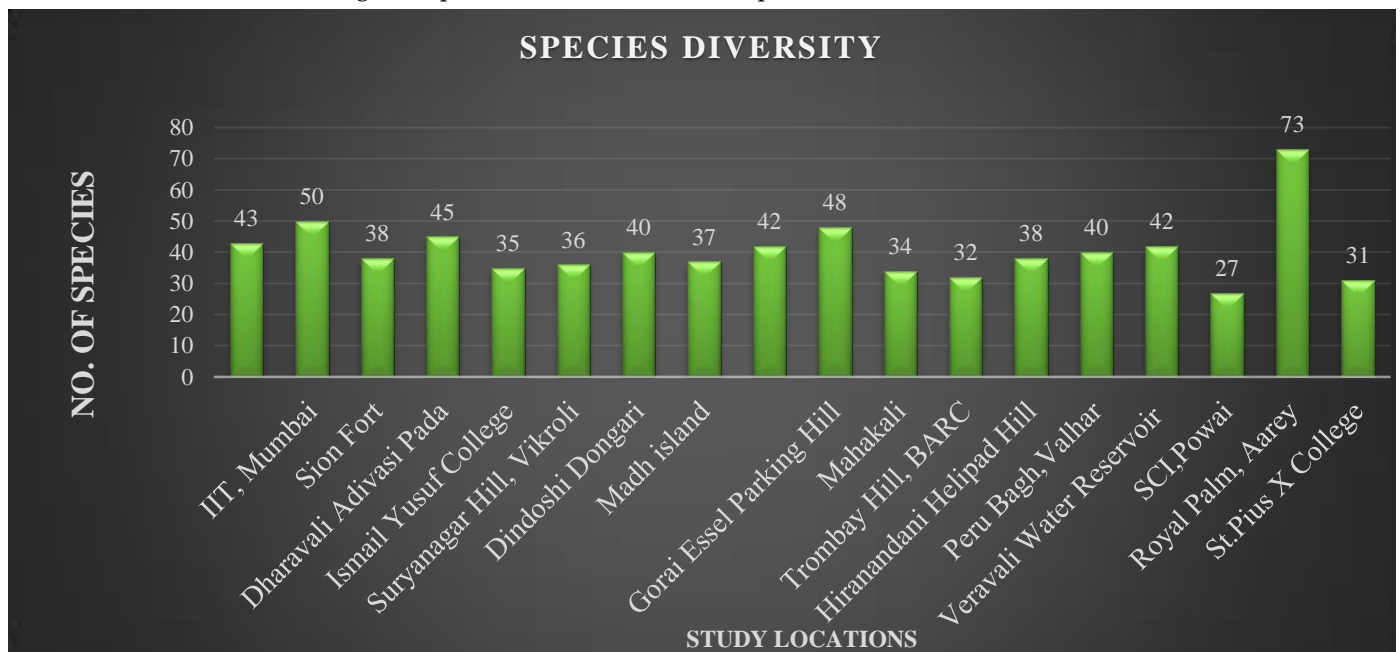


Figure 3: Species diversity within the selected study locations

Preserving such diverse ecosystems within the city limits is crucial to safeguarding biodiversity and ensuring a sustainable future for generations to come.

Conclusion

Assessing floral diversity is crucial for the conservation of natural resources. Without proper documentation and assessment, it's impossible to effectively conserve the rich biodiversity, including both flora and fauna. The escalating demands for food and shelter due to population growth have led to increased deforestation. Therefore, it's imperative to conserve these green spaces by assessing the unknown flora, which provides essential tangible and intangible benefits to humanity.

The present study aims to protect and preserve the green spaces within Mumbai, recognizing their significance and the need for conservation efforts. The findings reveal Mumbai's wealth of resources that contribute to the well-being of its residents. Identifying 18 areas with substantial plant diversity, totaling an additional 13.68 sq. km. underscores the potential for expanding the city's green areas. By safeguarding these regions, Mumbai could increase its green cover by 12.34%, contributing to the city's ecological sustainability.

Acknowledgement

We are thankful to Aslam Saiyad and Kaustubh Bhagat for their value contribution in documenting the floral diversity.

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