SUSTAINABLE DEVELOPMENT GOALS
-The need for a Grassroot Approach

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Foreword

In our modern world, the pursuit of progress is often synonymous with towering skyscrapers, technological advancements, and economic growth. However, amidst this fervor for development, the heartbeat of true progress lies not in the grandeur of infrastructures or the complexity of algorithms but in the resilience and vitality of our communities. It is in the grassroots, within the very fabric of local societies, where the essence of sustainable development truly resides. This book, "Sustainable Development Goals: Need for a Grassroots Approach," embarks on a transformative journey into the heart of sustainable progress.

The Sustainable Development Goals (SDGs) stand as a beacon for a better world, outlining 17 interconnected objectives to achieve a more equitable, prosperous, and sustainable future for all. While these global aspirations are laudable, their realization hinges on more than high-level policies and international agreements. It necessitates a ground-up approach, engaging communities, amplifying local voices, and empowering individuals to be the catalysts for change.

This book is a testament to the pivotal role grassroots initiatives play in shaping a sustainable world. It elucidates the need for a shift in focus, emphasizing the significance of local action in the realization of these global objectives. Through a tapestry of narratives, research, and practical insights, it unravels the tapestry of the grassroots movements that are quietly, yet profoundly, shaping our world. Within these pages, readers will explore the indispensable role of community-driven initiatives in achieving the SDGs. The stories shared span across continents, offering diverse perspectives and approaches that highlight the universal truth: change begins at the

grassroots. It unveils the power of local solutions in addressing global challenges, showcasing the ingenuity and resilience of communities in facing issues like poverty, climate change, health, education, and more. Moreover, the book goes beyond mere advocacy; it serves as a guide for those seeking to initiate, support, or scale grassroots efforts. It outlines practical strategies and best practices, offering a roadmap for implementing change at the local level. From mobilizing community resources to fostering partnerships and leveraging technology, this book provides a comprehensive toolkit for anyone passionate about effecting positive change in their community. In the quest for sustainability, the wisdom of grassroots efforts cannot be overlooked. It is within the hearts and homes of individuals that the spirit of change thrives. By embracing the principle of leaving no one behind, these local initiatives drive inclusivity, ensuring that the benefits of progress are distributed equitably among all members of society.

This book, through its deep exploration and advocacy, fosters a call to action. It urges policymakers, global leaders, and every citizen to recognize the pivotal role of grassroots movements in the pursuit of the SDGs. It ignites the flame of change, inspiring a collective reimagining of how progress is perceived and achieved. It empowers each reader to become a torchbearer of transformation, no matter their background, expertise, or resources.

In closing, the journey toward sustainable development is not a singular path but a mosaic of interconnected endeavors. This book stands as a compass, guiding us towards a future where the intertwining forces of local action and global goals converge harmoniously. It is an invitation to all individuals, communities, and institutions to join hands in weaving a world that thrives on the principles of sustainability, equity, and inclusivity. May the insights within these pages spark a revolution a grassroots revolution ushering in a new era of sustainable progress, where every voice matters, and every action counts and I take this opportunity to congratulate the Economics family for their initiative in organizing an international conference on this very relevant subject and the effort to bring forth a book of selected papers.

Dr. Rajeev Thomas
Principal

Preface

In the collective pursuit of a better world, the Sustainable Development Goals (SDGs) stand as a compass guiding our aspirations. Yet, the essence of these global ambitions lies not in distant boardrooms or grand assemblies but within the beating heart of our communities. This book, "Sustainable Development Goals: The need for a grassroots approach," delves into the very soul of progress, emphasizing the imperative role of grassroots initiatives in realizing these universal objectives.

The SDGs are not lofty ideals to merely admire from a distance; they are a blueprint for a world that thrives on inclusivity, sustainability, and shared prosperity. This book serves as a humble tribute to the power of local action, emphasizing that the SDGs can only be truly achieved through a ground-up approach. It unveils the unspoken narratives of resilience, innovation, and dedication that thrive within communities worldwide. These narratives resonate across cultures and geographies, demonstrating that the seed of change sprouts in the fertile soil of local action.

Moreover, this book is a guidebook, a roadmap for those seeking to initiate or support grassroots efforts. It encapsulates practical strategies, lessons learned, and the essential ingredients for success in these community-driven initiatives. It aims to inspire, inform, and empower all those impassioned to become agents of change, emphasizing that no contribution towards the SDGs is too small.

In essence, the pages that follow are not merely a compendium of ideas but a call to action. They invite us all to recognize the pivotal role of grassroots movements in the pursuit of a more sustainable, equitable, and harmonious world. They echo the sentiment that change begins at the grassroots, within the everyday actions and aspirations of ordinary people.

I would like to express my heartfelt thanks to all the authors who have enriched the book by contributing their paper. I also thank our patron Most Rev. Dr. Theodosius Mar Thoma Metropolitan, Former Manager, Rt. Rev. Dr. Thomas Mar Theethos Episcopa and Rt. Rev. Dr. Mathews Mar Makarios Episcopa for the strategic acumen and unwavering support infused this endeavor with organizational finesse. I extend my heartfelt

gratitude to the Bursar, Rev. S. George, whose meticulous financial guidance ensured the realization of this project, navigating budgetary seas with precision and wisdom. My deepest appreciation goes to the Principal, Dr. Rajeev Thomas, whose visionary leadership and encouragement fostered an environment where innovation thrived. Your unwavering belief in the importance of this work propelled it forward. I thank all the faculty members of Department of Economics for your support. We acknowledge all others who have supported and assisted directly and indirectly for completion of this work.

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Chapter 18

SDG 15.8: A Case study on the distribution the invasive alien plant species along urban-rural gradient in Kerala, India

Dr. Aswathy R Nair & Dr. Dhanya R

Abstract

An invasive species is an alien or exotic species, a non-native organism introduced into a new habitat or ecosystem, where it establishes and proliferates rapidly. It leads to ecological disruption, economic detriment and harm to human health. The United Nations' Sustainable Development Goal 15.8, emphasises the critical importance of preventing and managing invasive alien species (IAS) in terrestrial and aquatic environments, particularly prioritized species. Urban landscapes exhibit high spatial heterogeneity and have been identified as potential sources of Invasive Alien Plant (IAP) that threaten the native flora. Linear infrastructural elements like roads and railway lines have been facilitating the dispersal of IAP seeds. Global invasive species data, reveals that 242 invasive species, comprising 157 animal species and 37 herbaceous and shrub species found in India. In this Species such as Lantana Camara L., Euphorbia Heterophylla L., Parthenium Hysterophorus L., and Mikania Micrantha, have established widespread presence in various regions. In this context, it is essential to investigate the extent of invasive species proliferation in ecologically diverse areas. Urban ecological studies along the urban-rural gradient in Kerala are particularly pertinent. This study aims to find the distribution patterns of IAS along the urban-rural gradient In the Calicut - Tirur region. The intensive study was conducted along a roadway from Calicut to Tirur a 52-kilometer stretch with 45 randomly selected sample plots. The results of this study highlight a significant degree of IAP invasion in this region, hence public participation and LSGD will be beneficial to the eradication of IAP.

Keywords: SDG 15.8, Urban ecology, Invasive Alien Plants.

Introduction

In recent decades, there has been a significant shift in the field of ecology towards studying Invasive Plant Species (IAP), moving from the periphery to the mainstream. Invasive alien plants are foreign plant species introduced to new environments, often unintentionally, and have the ability to rapidly spread and outcompete native vegetation. The spread of IAP species is often linked to factors like travel, trade, and tourism, their reproductive and dispersal capabilities, rapid growth, and their ability to tolerate pollution and disturbances (Catford et al. 2009; Marco *et al.* 2010).

Urban areas are recognized as potential sources of IAP, posing a threat to native biodiversity in natural habitats (Padayachee et al. 2017). Ecological research on urban landscapes often categorizes them into "urban," "peri-urban," and "rural" based on land use (Aronson *et al.* 2015; Ariori*et al.* 2017). McDonnell and Pickett (1990) introduced the concept of an urban-to-rural ecological gradient to measure ecological changes in the area (Ariori*et al.*, 2017). Urbanization significantly alters native

terrestrial plant communities, leading to biotic homogenization in urban environments, where invasive alien plant species become dominant (McKinney and Lockwood 1999).

Invasive alien species (IAS) also have adverse economic impacts, costing India's economy about US$ 116 billion annually (Pimentel *et al.* 2001). Despite the ecological challenges posed by IAS in India, there's limited awareness of the significant financial costs associated with these invasions. A study on IAP identified 173 invasive alien species in India, spanning 117 genera and 44 plant families (Sudhakar 2008). Additionally, 54 terrestrial IAPs were reported in India (Sandilyan, .). In a related study by Sajeev *et al.* (2012), 38 invasive plant species were identified in Kerala's forests. The "Handbook on Invasive Plants of Kerala" by Suresh *et al. (*2013) is a notable effort, presenting a concise list of 84 terrestrial invasive alien plant species recorded in Kerala. Currently, there are 95 identified IAPs in Kerala (KFRI). These studies underline the importance of understanding and addressing the invasive species threat in different landscapes within the state.

To comprehend the consequences of IAP in urban areas and mitigate their impact, it's crucial to assess urban vegetation. Continuous assessments of urban vegetation provide essential insights into the ecological health of cities and enable the development of plans to protect native plants and control invasive species, supporting the long-term sustainability of urban areas.

This study explores the diversity and distribution of invasive alien plant species and co-occurring plants along an urban-to-rural gradient. Building on previous research (Kowarik2020; Ku¨hn*et al.* 2004), we hypothesize that there is a positive correlation between proximity to the city centre and the richness of invasive species. Specifically, we expect that sites closer to the city centre, characterized by higher urbanization levels, will exhibit a greater richness of invasive species.

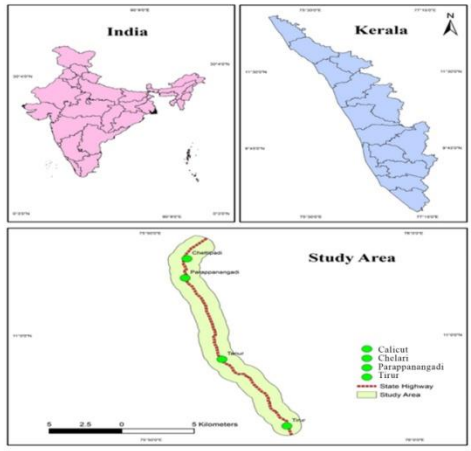
Objectives

- To investigate the distribution of invasive plants and cooccurring plants along an urban-rural gradient
- To examine the diversity indices of IAP and cooccurring plants
- To find the invasion of exotic species along an urban-rural gradient

Methodology

Study area

Malappuram is Kerala's largest district, situated at 11.0510° N latitude and 76.0711° E longitude. Calicut situated at 11.0510° N latitude and 76.0711° E longitude in west coast region of Kerala. The climate of the study area is tropical monsoon the average rainfall is 3266 mm and the temperature ranges from 28^0 c to 38.8^0c. This region has a well-developed transport system with roads and railways. The intensive study will be conducted along the 52 km from Calicut to Tirur road stretch.



Source: Google earth pro

Method

The sample plots (30mx3m) will be selected randomly along the urbanization gradient at every 1 km interval. Herbs and shrubs from the selected quadrant were taken to the study. All plants were identified and documented by species level with the help of the Handbook of Kerala Forest Research Institute and the International Plant Name Index (2019). The co-occurring plants in the same quadrant were identified and quantified using keys pertinent to the study area. To assess the quantitative vegetation composition, following formulas used.

Density: The expression of the numerical strength of a species or a category.

$$\text{Density} = \frac{\textit{Total no: of individuals of the species}}{\textit{No; of quadrat per unit studued}}$$

Frequency: The degree of dispersion of individual species or a category in an area.

$$\text{Frequency}(\%) = \frac{\textit{No. of units in which the species occured}}{\textit{Total no. of unit studied}} \times 100$$

Abundance: The number of individuals of different species or categories in the community per unit area.

$$\text{Abundance} = \frac{\textit{Total no. of species}}{\textit{No. of quadrat per unit in which they occur}}$$

Results

The study examined the vegetation composition,*Chromolaena odorata* and *Hyptissuaveolens* displayed high densities, comprising 54.4 and 44.8 individuals, respectively (Graph 1.1*). Chromolaena odorata* dominated with 43.60% abundance, followed by *Hyptissuaveolens* (35.90%), and *Synedrellanodiflora* (5.02%) (Graph 1.3). In contrast, *Sida acuta* and *Sidarhombifolia* exhibited high densities and abundances among Co-occurring plants (Graph 1.2 and Graph 1.4).

Plot 6 hadthe highest individual count (2,497), indicating a potential species hotspot, while Plot 3, 12, 22, 34, 35, and 39 showed lower counts, implying lower species

abundance in those areas (Graph 1.5). These findings provide valuable insights into the distribution and diversity of plant species along the urban-rural gradient, contributing to the understanding of ecological patterns in the region.

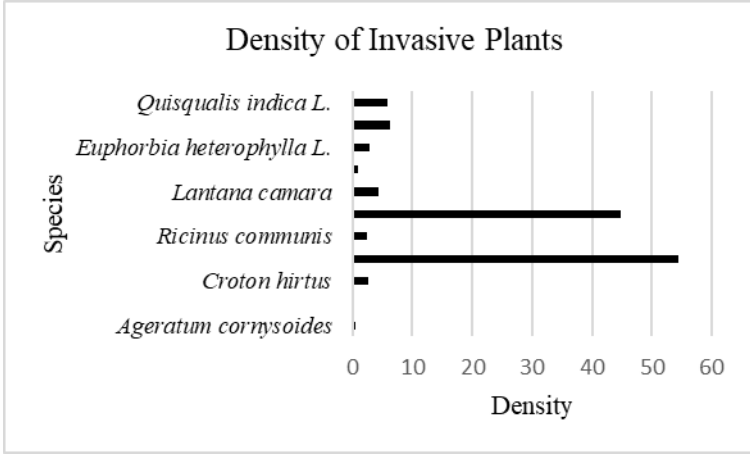


Figure 1.1. Density of invasive plant species

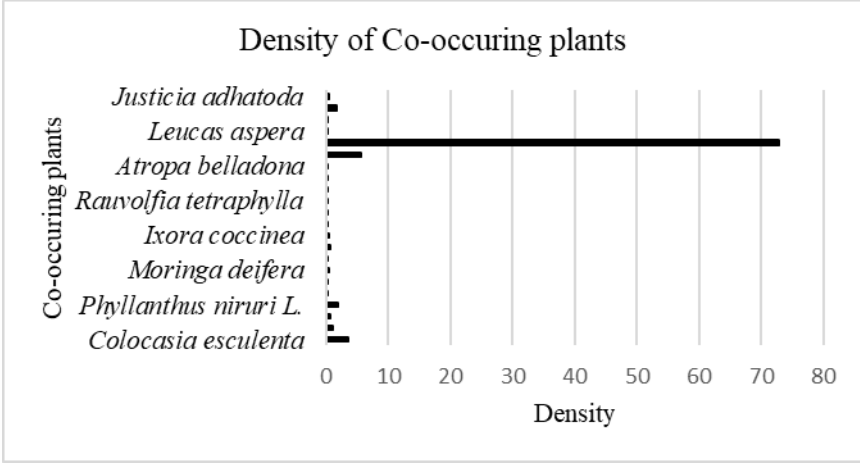


Figure 1.2 : Density of Co-occuring plants

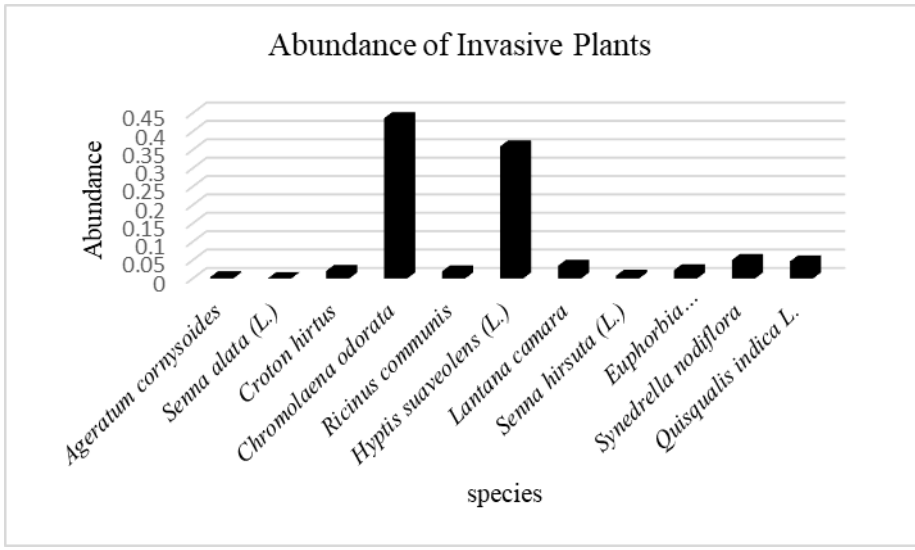


Figure 1.3: Abundance of invasive plant species

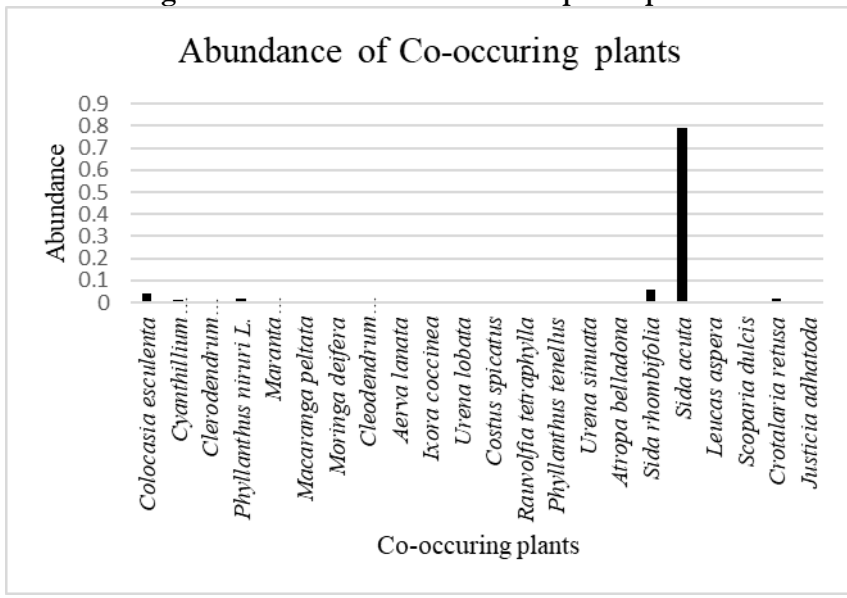
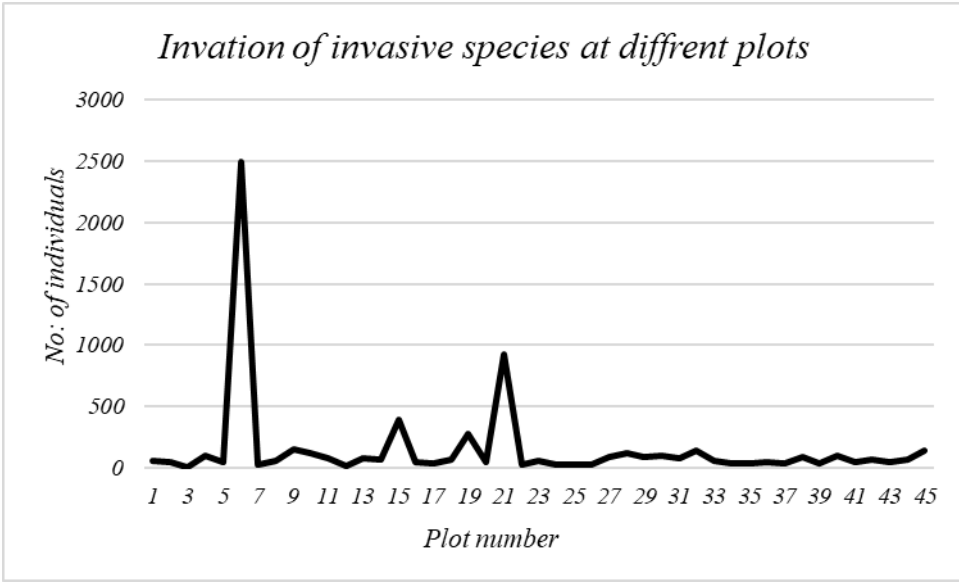


Figure 1.4. Abundance of Co-occuring plant species



1.5. Graph showing invasion of invasive species at different plots

Discussion

The study revealed that the IAP in the Tirur-Calicut area were highly diversified.11 IAP representatives were identified from five plant families: Caesalpiniaceae, Asteraceae, Euphorbiaceae, Laamiacaeae, and Cucumbretaceae. Among the invasive plants, *Chromolaena odorata, Hyptissuaveolens*, and *Synedrellanodiflora* were dominant in terms of their presence and abundance.

Other invasive species had lower values in these categories, indicating their relatively lesser impact or prevalence. In the co-occurring plant category*, Sida acuta* and *Sidarhombifolia* stood out with high densities, abundance. This suggests that these two species are more prevalent and significant in the context of co-occurring plants in the studied area.

Sl.No.	Co-occurring Plants	Density	Abundance
1	*Colocasia esculenta*	3.5333	0.0383
2	*Cyanthillium cinereum.*	1.0667	0.0116
3	*Clerodendrumpaniculatum*	0.6667	0.0072
4	*Phyllanthus niruri L.*	1.8889	0.0205
5	*Maranta arundinaceae*	0.3556	0.0039
6	*Macaranga peltata*	0.3111	0.0034
7	*Moringa deifera*	0.4444	0.0048
8	*Cleodendruminfortunatum*	0.1111	0.0012
9	*Aerva lanata*	0.6889	0.0075
10	*Ixora coccinea*	0.4000	0.0043
11	*Urena lobata*	0.3778	0.0041
12	*Costusspicatus*	0.2667	0.0029
13	*Rauvolfiatetraphylla*	0.1556	0.0017
14	*Phyllanthus tenellus*	0.3333	0.0036
15	*Urena sinuate*	0.2889	0.0031
16	*Atropa belladonna*	0.3556	0.0039
17	*Sidarhombifolia*	5.5778	0.0605
18	*Sida acuta*	72.9333	0.7907
19	*Leucas aspera*	0.2667	0.0029
20	*Scoparia dulcis*	0.1778	0.0019
21	*Crotalaria retusa*	1.6444	0.0178
22	*Justicia adhatoda*	0.4000	0.0043

Table 2.2.Density,Abundance, of Co-occuring plants

Sl.No.	Invasive Species	Density	Abundance
1	*Ageratum cornysoides*	0.444	0.004
2	*Senna alata (L.)*	0.089	0.001
3	*Croton hirtus*	2.556	0.020
4	*Chromolaena odorata*	54.400	0.436
5	*Ricinus communis*	2.422	0.019
6	*Hyptissuaveolens (L.)*	44.800	0.359
7	*Lantana camara*	4.311	0.035
8	*Senna hirsuta (L.)*	0.933	0.007
9	*Euphorbia heterophylla L.*	2.800	0.022
10	*Synedrellanodiflora*	6.267	0.050
11	*Quisqualis indica L.*	5.756	0.046

Colocasia esculenta has the highest density among the co-occurring plants with a value of 3.5333, indicating that it is relatively widespread in the area under study. *Sida acuta* stands out with a significantly high density of 72.9333, making it the most densely populated co-occurring plant. It also has a relatively high abundance of 0.7907, suggesting its dominance in the ecological community.Several co-occurring plants, such as *Cyanthillium cinereum, Clerodendrumpaniculatum,* and *Maranta arundinaceae,* have low densities and abundances, indicating their limited presence in the area.*Sidarhombifolia*exhibits a high density of 5.5778, making it relatively common, while its abundance is 0.0605.Other co-occurring plants, including *Phyllanthus niruriL.,Moringadeifera*, and *Aerva lanata,* have moderate to low densities and abundances, suggesting their coexistence but not dominance.

Chromolaena odorata has the highest density among the invasive species, with a substantial value of 54.400, indicating a significant presence of this invasive plant in the area. *Hyptissuaveolens (L.)* is another invasive species with a high density of 44.800 and an abundance of 0.359, signifying its widespread occurrence in the ecosystem.*Sennaalata (L.)* and *Senna hirsuta (L.)*have relatively low densities and abundances, suggesting that they are less prevalent compared to the previously mentioned invasive species.*Quisqualis indica L.* and *Synedrellanodiflora* both exhibit moderate densities and abundances, indicating their presence in the area but not as dominant as *Chromolaena odorata* and *Hyptissuaveolens.Ageratum cornysoides, Croton hirtus*, and *Ricinus communis*occur in the middle range in terms of density and abundance among the invasive species.

The quantitative analysis of data shows the competitive nature of certain invasive species, particularly *Chromolaena odorata*, which has become highly abundant and widespread. co-occurring plants exhibit lower density and abundance, indicating potential challenges in their ability to thrive in the presence of invasive species. Understanding these dynamics is essential for conservation efforts and managing the impacts of invasive species on ecosystems. It is crucial to continue monitoring these species and their interactions to develop effective strategies for preserving native biodiversity.

Conclusion

11 Invasive alien plants and 22 co-occuring plants were identified from the study area. The study highlights the high diversity of invasive alien species in the Tirur-Calicut area, with certain species showing dominance. co-occurring plants exhibit lower diversity and are characterized by the prevalence of specific species, such as *Sida acuta* and *Sidarhombifolia*.

The findings of this study serve as a baseline for evaluating the impact of human activities on urban ecosystems, specifically on biodiversity.The results also highlight the importance of periodic quantitative monitoring in urban habitats with varying degrees of urbanization. Such assessments generate precise knowledge about the current status and dynamics of species diversity in vegetation.As a result, deliberate efforts should be made to control these species and inform the community about the proliferation of these plants. Public participation and Local Self Government Department (LSGD) will be beneficial to the eradication of invasive plants.

The proliferation of invasive plant species in urban areas poses a significant challenge to achieving SDG 15.8 and threatens the well-being of both ecosystems and urban communities.To address these concerns and advance SDG 15.8, urban planners, environmental agencies, and communities need to implement strategies that include:
Early Detection and Rapid Response: Timely identification and management of invasive species can prevent their establishment and spread.
Education and Outreach: Raising awareness among urban residents about the impact of invasive species can encourage responsible landscaping and gardening practices.
Native Plant Promotion: Encouraging the use of native plants in urban landscaping can help restore ecological balance and support local wildlife.
Policy and Regulation: Implementing and enforcing regulations on the import and sale of potentially invasive plants is critical for prevention.
Research and Monitoring: Continual research and monitoring are essential to understand the dynamics of invasive species and adapt management strategies accordingly.

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