SURVEY OF ORNAMENTAL PLANTS IN UNIVERSITY OF BENIN, UNIBEN

BY

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SR/2309/RPR/25/51

UNIVERSITY OF BENIN

BENIN CITY

OCTOBER, 2025.

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A PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF PLANT BIOLOGY AND BIOTECHNOLOGY, FACULTY OF LIFE SCIENCES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE (HONOURS) DEGREE (BSC.) IN PLANT BIOLOGY AND BIOTECHNOLOGY IN THE UNIVERSITY OF BENIN, BENIN CITY, EDO STATE, NIGERIA.

OCTOBER, 2025.

AUTHOR'S STATEMENT

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DEDICATION

This work is dedicated to Almighty God for his love, guidance and care for me. And to my parents for their care, love and support towards me.

ACKNOWLEDGEMENT

Firstly, I want to appreciate God Almighty for his unlimited grace upon my life throughout the duration of my project. It wouldn't have been possible without Him. In addition, I want to thank my Supervisor Prof. M.E Osawaru for his wisdom, knowledge and guidance.

Also Thank you to Dr Ahana C. M. and Prof. Akinnibosun for their help, assistance and insights towards the completion of my project. Special thanks go to the Head of Department, Prof. Beckley Ikhajiagbe. I am also grateful to all the lecturers and the entire staff of the Department of Plant Biology and Biotechnology at the University of Benin for providing me with the knowledge and resources I needed throughout my academic development.

My deepest gratitude goes to my parents Mr. and Mrs. Ukpong and my love ones. Special thanks also to my siblings for their love and care. Thank you ma.

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ABSTRACT

This study surveyed the diversity, abundance, and distribution of ornamental plants within the University of Benin (UNIBEN), Edo State, Nigeria. Five sites were selected for the assessment they were Main Gate (Site A), Edaiken Road (Site B), Vice Chancellor's Office (Site C), Medical Complex (Site D), and Anatomy Back Gate (Site E). A line transect method was adopted, and plant species occurring along each transect were identified, counted, and recorded. Diversity was evaluated using the Shannon–Wiener diversity index (H′) and Evenness index (J). Results revealed variations in vegetation composition and diversity across the sites. Site A (Main Gate) had the highest number of individuals (63) and moderate diversity (H′ = 1.217), dominated by *Duranta erecta*. Site B (Edaiken Road) recorded the lowest richness (two species) and diversity (H′ = 0.694), while Site C (Vice Chancellor's Office) was strongly dominated by *Ixora coccinea* (80.33%), resulting in the lowest diversity (H′ = 0.666). Site D (Medical Complex) exhibited the highest diversity (H′ = 1.368) and evenness (J = 0.764), indicating a well-balanced vegetation structure, while Site E (Anatomy Back Gate) showed moderate richness (H′ = 1.220). Overall, findings showed that ornamental plant diversity in UNIBEN varied widely among sites, influenced by species dominance, planting design, and maintenance intensity. The Medical Complex emerged as the most ecologically balanced site, while the Vice Chancellor's Office was the least diverse. The study concludes that ornamental diversity within the university can be improved through deliberate introduction of more indigenous and underutilized species, adoption of mixed planting strategies, and sustainable landscape management to promote ecological stability and enhance aesthetic value.

CHAPTER ONE

INTRODUCTION

Ornamental plants are cultivated primarily for their beauty and functional value, and they contribute significantly to the quality of human environments. Beyond serving decorative purposes, they play crucial roles in enhancing air quality, regulating microclimates, improving psychological well-being, and supporting biodiversity (Lohr *et al.,* 1996). In urban landscapes, ornamentals provide ecological services such as shade provision, temperature regulation, carbon sequestration, and habitat for pollinators and birds, thereby linking aesthetic functions with ecological sustainability (Jim and Chen, 2009). Globally, ornamental horticulture has evolved into a key component of urban planning and landscape architecture, promoting sustainable cities and enriching cultural heritage (Van Huylenbroeck, 2018).

In tropical regions such as West Africa, the cultivation of ornamentals is especially relevant due to the year-round growing conditions that support a wide variety of flowering plants, palms, hedges, shrubs, and climbers. In Nigeria, ornamentals are widely planted in homes, religious centres, schools, markets, and institutional campuses. They not only beautify the environment but also reflect cultural identities and provide spaces for recreation, relaxation, and ceremonial activities. Previous studies conducted in major Nigerian cities such as Lagos and Ibadan have recorded a high diversity of ornamental trees, shrubs, and groundcovers, emphasizing their roles in urban beautification and ecological balance (Odewo *et al.,* 2009; Akpan and Akinlabi, 2015).

Despite this importance, research in Nigeria has largely focused on tree inventories and ethnobotanical uses of plants, with relatively few systematic studies dedicated to the diversity, distribution, and functions of ornamentals. As such, ornamental plants remain an under documented component of urban and institutional landscapes, even though they provide direct environmental, aesthetic, and social benefits. A systematic survey of ornamental plants can therefore serve as an important reference for ecological management, environmental education, and sustainable landscaping.

The University of Benin (UNIBEN), Benin City, is a large tertiary institution with extensive campus greenery. Across its academic, residential, and administrative areas, the campus is enriched with diverse ornamental species including hedges, lawns, palms, climbers, shrubs, and flowering plants that contribute to the beauty and serenity of the environment. These ornamentals also serve practical functions such as demarcating walkways, reducing dust, and providing shaded recreational areas.

1.2 LITERATURE REVIEW

Ornamental plants are cultivated primarily for decorative purposes, enhancing the visual appeal of landscapes while also providing ecological and social benefits (Jim and Chen, 2009). They contribute to environmental sustainability by reducing air pollutants, sequestering carbon, conserving soil, and regulating microclimates in urban areas (Akinyemi *et al.,* 2017). Beyond aesthetics, ornamental plants are also valuable in cultural, recreational, and educational contexts (Oloyede *et al.,* 2013).

1.2.1 Ornamental Plant Diversity in Nigeria

Nigeria possesses a rich diversity of ornamental plants, with species ranging from flowering plants to shrubs, trees, climbers, and grasses adapted to tropical conditions (Bamidele *et al.,* 2019). Surveys across cities such as Ibadan, Lagos, and Ilorin have documented extensive use of both indigenous and exotic ornamental species for landscaping, parks, and institutional beautification (Oloyede *et al.,* 2013; Ogundipe and Oyenubi, 2012). These studies highlight the growing interest in ornamental horticulture as a contributor to urban greening and biodiversity conservation.

1.2.2 Ecological and Socio-Economic Importance

Ornamental plants play a significant role in mitigating the negative effects of urbanisation. They improve air quality, serve as habitats for pollinators, and enhance human psychological well-being by creating more attractive environments (Jim and Chen, 2009). Socio-economically, ornamental horticulture supports landscaping industries, generates income, and promotes eco-tourism (Bamidele *et al.*, 2019). Universities and public institutions also benefit from ornamental plants by creating conducive learning spaces and preserving genetic resources for academic research (Ogundipe and Oyenubi, 2012).

1.2.3 Ornamental Plants in Nigerian Universities

Studies within Nigerian universities have reported diverse assemblages of ornamental plants that serve both aesthetic and academic functions. For example, (Ogundipe and Oyenubi 2012) documented over 100 species of ornamental plants in the University of Lagos, while (Oloyede *et al*.,2013) reported similar richness in Ibadan's parks and gardens. These surveys provide baseline data for plant conservation and sustainable landscaping practices. However, published information on the University of Benin (UNIBEN) remains scarce, creating a need for systematic surveys of its ornamental flora.

1.3 BACKGROUND FOR THE STUDY

The University of Benin (UNIBEN), located in Benin City, Edo State, is among Nigeria's foremost higher institutions with a large campus environment containing diverse plant species. While ornamental plants are visibly present across its faculties, hostels, and administrative areas, little documentation exists on their diversity, distribution, and ecological roles. Conducting a survey of ornamental plants in UNIBEN will therefore provide baseline data useful for conservation planning, teaching, landscaping design, and promoting environmental sustainability on campus.

1.4 JUSTIFICATION FOR FURTHER RESEARCH

Despite increasing research on ornamental plants in Nigeria, specific data on the diversity and uses of ornamental species within UNIBEN remain unavailable in published literature. A systematic survey is important to:

- Provide baseline information on species composition and diversity.
- Identify the dominance of indigenous versus exotic species.
- Support campus landscaping, environmental management, and biodiversity conservation.
- Serve as a reference point for botanical research, teaching, and future ecological studies.

1.5 AIM AND OBJECTIVES

Aim:

To assess and document the diversity, abundance, and distribution of ornamental plants within the University of Benin (UNIBEN) campus.

Objectives:

- To identify and classify the ornamental plant species present within the UNIBEN campus.
- To evaluate species richness, abundance, and diversity indices across selected sites.
- To generate baseline data that can support landscaping design, biodiversity conservation, and environmental management in UNIBEN.

CHAPTER TWO

MATERIALS AND METHODS

2.1 Study Area

The study was carried out at the University of Benin (UNIBEN), located in Ugbowo axis of Benin metropolis (6.2^0N – 5.3^0E) Benin City, Edo State, Nigeria. The institution lies within the humid tropical rainforest zone, which is characterized by high annual rainfall, warm temperatures, and a bimodal rainfall pattern that favours luxuriant vegetation growth. The campus is well known for its extensive greenery, comprising both indigenous and exotic ornamental plants that are distributed across academic, residential, and administrative areas.

2.2 Sampling Sites

Five sites within the university were selected for the study. Site A was the Main Gate, which represents the principal entrance of the campus and is landscaped with hedges and shrubs. Site B was located along Edaiken Road within the campus and consisted mainly of roadside vegetation. Site C was the Vice Chancellor's Office, which contains a variety of ornamental plants arranged in a formal administrative landscape. Site D was the Medical Complex, an area characterized by diverse plantings around medical facilities. Site E was the Anatomy Back Gate, a rear campus location that contained mixed ornamental stands Figure 2.1.

2.3 Sampling Design

A line transect method was employed for the vegetation assessment. At each site, a transect measuring 90 metres in length was laid, and observations were made at 1 metre intervals, giving a total of ninety sampling points per transect. At each interval, all ornamental plants that occurred directly on or adjacent to the line were identified, counted, and recorded.

Figure 2.1: Map of the study area. Source: Adapted from Oseaga *et al.* (2024)

2.4 Data Collection

Plant species were identified in the field using standard floras, taxonomic keys, and published reference materials. Where uncertainties arose, photographs were taken and later verified with the aid of experts and reference texts. For each site, the number of individuals per species was counted, and from these data, species richness, species abundance, and relative abundance were determined. Species richness was obtained as the total number of species recorded at a site, while species abundance represented the total number of individuals. Relative abundance was calculated as the proportion of each species relative to the total number of individuals recorded at the site.

2.5 Data Analysis

The data obtained from the field were summarized into frequency tables showing the species composition, number of individuals, and proportional abundance of ornamental plants at each site The Shannon–Wiener diversity index (H′) was employed as a measure of species diversity. This index takes into account both species richness and the relative abundance of each species, providing a balanced picture of diversity. The index was calculated using the formula

$$H' = - \Sigma (Pi \times \ln Pi)$$

where Pi = ni/N, ni is the number of individuals belonging to species i, and N is the total number of individuals of all species.

To complement this, the Evenness index (J) was calculated to assess how evenly individuals were distributed among the species present at each site. Evenness provides insight into whether diversity is dominated by a few species or spread more equally across many species. It was calculated as:

$$J = H' / \ln S$$

where S represents the total number of species observed at the site.

CHAPTER THREE

RESULTS

The results from the five study sites (A–E) within the University of Benin revealed notable differences in vegetation composition, abundance, and diversity. At Site A (Main Gate), a total of 63 individuals belonging to five species were recorded, with *Duranta erecta* dominating the stand at 63.49%. The Shannon diversity index (H′ = 1.047) suggested a moderate level of diversity. The Evenness value (J = 0.651) indicated that although several species were present, their distribution was somewhat uneven.

Site B (Edaiken Road) recorded the lowest richness, with only two species and a total of 16 individuals. Here, *Adonidia merrillii* was the dominant species, contributing 56.25% of the stand. The Shannon index (H′ = 0.694) confirmed the low diversity. However, the Evenness value (J = 1.000) showed that the two species were distributed almost perfectly evenly in terms of relative abundance.

At Site C (Vice Chancellor's Office), 61 individuals representing four species were recorded. The site was strongly dominated by *Ixora coccinea*, which accounted for 80.33% of the total individuals, and this heavy dominance suppressed diversity. This was reflected in the lowest Shannon index value (H′ = 0.666) across all sites, while the Evenness value (J = 0.480) further confirmed the lack of balance in species representation.

Site D (Medical Complex) consisted of 21 individuals from six different species. Unlike the other sites, species were relatively evenly distributed, with *Platycladus orientalis*, *Euphorbia hypericifolia*, and *Ixora coccinea* each contributing 19.05% of the stand. Consequently, Site D recorded the highest Shannon index (H′ = 1.368) and a high Evenness value (J = 0.764), highlighting its balanced composition and making it the most diverse site.

At Site E (Anatomy Back Gate), 35 individuals representing four species were found. *Duranta erecta* dominated with 40% of the stand, but the Shannon index (H′ = 1.220) indicated moderate diversity. The Evenness value (J = 0.880) suggested that despite the dominance of one species, the overall distribution of species was more balanced compared to Sites A and C.

Comparing across all sites, it is evident that species richness was highest at Sites A and D, and lowest at Site B with only two species. Site A also had the greatest number of individuals (63), while Site B recorded the least (16). In terms of dominance, Site C was the most heavily dominated by a single species, explaining its very low diversity, while Site D had the least dominance due to its balanced distribution of species. Based on Shannon index values, Site D emerged as the most diverse (H′ = 1.368), followed by Sites E (1.220) and A (1.047), whereas Sites B (0.694) and C (0.666) recorded the lowest diversity. Considering evenness, Site B scored the highest (J = 1.000) due to its perfectly balanced two-species composition, while Site C scored the lowest (J = 0.480) due to the overwhelming dominance of *Ixora coccinea*.

Overall, the Medical Complex (Site D) stood out as the most ecologically balanced and diverse in terms of both richness and evenness, while the Vice Chancellor's Office (Site C) was the least diverse due to strong dominance.

Table 3.1 Species composition and diversity index components for Site A

Species	Number	% of Stand	Pi	log_2Pi	$Pi \cdot log_2Pi$	lnPi	Pi·lnPi
Hibiscus rosa-sinensis	1	1.59	0.0159	-5.977	-0.095	-4.143	-0.066
Tradescantia spathacea	2	3.17	0.0317	-4.977	-0.158	-3.450	-0.109
Ixora coccinea	10	15.87	0.1587	-2.655	-0.421	-1.841	-0.292
Duranta erecta	40	63.49	0.6349	-0.655	-0.416	-0.454	-0.288
Acalypha wilkesiana	10	15.87	0.1587	-2.655	-0.421	-1.841	-0.292
Total	63	100.00	1.000		-1.511		-1.047

Key to Parameters

% of Stand — Percentage abundance

Pi — Proportional abundance

log2Pi — Base-2 logarithm of the proportional abundance

Pi·log2Pi — Product of the proportional abundance and its base-2 logarithm

lnPi — Natural logarithm (base-e) of the proportional abundance

Pi·lnPi — Product of the proportional abundance and its natural logarithm

Table 3.2 Species composition and diversity index components for Site B

Species	Number	% of Stand	Pi	$\log_2 Pi$	$Pi \cdot \log_2 Pi$	lnPi	Pi·lnPi
Adonidia merrillii	9	56.25	0.5625	-0.83	-0.467	-0.576	-0.324
Plumeria pudica	7	43.75	0.4375	-1.19	-0.519	-0.826	-0.361
Total	16	100.00	1.000		-0.986		-0.694

Key to Parameters

% of Stand — Percentage abundance

Pi — Proportional abundance

log2Pi — Base-2 logarithm of the proportional abundance

Pi·log2Pi — Product of the proportional abundance and its base-2 logarithm

lnPi — Natural logarithm (base-e) of the proportional abundance

Pi·lnPi — Product of the proportional abundance and its natural logarithm

Table 3.3 Species composition and diversity index components for Site C

Species	Number	% of Stand	Pi	$\log_2 Pi$	$Pi \cdot \log_2 Pi$	lnPi	Pi·lnPi
Ixora coccinea	49	80.33	0.803	-0.317	-0.255	-0.220	-0.177
Duranta erecta	8	13.11	0.131	-2.93	-0.384	-2.03	-0.266
Polyalthia longifolia	2	3.28	0.033	-4.93	-0.164	-3.41	-0.113
Viburnum suspensum	2	3.28	0.033	-4.93	-0.164	-3.41	-0.113
Total	61	100.00	1.000		-0.967		-0.666

Key to Parameters

% of Stand — Percentage abundance

Pi — Proportional abundance

log2Pi — Base-2 logarithm of the proportional abundance

Pi·log2Pi — Product of the proportional abundance and its base-2 logarithm

lnPi — Natural logarithm (base-e) of the proportional abundance

Pi·lnPi — Product of the proportional abundance and its natural logarithm

Table 3.4 Species composition and diversity index components for Site D

Species	Number	% of Stand	Pi	log_2Pi	$Pi \cdot log_2Pi$	lnPi	Pi·lnPi
Platycladus orientalis	4	19.05	0.190	-2.39	-0.455	-1.66	-0.316
Hibiscus rosa-sinensis	3	14.29	0.143	-2.81	-0.403	-1.95	-0.278
Euphorbia hypericifolia	4	19.05	0.190	-2.39	-0.455	-1.66	-0.316
Mussaenda erythrophylla	3	14.29	0.143	-2.81	-0.403	-1.95	-0.278
Tecoma stans	3	14.29	0.143	-2.81	-0.403	-1.95	-0.278
Ixora coccinea	4	19.05	0.190	-2.39	-0.455	-1.66	-0.316
Total	21	100.00	1.000		-2.57		-1.368

Key to Parameters

% of Stand — Percentage abundance

Pi — Proportional abundance

log2Pi — Base-2 logarithm of the proportional abundance

Pi·log2Pi — Product of the proportional abundance and its base-2 logarithm

lnPi — Natural logarithm (base-e) of the proportional abundance

Pi·lnPi — Product of the proportional abundance and its natural logarithm

Table 3.5 Species composition and diversity index components for Site E

Species	Number	% of Stand	Pi	$\log_2 Pi$	$Pi \cdot \log_2 Pi$	lnPi	Pi·lnPi
Ixora coccinea	7	20.0	0.200	-2.32	-0.464	-1.61	-0.322
Hamelia patens	2	5.7	0.057	-4.13	-0.236	-2.86	-0.163
Duranta erecta	14	40.0	0.400	-1.32	-0.528	-0.92	-0.368
Polyalthia longifolia	12	34.3	0.343	-1.54	-0.528	-1.07	-0.368
Total	35	100.0	1.000		-1.76		-1.22

Key to Parameters

% of Stand — Percentage abundance

Pi — Proportional abundance

log2Pi — Base-2 logarithm of the proportional abundance

Pi·log2Pi — Product of the proportional abundance and its base-2 logarithm

lnPi — Natural logarithm (base-e) of the proportional abundance

Pi·lnPi — Product of the proportional abundance and its natural logarithm

Table 3.6: Species found in the study area

S/N	Specie	Family
1.	*Viburnum suspensum*	Adoxaceae
2.	*Polyalthia longifolia*	Annonaceae
3.	*Plumeria pudica*	Apocynaceae
4.	*Adonidia merrillii*	Arecaceae
5.	*Tecoma stans*	Bignoniaceae
6.	*Tradescantia spathacea*	Commelinaceae
7.	*Platycladus orientalis*	Cupressaceae
8.	*Acalypha wilkesiana*	Euphorbiaceae
9.	*Euphorbia hypericifolia*	Euphorbiaceae
10.	*Hibiscus rosa-sinensis*	Malvaceae
11.	*Hamelia patens*	Rubiaceae
12.	*Ixora coccinea*	Rubiaceae
13.	*Mussaenda erythrophylla*	Rubiaceae
14.	*Duranta erecta*	Verbenaceae

Plate 3.1: *Ixora coccinea*

Plate 3.2: *Duranta erecta*

Plate 3.3: *Platycladus orientalis*

Plate 3.4: *Polyalthia longifolia*

CHAPTER FOUR

DISCUSSION

The overall trend, as presented in the vegetation diversity results across the sampling sites, showed that Site D (Medical Complex) recorded the highest Shannon diversity index (H′ = 1.368) and Evenness (J = 2.570), making it the most ecologically balanced and diverse location. This was followed by Site E (H′ = 1.220), Site A (H′ = 1.047), and Site B (H′ = 0.694), while Site C (Vice Chancellor's Office) exhibited the lowest diversity (H′ = 0.666) due to strong dominance by *Ixora coccinea*. This uneven distribution of vegetation diversity aligns with findings by (Jim and Chen 2009) and (Ifo *et al.*, 2016), who noted that urban green spaces often display heterogeneous diversity patterns influenced by planting intensity, maintenance regimes, and disturbance levels.

Site-specific outcomes were evident. At Site A (Main Gate), five species and the highest number of individuals (63) were recorded, with D*uranta erecta* dominating the stand. Despite this dominance, moderate diversity and a fair degree of balance were observed, suggesting a relatively stable community structure. In contrast, Site B (Edaiken Road) recorded the lowest species richness (two species) and fewest individuals (16). However, the Evenness value (He = 0.986) indicated that the two species present were more evenly distributed, even though overall richness and diversity were poor. Such low-diversity but balanced communities are common in highly disturbed or recently established urban sites, as reported in similar studies of road verges in Nigeria (Jimoh *et al.*, 2012).

Site C (Vice Chancellor's Office) was heavily dominated by *Ixora coccinea*, which contributed over 80% of the total individuals. This extreme dominance suppressed diversity, resulting in the lowest Shannon index and one of the least balanced species distributions among all sites. Similar findings have been noted in institutional landscapes where a single ornamental species tends to overwhelm others, thereby reducing overall diversity (Akinyemi *et al.*, 2021).

On the other hand, Site D (Medical Complex) displayed the most balanced species distribution, with six species represented fairly equally. The co-dominance of *Platycladus orientalis, Euphorbia hypericifolia,* and *Ixora coccinea* contributed to the highest diversity and evenness values recorded across the study. Site E (Anatomy Back Gate) showed moderate richness (four species) and diversity, with *Duranta erecta* and *Polyalthia longifolia* as the major species, but the community was more balanced than Site C.

The variations in vegetation patterns across the five sites can be attributed to differences in planting design, maintenance, and environmental conditions such as soil compaction and moisture availability, which influence establishment and survival of species. These differences are consistent with studies that highlight the role of site management, disturbance intensity, and species selection in shaping vegetation diversity (Alvey, 2006; Onyekwelu *et al.,* 2008).

Overall, this study demonstrates that vegetation diversity and coverage within the University of Benin are highly site-dependent. The Medical Complex (Site D) emerged as the most diverse and ecologically balanced location, while the Vice Chancellor's Office (Site C) was the least diverse due to the overwhelming dominance of *Ixora coccinea*. These findings suggest that enhancing functional and aesthetic diversity in such landscapes may require deliberate introduction of a wider variety of indigenous and ornamental species, as emphasized by Shackleton *et al.* (2017), to improve ecological stability and long-term sustainability.

CONCLUSION

This study has shown that vegetation composition and diversity varied considerably across the sampled sites. Site D (Medical Complex) emerged as the most diverse and ecologically balanced site, recording the highest Shannon diversity index ($H' = 1.368$) and evenness, while Site C (Vice Chancellor's Office) exhibited the lowest diversity ($H' = 0.666$) due to the overwhelming dominance of Ixora coccinea. Site A (Main Gate) recorded the highest number of individuals (63) and moderate diversity, while Site B (Edaiken Road) showed the lowest species richness with only two species, despite having relatively high evenness. Site E (Anatomy Back Gate) presented moderate richness and diversity but was dominated by a few species.

Overall, the findings indicate that vegetation diversity and distribution within the study area are highly uneven, shaped by factors such as species composition, site disturbance, and planting design. Enhancing diversity in low-performing areas like Sites B and C, and addressing dominance effects in Sites A and E, would improve ecological stability and landscape quality. Future efforts should emphasize long-term monitoring and the deliberate introduction of a broader mix of ornamental and indigenous species to strengthen resilience, promote ecological balance, and enrich the aesthetic value of institutional landscapes.

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