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Documentation and establishment of the rose garden at Nehru Zoological Park, Hyderabad

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Abstract

To commemorate its 60-year service legacy, Nehru Zoological Park (NZP), Hyderabad, established a dedicated rose garden on October 6, 2023. The rose garden comprises of 60 different species of roses which includes floribundas and hybrid tea roses. The 60 roses signifies the 60 glorious years of the zoo services .which signifies NZP as a living tribute and a multifunctional resource for education, conservation, and sustainable horticulture. This paper presents the first complete inventory and morphological analysis of the collection, organized across four thematic blocks comprising approximately 15 beds each. Detailed varietal data including flower color, size, flowering habit, petal count, leaf characteristics, growth vigor (scale 1-5), and special traits are systematically documented. Beyond its aesthetic role, the garden is positioned as a center for public botanical education, a source for sustainable gardening workshops, and a potential model for revenue generation through plant sales. This initiative redefines the role of zoological parks in plant conservation and public horticultural engagement, providing a foundational dataset for future agronomic research and community outreach programs.

Keywords: Rose Cultivation, Botanical Inventory, Horticultural Education, Zoo Conservation, Sustainable Gardening, *Rosa* spp., Nehru Zoological Park

1. Introduction

Roses (*Rosa* spp.), celebrated worldwide as the "Queen of Flowers," hold profound cultural, aesthetic, and economic significance. Their cultivation traces back thousands of years, and ongoing hybridization has produced vast diversity in forms, colors, and survival traits (Pemberton *et al.*, 2018) ^[11]. This floral variety not only enriches personal gardens but also enhances public spaces, and modern zoological parks have begun to perceive botanical collections as vital components of their missions alongside faunal conservation. The establishment of the Diamond Jubilee Rose Garden at Nehru Zoological Park (NZP) in Hyderabad exemplifies this evolutionary approach. Inaugurated on October 6, 2023, the garden commemorates 60 years of NZP's dedication to biodiversity conservation and public education (Pemberton *et al.*, 2018) ^[11].

The garden, showcasing an impressive array of 60 different rose varieties, serves as more than a visual attraction; it functions as an interactive living laboratory. The purpose is not merely to beautify the space but to foster understanding of horticulture among the public, promote sustainable gardening practices, and explore innovative methods to achieve self-sustainability through botanical enterprise

(Pemberton *et al.*, 2018) ^[11]. This initiative serves as a bridge connecting professional horticulture with public knowledge, aiming to facilitate a deeper appreciation of rose cultivation and biodiversity conservation (Gagliardi *et al.*, 2020; Pillemer *et al.*, 2016) ^[6, 12]. This paper aims to document the initial collection at the Diamond Jubilee Rose Garden, providing a systematic morphological and phenological inventory.

2. Materials and Methods

2.1. Garden Establishment and Design

The Rose Garden was meticulously designed and established within the NZP grounds on October 6, 2023. The garden has 4 blocks each block comprises about 15 flower beds, each flower bed has 8 plants of a particular species. Surrounding each bed is the lawn for the easy access through the garden. There is a mid-pathway to maintain the garden symmetry. The irrigation system is well established for the maintenance of the garden. The features of the garden are highly attractive with contrasting colours of the roses which is enhancing the aesthetic sense of the observer.

Table 1: List of rose cultivars evaluated across four experimental blocks

Block-1	Block-2	Block -3	Block-4
Botere	Juantia	Plum perfect	gemi
amelia	Desert peace	Ferry parsche	Happy wedding bells
machoman	olympus	Black magic	La rose du petite prince
Maurie utelio	Celestial night	Varenna alle	Violets pride
Bulls eye	Owens pride	Taj mahal red	anastasia
Eternal flame	White avalanche	King small	Big apple
Panther rose	Happy retirement	Laura bush	Yankee doodle
elvis	Anticipation	arctic	Earth angle
Soft touch	Sympa de belleve	Memorial day	Special friend
Hans	Earth angel	Super troupier	Minerva
Oh happy day	brocellende	Zodiko	malwa
Sanish yellow	Just imagine	Tanned beauty	Your beautiful
Coral spire	temptress	beverly	
Mid summer snow	Sweet haze	Blue delight	
Rosanna jacobs	Pink promise	Marchen konigin	
	Tai tai tai	Trier 2000	
		Garden the wall	

2.2. Data Collection and Documentation

Data on each rose variety were collected through direct observation and systematic assessments conducted by NZP horticultural staff during the initial establishment phase. Specific parameters recorded included:

- **Flower Color:** Standardized according to the Royal Horticultural Society (RHS) or American Rose Society (ARS) color codes where applicable (Pemberton *et al.*, 2018) ^[11].
- **Flowering Habit:** Categorized as early, mid, late season, continuous, or sparse, depending on observed patterns.
- **Petal Size:** Measured in diameter (cm) at full bloom.
- **Petal Count:** Recorded as a range derived from representative samples.
- **Leaf Characteristics:** Evaluated for texture, color, size, and overall health (Pemberton *et al.*, 2018) ^[11].
- **Growth Vigor:** Subjectively rated from 1 (very poor) to 5 (excellent) based on assessment criteria including establishment growth, stem strength, and density of foliage.

- **Special Traits:** Noted for unique morphological, historical, or performance characteristics relevant to each variety (Pemberton *et al.*, 2018) ^[11].

2.3. Categorization and Analysis

The varieties were carefully grouped into four blocks during the planting phase based on both aesthetic factors (such as color and form) and horticultural considerations (including flowering time and growth habit). Compiled data were structured into block-wise tables to facilitate clarity and comparative analysis. This systematic approach highlighted the importance of organization in both education and outreach activities concerning horticulture within a zoological park context (Dudo, 2012; Clark *et al.*, 2016) ^[3, 2].

3. Results

The garden successfully established 60 distinct rose varieties. The results are presented in four comprehensive tables, one for each garden block.

Table 2: Block-1 Rose Cultivar Evaluation Table

Variety Name	Flower Color	Flowering Habit	Flower Size (cm)	Petal Count	Leaf Characteristics	Growth Vigor (1-5)	Special Traits
Botere	Deep Crimson	Early season, single flush	12-14	35-40	Dark green, glossy	4.5	Exhibition form, mild fragrance
Amelia	Soft Pink	Continuous, free-flowering	10-12	25-30	Medium green, semi-glossy	4.0	Disease resistant, long stems
Machoman	Crimson	Mid-season, moderate repeat	11-13	30-35	Leathery, dark	4.0	Strong stems, heat tolerant
Maurie Utelio	Lavender-Pink stripes	Continuous, cluster-flowering	8-10	20-25	Bright green, healthy	3.5	Striped pattern, light fragrance
Bulls Eye	Red-White bicolor	Early to mid-season, continuous	7-9	20-25	Small, dense foliage	3.5	Distinct eye pattern
Eternal Flame	Orange-Red blend	Continuous, good repeat	13-15	40-45	Large, semi-glossy	4.0	Excellent petal substance
Panther Rose	Deep Purple-Red	Mid-season, moderate repeat	10-12	35-40	Dark, rugose	4.0	Near-black in bud stage
Elvis	Bright Golden Yellow	Early, good repeat	9-11	30-35	Light green, moderate density	3.5	Vibrant color, slight fragrance
Soft Touch	Pastel Pink	Continuous light bloom	4-6	40-45	Soft, matte, small leaves	2.5	Miniature, container suitable
Hans	White	Mid-season, single heavy flush	6-8	20-25	Largest leaves in collection	4.5	Historic variety, very hardy
Oh Happy Day	Golden Yellow	Early to mid-season, good repeat	8-10	25-30	Glossy, medium green	3.5	Cheerful color, cluster flowering
Sanish Yellow	Lemon Yellow	Mid-season, continuous	7-9	25-30	Small, bright green	3.0	Fade-resistant yellow

Coral Spire	Coral-Orange	Mid to late season	9-11	30-35	Narrow, pointed, healthy	3.5	Unusual coral hue
Mid Summer Snow	Pure White	Heavy early flowering	8-10	20-25	Dense, medium green	4.0	Prolific bloomer, snow-like effect
Rosanna Jacobs	Deep Pink	Continuous, moderate	7-9	25-30	Semi-glossy, healthy	3.5	Named for local horticulturist

Table 3: Block-2 Rose Cultivar Evaluation Table

Variety Name	Flower Color	Flowering Habit	Flower Size (cm)	Petal Count	Leaf Characteristics	Growth Vigor (1-5)	Special Traits
Juantia	Pale Pink	Very sparse flowering	5-7	15-20	Sparse, light green	2.0	Minimal ornamental value
Desert Peace	Cream-Yellow blend	Mid-season continuous	14-16	45-50	Broad, leathery	4.5	Exceptional petal count, heat tolerant
Olympus	White-Pink blend	Mid-season	9-11	30-35	Medium, glossy	3.5	Classical form, good vase life
Celestial Night	Dark Purple	Late/mid flowering	10-12	35-40	Dark, textured	3.5	Deep color, night garden appeal
Owens Pride	Peach	Very low vegetative growth	6-8	25-30	Sparse, pale green	1.5	Minimal growth, collector item
White Avalanche	Pure White	Heavy mid-season	11-13	40-45	Dense, bright green	4.0	Mass blooming effect
Happy Retirement	Salmon-Orange	Continuous light	8-10	25-30	Medium, matte	3.0	Cheerful color, reliable
Anticipation	Deep Red	Mid-season	15-18	20-25	Large, coarse	4.5	Largest flower size, fewer petals
Sympa de Bellevue	Pink Blend	Continuous	9-11	35-40	Fine, dense foliage	3.5	Old garden style, fragrant
Earth Angel	Lavender	Less flowering	8-10	30-35	Gray-green, fuzzy	2.5	Subdued flowering, unique foliage
Brocellende	Bright Pink	Mid-season	7-9	30-35	Glossy, pointed	3.0	Good garden presence
Just Imagine	Apricot-Blend	Continuous	10-12	35-40	Healthy, medium density	4.0	Complex color, exhibition quality
Tempress	Deep Red	Mid to late season	9-11	30-35	Dark, glossy	3.5	Rich color, moderate performer
Sweet Haze	Pastel Lavender	Continuous light	6-8	25-30	Delicate, light foliage	2.5	Soft color, airy appearance
Pink Promise	Clear Pink	Mid-season	10-12	40-45	Healthy, vigorous	4.0	Reliable pink, good cutting rose
Tai Tai Tai	Orange-Pink	Continuous	5-7	20-25	Small, dense	3.0	Novelty size, cluster flowering

Table 4: Block-3 Rose Cultivar Evaluation Table V

Variety Name	Flower Color	Flowering Habit	Flower Size (cm)	Petal Count	Leaf Characteristics	Growth Vigor (1-5)	Special Traits
Plum Perfect	Plum Purple	Mid-season peak	8-10	35-40	Dark, healthy	3.5	Perfect form, rich color
Ferry Parsche	Bright Red	Mid-season	9-11	30-35	Glossy, dense	3.5	Classic red rose, good stems
Black Magic	Darkest Red	Late season	11-13	40-45	Very dark, leathery	4.0	Nearly black flowers, dramatic
Varenna Allen	Light Pink	Very sparse flowering	5-7	15-20	Sparse, light green	1.5	Minimal flowering
Taj Mahal Red	True Red	Continuous long-lasting	10-12	40-45	Healthy, glossy	4.5	Exceptional longevity (10-14 days)
King Small	Golden Yellow	Continuous	4-6	25-30	Small, bright	3.0	Compact growth, cheerful
Laura Bush	Pink Blend	Good & continuous flowering	8-10	35-40	Dense, healthy	4.0	Reliable continuous flowering
Arctic	Pure White	Mid-season	9-11	30-35	Light green, healthy	3.5	Clean white, good garden rose
Memorial Day	Deep Pink	Seasonal peak	12-14	45-50	Leathery, dark	4.0	Formal bloom, high petal count
Super Trouper	Orange-Red	Continuous	10-12	30-35	Glossy, vigorous	4.0	Bright color, strong performer
Zodiko	Pink-White blend	Long-lasting flowers	8-10	30-35	Susceptible foliage	2.5	Easily attacked by pests
Tanned Beauty	Apricot-Orange	Less flowering	9-11	30-35	Medium, healthy	2.0	Beautiful color but sparse bloom
Beverly	Soft Pink	Mid-season	10-12	40-45	Healthy, dense	3.5	Old rose fragrance, repeat bloom
Blue Delight	Lavender-Blue	Continuous	8-10	30-35	Long internodal length	4.0	Unusual blue tone, distinctive growth
Marchen Konigin	Deep Pink	Mid to late season	11-13	40-45	Healthy, vigorous	4.0	Fairy-tale appearance, abundant petals
Trier 2000	Bright Red	Continuous	9-11	30-35	Dense, healthy	4.0	Modern variety, reliable red
Garden the Wall	Pink Blend	Continuous spreading	6-8	25-30	Small, dense	4.0	Ideal for vertical gardening

Table 5: Block-4 Rose Cultivar Evaluation Table

Variety Name	Flower Color	Flowering Habit	Flower Size (cm)	Petal Count	Leaf Characteristics	Growth Vigor (1-5)	Special Traits
Gemini	Red-White bicolor	Mid-season	10-12	30-35	Healthy, balanced	3.5	Distinct bicolor, star pattern
Happy Wedding Bells	Pure White	Good flowering	11-13	40-45	Healthy, glossy	4.0	Wedding-quality blooms, fragrant
La Rose du Petit Prince	Deep Pink	Continuous, less compact	7-9	25-30	Open habit, healthy	3.5	Charming form, spreading growth
Violets Pride	Deep Purple	Heavy early flowering	9-11	35-40	Healthy, vigorous	4.0	Prolific early bloomer
Anastasia	White	Mid-season	12-14	45-50	Healthy, glossy	4.5	Exhibition quality, perfect form
Big Apple	Bright Red	Continuous	11-13	35-40	Large, leathery	4.0	Bold red, substantial blooms
Yankee Doodle	Red-White striped	Mid-season	8-10	25-30	Healthy, vigorous	3.5	Patriotic stripes, novelty
Earth Angle	Peach-Pink	Mid-season	8-10	30-35	Healthy, balanced	3.5	Reliable performer
Special Friend	Soft Pink	Continuous	3-4	15-20	Delicate, fine texture	2.5	Smallest petal size in collection
Minerva	Lavender-Blue	Very late flowering	8-10	30-35	Healthy, upright	3.0	Completely late flowering
Malwa	Coral-Pink	Mid-season	7-9	25-30	Healthy, moderate	3.5	Regional variety, good adaptability
Your Beautiful	Pink Blend	Early flowering	10-12	40-45	Healthy, vigorous	4.0	Early season star, reliable

The collection displays significant horticultural diversity across key metrics. Flower diameters range from the exceptionally large blooms of 'Anticipation' (15-18 cm) to the miniature flowers of 'Special Friend' (3-4 cm). Petal counts vary from 45-50 in 'Desert Peace' and 'Memorial Day' to 15-20 in 'Juantia' and 'Varenna Allen'. Growth vigor ratings span from 1.5 ('Owns Pride', 'Varenna Allen') to 4.5 ('Botere', 'Desert Peace', 'Hans', 'Taj Mahal Red', 'Anastasia'). Phenological variation includes the full seasonal spectrum, from early heavy bloomers like 'Violets Pride' to very late flowering 'Minerva', with continuous performers like 'Laura Bush'. The color palette features distinctive forms such as the lavender-blue of 'Blue Delight', near-black buds of 'Panther Rose' and 'Black Magic', coral-orange of 'Coral Spire', and striped patterns of 'Maurie Utelio' and 'Yankee Doodle'. Specialized traits include exceptional flower longevity in 'Taj Mahal Red' (10-14 days), the largest foliage on 'Hans', and noted pest susceptibility in 'Zodiko'.

4. Discussion

The NZP Rose Garden exemplifies a meticulously curated living collection that extends beyond mere aesthetic appeal to serve as a notable educational resource. By incorporating rose varieties characterized by unique traits and documented vulnerabilities, the garden offers a tangible reference for studying genetic diversity, allowing for exploration of the trade-offs associated with plant breeding (Liang *et al.*, 2017; Gitonga *et al.*, 2014) [8, 7]. The extreme flower diameters noted in cultivars such as 'Anticipation,' which measures up to 15-18 cm, and the diminutive 'Special Friend' at 3-4 cm, exemplify the extensive diversity present within the collection (Rawandoozi *et al.*, 2023) [13].

Petal counts also exhibit significant variation, with some roses like 'Desert Peace' and 'Memorial Day' showcasing 45-50 petals, whereas others, like 'Juantia' and 'Varenna Allen,' contain only 15-20 petals. This contrast not only highlights the ornamental diversity of roses but also serves as a platform for understanding the genetics behind flowering

traits (Liang *et al.*, 2017; (Schiffer *et al.*, 2023) [8, 14]. Furthermore, growth vigor rates ranging from 1.5 for some varieties to 4.5 for others indicate diverse responses to local climatic and soil conditions, which can provide insights into best practices for horticultural management (Gitonga *et al.*, 2014) [7].

The incorporation of phenology into garden management adds another layer of complexity, as the collection spans a full seasonal spectrum. Varieties such as 'Violets Pride' bloom heavily in early seasons, while 'Minerva' emerges as a late flower, and 'Laura Bush' presents continuous blooming. This phenological variability not only serves practical aesthetic purposes, ensuring year-round visual interest, but also allows the garden to act as a living laboratory for scientific research into climate effects on flowering timing and subsequent ecological interactions (Schiffer *et al.*, 2023; Forrest & Miller-Rushing, 2010; Forrest, 2014) [14, 5].

The garden's design is strategically organized into four thematic blocks that integrate aesthetic appeal with educational outcomes, ensuring inclusive accessibility and year-round engagement with botanical diversity. This intentional layout supports NZP's broader conservation-education mandate, bridging the gap between horticulture and biodiversity stewardship (Sherry *et al.*, 2007; Badeck *et al.*, 2004) [15, 1]. Additionally, the model for plant sales and public workshops developed within the garden context offers a promising avenue toward economic sustainability for public gardens, benefiting both the institution and the community it serves (Wolf *et al.*, 2017; Neil & Wu, 2006) [16, 9].

As an essential contribution to local climate research, the garden establishes a phenological baseline that can be referenced in future studies. Subsequent research could focus on longitudinal performance data, assessing visitor educational outcomes, and developing collaborations with academic institutions. These initiatives could enhance the garden's impact as a resource for future research and community engagement.

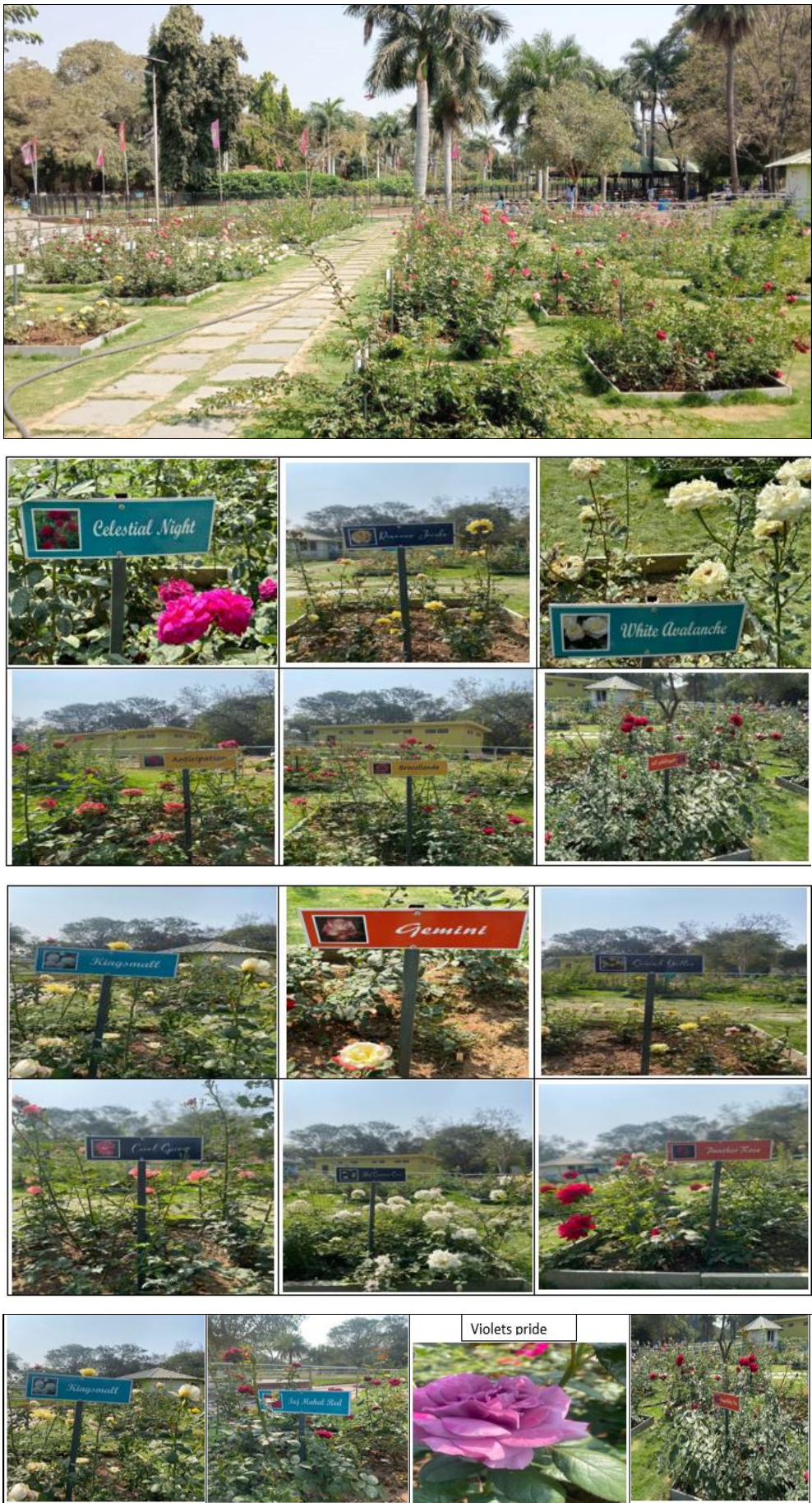


Fig 1: Students visiting rose garden

Conclusion

The Diamond Jubilee Rose Garden at Nehru Zoological Park, Hyderabad, stands as a multifaceted botanical resource, serving more than a commemorative purpose. It is a functional hub for horticultural education, a conservatory of rose diversity, and a pilot project for sustainable institutional gardening. The comprehensive inventory detailed herein provides a valuable dataset for gardeners, educators, and researchers alike. By effectively integrating aesthetic beauty with scientific documentation and a public mission, NZP successfully enhances the role of zoological parks in promoting holistic environmental conservation and education. Future community engagement and horticultural research initiatives anchored in this garden will continue to celebrate biodiversity across all dimensions.

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