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Transforming Rainwater Harvesting Ponds into Sustainable Ecosystems: The Multipurpose Forest Model from Kanha Shanti Vanam, Hyderabad, Telangana, India

Bhuvaragasamy Rathinasabapathy, Ananthaneni Sreenath

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ABSTRACT

In the semi-arid Deccan Plateau, erratic precipitation and high evaporation severely constrain ecological stability and groundwater replenishment. This study evaluates the ecological restoration of two rainwater harvesting units-Nursery Pond and Meera Pond-within the 1400-acre Kanha Shanti Vanam landscape in Telangana, India. The primary objective was to transform conventional runoff catchment basins into high-functioning ecological units using contour-based earthworks and a Multipurpose Dense Forest (MDF) bio-engineering model. Hydrological interventions, including contour bunding and biological slope stabilization using deep-rooting grasses (*Chrysopogon zizanioides* and *Cymbopogon citratus*), significantly mitigated surface runoff velocity, arrested erosion, and prevented siltation. Concurrently, a multi-tier plantation strategy categorized 40 botanical species across distinct ecological zones: riparian water-edge buffers (*Terminalia arjuna, Barringtonia acutangula*), canopy and keystone anchors (Ficus spp.) on bund crests, and an understory rich in pollinator-supporting, fruiting, and aromatic flora (Ocimum, Jasminum, Vitex spp.). The restoration achieved sustained surface water retention, localized water table replenishment, and microclimate moderation, while establishing a therapeutic olfactory landscape. Seasonal surveys confirmed marked biodiversity recovery, supporting diversified insect pollinators, herpetofauna, and seasonal waterbirds (*Mycteria leucocephala, Alcedo atthis*). These findings demonstrate that integrating nature-based hydrological earthworks with functional, multi-tier native plant zoning creates a self-sustaining ecological sanctuary and enhances climate resilience. This integrated bio-engineering framework provides a scalable, socio-ecologically viable blueprint for degraded semi-arid wetland restoration across the Deccan Plateau.

Keywords Deccan plateau, Ecological restoration, Rainwater harvesting, Multipurpose dense forest, Bio-engineering, Water conservation.

Bhuvaragasamy Rathinasabapathy[1], Ananthaneni Sreenath[2]*

[1]Chief Ecologist, [2]Senior Conservation Scientist
Forests By Heartfulness, Heartfulness Institute,
Kanha Shanti Vanam, Ranga Reddy District. Telangana 509325, India

Email: sreenath.a@volunteer.heartfulness.org
*Corresponding author

INTRODUCTION

Pond restoration is essentially about bringing degraded or neglected ponds back to a healthy and functional condition so they can support biodiversity, maintain good water quality, and continue providing important ecosystem services. In many regions, ponds decline over time due to multiple pressures such as nutrient pollution, siltation, invasive species, and growing human disturbance. These factors disrupt the natural balance of the ecosystem and reduce its ability to function effectively (Carpenter *et al.* 1998. Millennium Ecosystem Assessment 2005). In practical terms, restoring a pond requires a mix of physical, chemical, and biological interventions aimed at reversing this degradation.

Common approaches include removing accumulated sediments to restore depth, controlling nutrient inputs from surrounding areas, and re-establishing more natural water flow patterns. Equally important is the restoration of native vegetation along pond margins, which helps stabilize soils, filter pollutants, and provide habitat for a wide range of organisms such as fish, amphibians, birds, and microorganisms (Mitsch and Gosselink 2015, IUCN 2013). When these measures are implemented effectively, restored ponds can enhance groundwater recharge, reduce flood risks, store carbon, and serve as valuable habitats for local biodiversity (FAO 2018).

A major challenge in many pond ecosystems is eutrophication, which is mainly caused by excessive inputs of nitrogen and phosphorus from agricultural runoff, sewage, and urban sources. This often results in algal blooms, reduced light availability, and depletion of dissolved oxygen, creating stressful or even uninhabitable conditions for aquatic life (Smith *et al.* 1999, Jeppesen *et al.* 2005). As a result, restoration efforts frequently focus on reducing nutrient loads and improving overall ecological balance. Measures such as creating vegetative buffer zones and applying aeration techniques are commonly used to improve water quality and restore oxygen levels (UNE 2016).

Importantly, pond restoration goes beyond ecological improvement and has strong social and economic relevance. In countries like India, ponds are closely linked to rural and urban livelihoods, supporting irrigation, livestock needs, domestic water use, and cultural practices. Restoring these water bodies can therefore enhance water security, support local economies, and improve resilience to climate variability and change (Millennium Ecosystem Assessment, 2005, FAO 2018). Overall, pond restoration is best seen as a multidisciplinary effort that combines ecological understanding, management practices, and active community participation to ensure long-term sustainability.

Restoring the rainwater harvesting (RWH) in regions with low annual rainfall (650–700 mm) is more than a conservation effort; it is a necessity for climate resilience. In the Deccan Plateau, where the soil profile often struggles with runoff and high evaporation rates, the creation of decentralized ponds serves as a vital tool for groundwater recharge. The restoration of the Nursery and Meera Ponds goes beyond simple water storage. The objective is to transform these water bodies into living laboratories of biodiversity. By employing a Multipurpose Dense Forest (MDF) strategy, the bunds and slopes are not merely structural barriers but thriving habitats. This approach ensures that while the ponds act as a sponge for the earth, the surrounding vegetation provides an olfactory experience for visitors, sustainable yields for human use, and a sanctuary for local pollinators.

MATERIALS AND METHODS

Study Area

Kanha Shanti Vanam is the Global Headquarters of the Sri Ram Chandra Mission (Heartfulness Institute), situated approximately 8 km from NH-44 Timmapur, in Nandhigama Mandal, Ranga Reddy District, Hyderabad, Telangana, India. The Heartfulnes Institute (HFI) spans over 1400 acres, lies between 15° 48′ 32″ and 19° 55′ 46″ N latitude and 77° 09′ 02″ and 81° 18′ 51″ E longitude (Fig 1), altitude around 450 m MSL, and features a diverse range of plantations, showcasing a successful model of semi-arid landscaping.

To mitigate land degradation and restore ecological functionality, an integrated watershed management and targeted eco-restoration framework

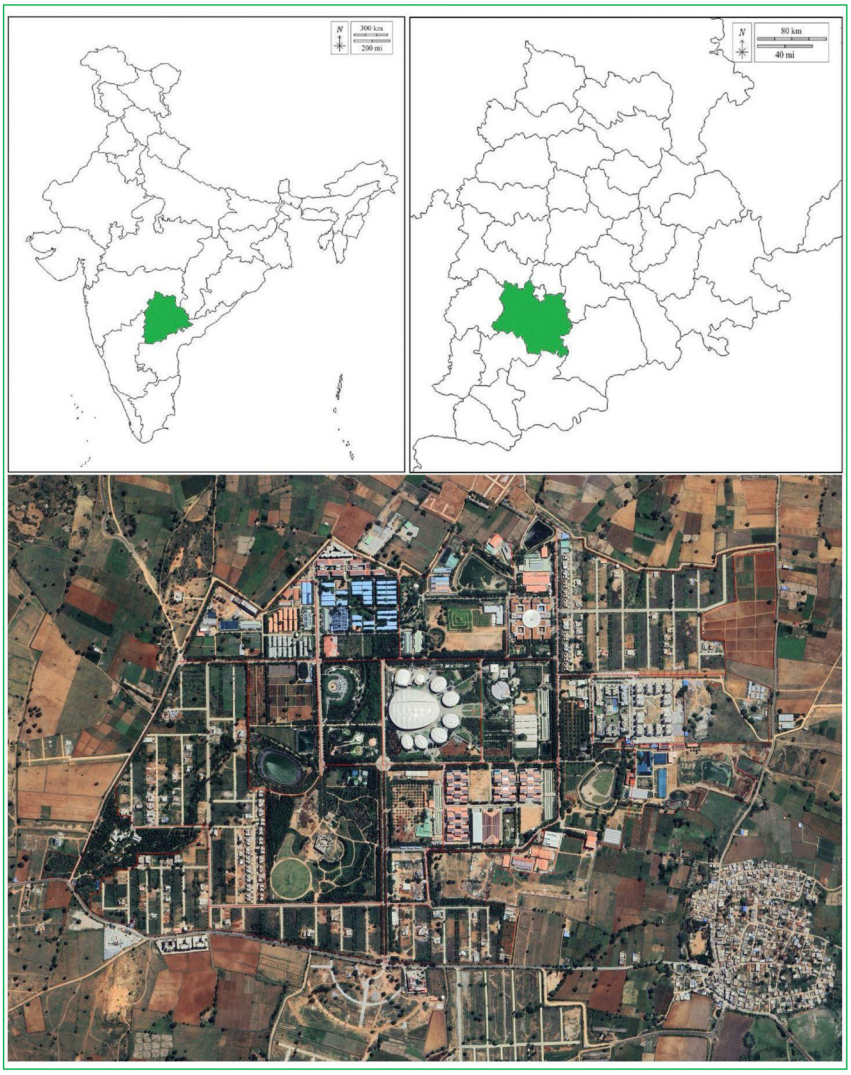

Fig. 1. Map showing location of the Kanha Shanti Vanam, Ranga Reddy District, Hyderabad, Telangana, India.

was implemented. Ridge-to-valley hydrological interventions comprise Continuous Contour Trenches were made systematically across slope gradients to maximize in-situ moisture retention, coupled with downstream loose boulder check dams equipped with central trapezoidal spillways for safe peak-discharge regulation. This engineering blueprint is biologically synchronized with a three-tier vegetative zonation strategy. Riparian species (*Terminalia arjuna, Barringtonia acutangula*) are positioned along water-edges at density of 3.5 to 4 m for structural bank stabilization, while multi-layered medicinal shrubs (*Vitex negundo*) and dense aromatic ground cover (*Ocimum* spp.) occupy the mid-slope terraces. The upper ridges are anchored by a staggered with 4 m distance canopy matrix of pollinator-supporting species (*Cassia fistula, Butea monosperma*). All vegetative blocks are established in solarized pits backfilled with topsoil, vermicompost, and biochar amendments to drastically enhance long-term soil carbon sequestration, control splash erosion, and optimize overall ecosystem resilience.

Pond Network Development

An interconnected system of eight ponds was designed and implemented to capture and store runoff water. Within this network, the Nursery Pond (Fig 2) and Meera Pond were excavated to enhance storage capacity and support ecological restoration.

Hydrological and Soil Conservation Interventions

To manage site topography and reduce runoff velocity, contour bunding was implemented following natural land contours. This approach facilitated increased infiltration, reduced soil erosion, and minimized sediment transport into pond systems.

Slope stabilization was achieved through the planting of deep-rooting grasses, including *Vetiveria zizanioides* (vetiver) and *Cymbopogon citratus* (lemongrass). These species were selected for their ability to bind soil effectively, reduce erosion, and prevent siltation within the ponds.

Plantation Strategy and Ecological Zonation

A multi-tier vegetation model was created based on moisture gradients and ecological function:

Riparian Zone (water's edge): Planted with moisture-tolerant species to enhance filtration and stabilize pond margins.

Bund Crest (upper layer): Large canopy tree species were established to provide shade, reduce evaporation, and improve soil moisture retention.

Understory Layer: Included shrubs, herbs, and useful plants to increase biodiversity and functional diversity.

To ensure that plant communities were precisely aligned with site-specific hydrological conditions, species selection and spatial distribution across the pond profile at Kanha Shanti Vanam were determined by taxonomists and ecological experts based on distinct micro-topographical and ecohydrological zonation constraints. On the well-drained bund crest and upper bank, deep-rooted canopy trees Terminalia arjuna and Mangifera indica were established; T. arjuna functions as a vital ecosystem engineer, mechanically anchoring the embankment and enhancing soil nutrient and moisture retention via its extensive canopy



Fig. 2. Restored Pond area in to Sustainable Pond Ecosystem in Kanha Santhi Vanam.

and interlocking root framework (Sunil *et al.* 2019). Conversely, the frequently saturated pond margins were populated by the highly flood-tolerant species *Syzygium cumini* and *Barringtonia acutangula.*

B. acutangula serves as a critical pioneer associate along waterlines, providing a high surficial root density capable of enduring prolonged anoxia and resisting wave-induced edge erosion (Bachan, 2003). Meanwhile, *S. cumini* dynamically adapts to fluctuating water tables by producing specialized adventitious root networks that partially counteract the physiological constraints of prolonged waterlogging while structurally binding loose shoreline aggregates (Li *et al.* 2023). This deliberate spatial zonation combines lateral understory architectures with deep taproot frameworks to optimize both slope stability and freshwater biodiversity.

RESULTS

Botanical Composition and Functional Zoning

The restored pond system exhibited a structured plant community aligned with functional sustainability and ecological roles.

Riparian species: *Terminalia arjuna, Syzygium cumini, Barringtonia acutangula,* and *Mangifera indica* contributed to bund stabilization and microclimate regulation.

Medicinal and Aromatic species: *Murraya koenigii* and *Ocimum grattisimum* provided ecological and socio-economic benefits.

Pollinator-support species: *Bauhinia purpurea, Cassia fistula, Holmskioldia sanguinea*, and *Artabotrys hexapetalus* supported year-round pollinator activity.

Fruiting species: *Annona squamosa, Carissa carandas, Malpighia emarginata,* and *Morus indica* enhanced food availability for fauna and other Biodiversity.

This zonation resulted in improved habitat heterogeneity and ecological functionality across the plantation sites.

Hydrological and Ecological Outcomes

The implementation of contour bunding and pond excavation improved water retention and reduced surface runoff. Slope stabilization measures significantly minimized sediment inflow into the ponds, maintaining storage efficiency. Vegetation establishment contributed to enhanced soil moisture retention and microclimatic moderation.

Sensory Landscape Development

A sensory walking pathway was developed using fragrant species such as *Artabotrys hexapetalus, Vitex spp. (V. negundo, V. trifoliata, V. altissima), Ocimum grattisimum, Jasminum multiflorum, Jasminum auriculatum, Murrya konigii, Murrya paniculata, Gardenia jasminoides, Gardenia gummifera, Budligia asiatica* and *Artimissia indica.* This resulted in a unique olfactory environment characterized by natural plant volatiles, contributing to well-being of human and other biodiversity.

Created Plantation strategy:

Species were systematically planted based on their primary ecological functions to ensure non-redundancy and maximize restoration efficiency (Table 1 & Fig 3). Riparian species such as *Terminalia arjuna* and *Barringtonia acutangula* contribute to bank stabilization, hydrological regulation, and erosion control. Aromatic and sensory plants, including *Ocimum* spp., *Jasminum* spp., and *Gardenia* spp., support pollinators while creating a therapeutic-valued landscape.

Pollinator-supporting species like *Cassia fistula* and *Butea monosperma* enhance biodiversity through sustained nectar supply. Medicinal and aromatic plants provide health benefits and ecological resilience, while fruit-bearing species such as *Annona* and *Syzygium* support faunal diversity and trophic interactions. Native and timber species aid in carbon sequestration and structural restoration. Additionally, grasses like *Vetiveria zizanioides* and *Cymbopogon citratus* play a crucial role in bund stabilization, soil binding, and erosion control.

The restoration of the Nursery and Meera Ponds

Table 1. Functional classification of plant species used in ecological restoration of the Ponds.

Species	Family	Purpose	Ecological Roles
		Riparian / Water-Loving Species	
Terminalia arjuna	Combretaceae	Bank stabilization	Flood control, riparian habitat support
Barringtonia acutangula	Lecythidaceae	Water-edge stabilization	Aquatic habitat support, erosion control
Syzygium cumini	Myrtaceae	Moisture retention	Soil binding, faunal support
Mangifera indica	Anacardiaceae	Shade and microclimate regulation	Carbon sequestration, habitat provision
		Medicinal, Aromatic and Sensory Species	
Murraya koenigii	Rutaceae	Aromatic and medicinal use	Pollinator attraction, ethnobotanical value
Zanthoxylum rhetsa	Rutaceae	Aromatic and medicinal use	Pollinator attraction, ethnobotanical and food value
Ocimum basilicum	Lamiaceae	Aromatic enrichment	VOC emission, pollinator support
Ocimum gratissimum	Lamiaceae	Medicinal and aromatic	Pest deterrence, pollinator attraction
Jasminum multiflorum	Oleaceae	Fragrance	Pollinator attraction
Jasminum auriculatum	Oleaceae	Sensory enhancement	Human well-being support
Murraya paniculata	Rutaceae	Ornamental fragrance	Pollinator attraction
Gardenia jasminoides	Rubiaceae	Ornamental	Biodiversity support
Gardenia gummifera	Rubiaceae	Medicinal	Habitat enrichment
Buddleja asiatica	Scrophulariaceae	Butterfly attractant	Pollinator support
Vitex negundo	Lamiaceae	Medicinal shrub	Pest repellent, soil stabilization
Vitex trifolia	Lamiaceae	Coastal adaptation	Soil stabilization
Artabotrys hexapetalus	Annonaceae	Fragrant climber	Pollinator attraction
Artemisia indica	Asteraceae	Medicinal	Pest control, ecological resilience
Barleria prionitis	Acanthaceae	Medicinal	Ethnobotanical importance
Sauropus androgynus	Phyllanthaceae	Edible leaves	Nutritional support
		Pollinator-Supporting Species	
Bauhinia purpurea	Fabaceae	Ornamental flowering	Nectar source for pollinators
Cassia fistula	Fabaceae	Seasonal flowering	Supports bees and insects
Butea monosperma	Fabaceae	Flowering tree	Bird and insect attraction
Erythrina variegata	Fabaceae	Nectar-rich flowers	Bird pollination, nitrogen fixation
Hibiscus rosa-sinensis	Malvaceae	Ornamental flowering	Pollinator attraction
Barleria cristata	Acanthaceae	Flowering shrub	Supports insect diversity
Eranthemum pulchellum	Acanthaceae	Ornamental	Enhances pollinator activity
Homskioldia sanguinea	Lamiaceae	Ornamental	Pollinator attraction
		Fruiting and Wildlife-Supporting Species	
Annona squamosa	Annonaceae	Edible fruit	Wildlife food source
Annona reticulata	Annonaceae	Edible fruit	Supports birds and insects
Carissa carandas	Apocynaceae	Fruit shrub	Bird attraction
Malpighia emarginata	Malpighiaceae	Nutritional fruit	Supports biodiversity
Morus indica	Moraceae	Fruit production	Supports birds and silkworms
Eugenia uniflora	Myrtaceae	Edible fruit	Bird and pollinator support
Syzygium samarangense	Myrtaceae	Fruit tree	Soil binding and faunal support
Averrhoa bilimbi	Oxalidaceae	Edible fruit	Nutritional and ecological role
Walsura trifoliata	Meliaceae	Edible fruit	Habitat enrichment
		Native, Timber, and Restoration Species	
Chukrasia tabularis	Meliaceae	Timber and restoration	Carbon sequestration
Caryota urens	Arecaceae	Multipurpose palm	Soil binding, faunal habitat
Commiphora caudata	Burseraceae	Dryland adaptation	Drought resilience, habitat support
Vitex altissima	Lamiaceae	Tree cover	Carbon sequestration

Table 1. Continued.

Species	Family	Purpose	Ecological Roles
Swietenia macrophylla	Meliaceae	Timber and medicinal	Carbon sequestration
		Soil Stabilizing Species	
Scaevola taccada	Goodeniaceae	Coastal stabilization	Erosion control
		Medicinal and Aromatic Grass Species for Bund stabilization	
Vetiveria zizanioides (syn. Chrysopogon zizanioides)	Poaceae	Bund stabilization, aromatic use	Deep root system for soil binding, erosion control, water infiltration enhancement
Cymbopogon citratus	Poaceae	Aromatic grass	Soil stabilization, pest deterrence, aromatic VOC emission
Pennisetum purpureum	Poaceae	Soil binding, biomass	Rapid growth, slope stabilization, organic matter addition
Saccharum munja	Poaceae	Bund reinforcement	Strong fibrous roots, erosion control, drought resilience

serves as a practical application of the ecological niche theories explored in JVR Park (Rathinasabapathy and Sreenath 2025). By mapping species to specific moisture gradients, we moved beyond simple greening to functional ecosystem bio-engineering.

Ecological Impacts

Groundwater Recharge: Preliminary observations suggest a rise in the local water table, evidenced by prolonged moisture levels in the surrounding soil during the dry season.

Biodiversity Corridor: The inclusion of "Prinklyash" and Mahogany (*Swietenia macrophylla*) provides structural height, attracting predatory birds that help manage the insect population naturally.

Stabilization: The Vetiver grass has successfully prevented bund breach during heavy downpours, showcasing the efficacy of bio-fencing over concrete structures.

Application of the Keystone Species

Drawing from our previous research on Ficus species (Sreenath and Rathinasabapathy 2026), we purposefully integrated figs within the pond periphery. While the *Barringtonia* thrives at the water's edge, the *Ficus* species planted on the higher bunds act as "ecological anchors." These trees provide essential nesting sites for avifauna that utilize the ponds for hydration, thereby creating a self-sustaining nutrient cycle between the water and the surrounding forest.

Urban Forest Lessons

The Multipurpose Dense Forest (MDF) model at the Nursery and Meera Ponds incorporates the ecosystem service lessons learned from the JVR Park study (Rathinasabapathy and Sreenath 2025). By selecting a high density of pollinator-attracting species (Sreenath *et. al.* 2025) (*e.g., Bauhinia purpurea, Cassia fistula,* and *Homsikoldia sanguinea)*, we ensured that the pond area serves as a "biodiversity hub" within the larger Kanha landscape.

The inclusion of sustainable-use plants like *Morus indica* and *Murraya koenigii* ensures that the local community interacts with the pond ecosystem daily, fostering a sense of stewardship that is vital for long-term conservation.

Faunal Colonization and Biodiversity Observations

To understand initial wildlife colonization following pond excavation and plantation, periodic opportunistic field observations were carried out during morning (06:30-07:30 am IST) and evening (16:30-17:30 pm IST) visits across winter, summer, and post-monsoon seasons. Because the planted vegetation is in its early



Fig. 3. A. *Annona squamosa,* **B.** *Ardisia elliptica,* **C.** *Ardisia solanacea,* **D.** *Artabotrys hexapetalus,* **E.** *Bauhinia acuminata,* **F.** *Bauhinia purpurea,* **G.** *Cassia fistula,* **H.** *Eranthemum pulchellum,* **I.** *Eugenia uniflora,* **J.** *Gardenia jasminoides,* **K.** *Justicia adhatoda* and **L.** *Malpighia emarginata.*

establishment phase, these records reflect baseline colonization rather than an exhaustive census.

Entomofauna and Floral Phenology

As the newly introduced native shrubs and herbs began their seasonal flowering cycles, insect visitors rapidly colonized the pond environs (Sreenath *et al.* 2025). The staggered blooming of species such as *Murraya koenigii, Lawsonia inermis, Ocimum gratissimum, Holmskioldia sanguinea,* and *Barleria cristata* provided an early, dependable supply of nectar and pollen. Commonly observed butterflies included the Blue Tiger (*Tirumala limniace*), Plain Tiger (*Danaus chrysippus*), Striped Tiger (*Danaus genutia*), Common Crow (*Euploea core*), and Choc-

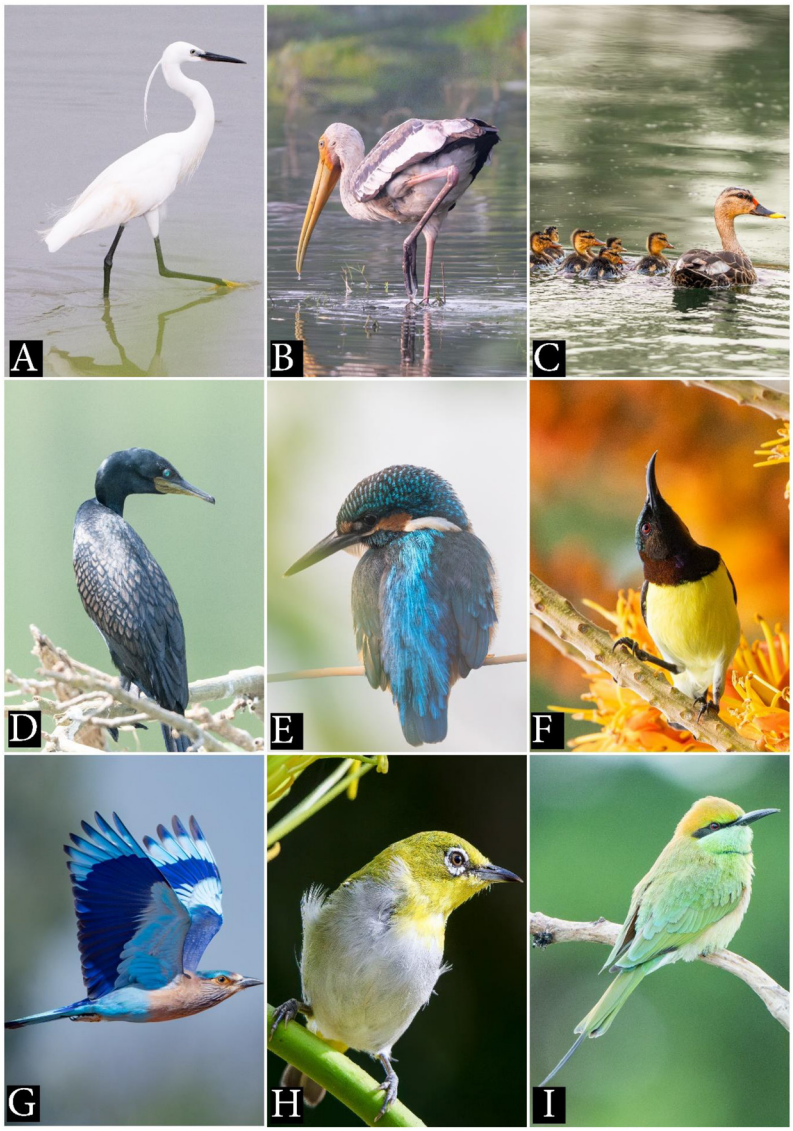

Fig. 4. A. *Egretta garzetta,* **B.** *Mycteria leucocephala,* **C.** *Anas poecilorhyncha,* **D.** *Microcarbo niger,* **E.** *Alcedo atthis,* **F.** *Leptocoma zeylonica,* **G.** *Coracias benghalensis,* **H**. *Zosterops palpebrosus,* and **I**. *Merops orientalis.*

olate Pansy (*Junonia iphita*). Honey bees (*Apis cerana, Apis florea*), solitary bees, and wasps were regularly noted across the floral canopy, alongside nectar-feeding Purple Sunbirds (*Cinnyris asiaticus*).

Amphibians as Primary Colonizers

The perennial moisture along pond fringes facilitated early amphibian colonization:

Asian Common Toad (*Duttaphrynus melanostictus*): Observed frequently at dusk and night foraging for insects among leaf litter, stone pitching, and pathways.

Indian Bullfrog (*Hoplobatrachus tigerinus*): Present across open-water pockets. During the monsoon breeding season (July-August), conspicuous breeding behavior was noted-males developed bright lem-

on-yellow coloration with blue vocal sacs, vocalizing in shallow littoral vegetation where egg deposition occurred.

These anurans establish an essential biomass base that supports local reptiles and wading birds.

Herpetofaunal Sightings

Reptiles responded to the micro-habitats created by earthen bunds, rip-rap stones, and groundcover: Diurnal lizards included the Common Garden Lizard (*Calotes versicolor,* 15 sightings during summer counts) basking on shrubs, and the Common Keeled Grass Skink (*Eutropis carinata,* 5 sightings) foraging in damp mulch.

Snakes recorded hunting around the water's edge and bunds included the non-venomous Indian Rat Snake (*Ptyas mucosa*, 6 sightings) and Asian Bronzeback Tree Snake (*Dendrelaphis tristis*, 3 sightings). Occasional sightings of venomous species-the Spectacled Cobra (*Naja naja*) and Russell's Viper (*Daboia russelii,* 3 sightings combined)-indicate an emerging predator-prey balance regulating local rodents and frogs (Rathinasabapathy and Sreenath 2025).

Avian Diversity and Breeding Records

The presence of standing water and early insect abundance attracted a steady variety of resident birds (Fig 4).

Waterbirds and Piscivores: Frequently observed feeding in shallow margins were the Little Cormorant (*Microcarbo niger*), Indian Pond Heron (*Ardeola grayii*), Cattle Egret (*Bubulcus ibis*), Little Egret (*Egretta garzett*a), and three kingfisher species: Pied Kingfisher (*Ceryle rudis*), Common Kingfisher (*Alcedo atthis*), and White-throated Kingfisher (*Halcyon smyrnensis*).

Insectivores: Daily encounters included the Indian Roller (*Coracias benghalensis*), Green Bee-eater (*Merops orientalis*), Greater Coucal (*Centropus sinensis*), Asian Koel (*Eudynamys scolopaceus*), Oriental White-eye (*Zosterops palpebrosus*) and Nector feeding birds like Purple-rumped sunbird (*Leptocoma zeylonica*).

Breeding Activity: Shoreline emergent vegetation supported successful nesting by the Indian Spot-billed Duck (*Anas poecilorhyncha*) and Little Grebe (*Tachybaptus ruficollis*). Larger wading birds such as the Painted Stork (*Mycteria leucocephala*), Grey Heron (*Ardea cinerea*), and Oriental Darter (*Anhinga melanogaster*) were only occasional visitors, as the young plantation has not yet developed the mature canopy trees required for large colonial roosts.

DISCUSSION

Recent studies in restoration ecology emphasize the role of Vetiver grass (Chrysopogon zizanioides) in bio-engineering and slope stability. Research indicates that nature-based solutions are critical for water management in semi-arid regions, where native species significantly outperform exotics due to their evolutionary adaptation to erratic rainfall patterns (Okello *et al.* 2024). The successful integration of diverse plant species into managed landscapes is further supported by assessments of urban ecosystem services in the Deccan region, which highlight how planned biodiversity enhances ecological niches (Rathinasabapathy and Sreenath 2025). At Kanha Shantivanam, the focus on specific botanical groups-such as the conservation of keystone Ficus species-demonstrates the potential for restored sites to support complex trophic layers and maintain long-term ecological health (Sreenath and Rathinasabapathy 2026).

In addition to this, the concept of Aroma-scapes in urban and peri-urban forests has been linked to increased human well-being and psychological restoration. Integrating medicinal plants like *Vitex negundo* and sustainable harvest species like *Murraya koenigii, Annona squamosa, Syzygium cumini, Magifera indica, Syzygium samaraganense, Ardesia elliptica, Phyllanthus acidus* aligns with the United Nations Sustainable Development Goals (SDGs) regarding life on land and water management.

CONCLUSION

The Nursery and Meera Pond project demonstrates that pond restoration in the Deccan Plateau must be an integrated effort. By combining water resource management (WRI 2023) with the keystone spe-

cies approach and ecosystem service mapping, we have transformed two simple catchment areas into high-functioning ecological units. This study confirms that a dense, multi-tier native plantation not only recharges the groundwater but also restores the biological soul of the landscape. This model serves as a blueprint for sustainable land management in the Deccan Plateau.

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REFERENCES

Bachan, K. H. A. (2003). Riparian vegetation along the middle and lower zones of the Chalakkudy River. Kerala Research Programme on Local Level Development, Centre for Development Studies.

Carpenter, S. R., Caraco, N. F., Correll, D. L., Howarth, R. W., Sharpley, A. N., & Smith V. H. (1998). Nonpoint pollution of surface water with phosphorus and nitrogen. *Ecological Applications*, 8 (3), 559-568.

Food and Agriculture Organization (2018). Reports on water and Ecosystem services.

International Union for Conservation of Nature (2013). The Management and Restoration of Small Water Bodies.

Jeppesen, E., Sondergaard, M., Jensen, J. P., Havens, K. E., Anneville, O., Carvalho, I., Coveney, M. F., Deneke, R., Dokulil, M. T., Foy, B., Gerdeaux, D., Hampton, S. E., Hilt, S., Kangur, K., Kohler, J., Lammens, E. H. H. R., Lauridsen, T. L., Manca, M., Miracle, M. R., Moss, B., Noges, P., Persson, G., Phillips, G., Portielje, R., Romo, S., Schelske, C. L., Straile, D., Tatrai, I., Willen, E., & Winder, M. (2005), Lake responses to reduced nutrient loading-an analysis of contemporary long-term data from 35 case studies. *Freshwater Biology,* 50: 1747-1771. https://doi.org/10.1111/j.1365-2427.2005.01415.x.

Li, D., Miao, L., Tian, M., & Yang, F. (2023). Differences in eco-physiological responses to the removal of adventitious roots between Syzygium nervosum A. Cunn. ex DC. and Syzygium cumini (L.) Skeels saplings under waterlogging. Annals of Forest Science, 80(1), 11.

Millennium Ecosystem Assessment (2005). *Ecosystem and Human Well-being: wetlands and Water Synthesis.*

Mitsch, W. J., & Gosselink, J. G. (2015). Wetlands (5th ed.).

Okello, C., Githiora, Y. W., Sithole, S., & Owuor, M. A. (2024). Nature-based solutions for water resource management in Africa's arid and sem-arid lands (ASALs): A systematic re view of existing interventions. *Nature-Based Solutions*, 6, 100172. https://doi.org/10.1016/j.nbsj.2024.100172

Rathinasabapathy, B., & Sreenath, A. (2025). The sustaining biodiversity in urban landscapes: A biodiversity overview and ecosystem services (Ecological Niche) of JVR Park, Hyderabad, Telangana, India. *Environment Conservation Journal,* 26(4), 1204–1214. https://doi.org/10.36953/ECJ.33643115.

Smith, V., Tilman, G., & Nekola, J. (1999). Eutrophication: impacts of excess nutrient inputs on freshwater, marine, and terrestrial ecosystems. *Environmental Pollution*, 100(1–3), 179–196. https://doi.org/10.1016/s0269-7491(99)00091-3

Sreenath, A., Uday Kumar, M., Nagesh, C., Shirisha, C., & Ranjith Kumar, P. (2025). Honey Bee Foraging Plants of Kanha Shanti Vanam, Ranga Reddy, Telangana, India. *International Journal of Current Research and Academic Review,* 13(4): 15-24. https://doi.org/10.20546/ijcrar.2025.1304.003

Sreenath. A., & Rathinasabapathy, B. (2026). The keystone species: emphasizing the conservation of Ficus (Fig) species at Kanha Shanti Vanam, Hyderabad, Telangana, India, *International Journal of Phytology Research,* 6(1): 05–09. https://doi.org/10.64171/IJPR.2026.6.1.5-9

Sunil, C., Somashekar, R. K., & Nagaraja, B. C. (2019). Influence of Terminalia arjuna on the riparian landscapes of the River Cauvery of South India. *Landscape Research*, 44(8), 982–996.

United Nations Environment Programme (2016). A Snapshot of the World's Water Quality.