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Medicinal Plant Diversity in an Urbanizing World: Lessons from GKVK Biodiversity Heritage Site

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ABSTRACT

Nature's medicine cabinet is shrinking as concrete jungles replace green spaces. But can urban green spaces still serve as refuges for medicinal plants? This study examined how different land uses affect medicinal plant diversity at Bengaluru's Gandhi Krishi Vijnana Kendra (GKVK), a designated biodiversity heritage site. The research documented 78 medicinal plant species across the campus, with gardens supporting the most diverse communities and tree plantations the least. Herbs made up nearly half of all species, while the pea family (Fabaceae) dominated with over one-third of plants. Findings indicate that maintaining mixed landscapes containing gardens, natural forests, and cultivated fields can effectively preserve medicinal plant communities alongside ongoing development.

INTRODUCTION

Overview

As cities expand rapidly, preserving natural ecosystems within urban environments becomes essential for protecting plant and animal diversity. Semi-natural ecosystems serve as vital refuges for

many species in metropolitan regions. The Gandhi Krishi Vijnana Kendra (GKVK) Biodiversity Heritage Site in Bengaluru exemplifies this conservation importance. Located within Bengaluru's most ecologically significant green space, the site sustains diverse flora and fauna communities while providing an optimal environment for systematic documentation and analysis of medicinal species distribution patterns.

Scientific evidence supports the need for urban biodiversity sites like GKVK. Recent research shows that urban green spaces have become essential lifelines for protecting nature in our rapidly growing cities, where concrete and buildings are swallowing up wild areas (Lepczyk *et al*., (2017) and this is especially crucial for medicinal plants. In 2007, Archana Verma and her team found that city residents were still hunting for and using traditional healing plants for their health, even as urban development threatened to wipe these precious plants out. They warned that we need to act fast to protect and grow these healing plants before our cities lose them forever, highlighting why preserving spaces like the GKVK campus is so crucial for our urban future.

Understanding Medicinal Plant Diversity: Ecological Perspectives from a Semi-Natural Ecosystem

The GKVK campus functions not merely as an urban green space but as a living laboratory that illustrates the coexistence of human activity and biodiversity conservation. Through systematic field surveys conducted across all major land-use types, this study documented 78 medicinal plant species distributed across diverse land-use types within the campus.

Herbs constituted the most abundant growth form, comprising 48.72% of the recorded species, followed by trees (33.33%), shrubs (16.67%), and climbers (1.28%). Land-use type significantly influenced species distribution patterns. Gardens harboured the highest number of medicinal species (34), followed closely by natural forest fragments (33) and cultivated farmland (32). In contrast, monoculture tree plantations supported markedly lower species richness (18), representing a 47% reduction compared to the most diverse habitats.

Quantitative diversity analyses revealed notable differences among land-use categories. Gardens exhibited the highest biodiversity indices (Shannon index = 2.91; Simpson index = 0.93), whereas plantations recorded the lowest diversity (Shannon = 1.82; Simpson = 0.76). Growth form also emerged as a key determinant of community structure, with herbaceous taxa demonstrating substantially greater diversity (Shannon = 2.681; Simpson = 0.90) than woody taxa, suggesting that smaller, fast-growing species may be more responsive to microhabitat variation and disturbance regimes.

Taxonomically, the Fabaceae family was the most dominant, representing over one-third of the total medicinal flora. This prominence aligns with global patterns, as Fabaceae represents one of the most phytochemically diverse plant families, with species producing a wide array of bioactive compounds, including anti-inflammatory, antimicrobial, and antioxidant agents. Asteraceae (21.4%) and Myrtaceae (14.3%) were the next most represented families, highlighting the site's underlying phylogenetic diversity.

This research demonstrates that land use directly impacts plant diversity. Gardens, with their mix of native and cultivated plants, artificially create diverse environments that support more medicinal species, while plantations simplify ecosystems with few species and reduce biodiversity. These findings highlight the importance of

maintaining varied land-use practices to preserve medicinal plant communities in urban-adjacent areas.

An additional noteworthy observation concerns floristic origin. Non-native herbs comprised a majority (54.1%) of the herbaceous species pool, indicating successful establishment in disturbed or managed habitats. In contrast, native taxa remained dominant among trees (64.3%) and shrubs (53.6%), suggesting that larger, longer-lived woody species may exhibit greater establishment requirements and competitive exclusion capabilities, leading to enhanced resistance to exotic species invasion.

CONCLUSION

This research reveals that thoughtful land management practices can maintain diverse medicinal plant communities even within developed landscapes, offering valuable insights for sustainable urban planning. Our results advocate for integrative land-use planning strategies that maintain habitat heterogeneity and promote both native species conservation and sustainable utilization of medicinal plant resources in rapidly urbanizing landscapes. Long-term monitoring of how species composition changes under different management approaches would help us understand whether these medicinal plant communities remain stable over time. Comparing findings across multiple institutional campuses could also help identify broader patterns and develop practical guidelines for medicinal plant conservation in semi-urban settings. The insights from this research can inform the design of future institutional landscapes that balance developmental needs with biodiversity conservation goals.

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