Indiana Journal of Multidisciplinary Research
Abbreviated Tittle- Ind J Multi Res
ISSN *(Online)*- 2583-3820
Journal Homepage Link- https://indianapublications.com/Journals/IJMR
DOI: https://doi.org/10.5281/zenodo.21284213

INDIANA PUBLICATIONS
PRODUCTIVE AND QUALITY RESEARCH

Research Article

Volume-06|Issue-04|2026

Advantage, Application and Analysis of Flora in Semi-Arid Region

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Article History
Received: 20.06.2026
Accepted: 08.07.2026
Published: 10.07.2026

Citation
Singh, G. S. & Sharma, A. (2026). Advantage, Application and Analysis of Flora in Semi-Arid Region. *Indiana Journal of Multidisciplinary Research, 6*(4), 1-5.

Abstract: The urban biota and communities that live within city limits are home to a wealth of floral diversity. The distinctive plant assemblages found within old city walls are maintained due to the presence of favorable growing conditions, including suitable temperature, humidity, and nutrient availability. The types of plants present at different locations and the overall plant composition determine the success of wall vegetation. In metropolitan settings, it is especially important to prioritize the use of advanced technologies in wall engineering to improve quality and encourage a diverse species composition. Natural and living walls not only purify the air, reduce carbon footprints, and maintain ecological balance in urban environments, but also provide valuable information on changing landscapes. In addition to aiding in the conservation of rare, endangered, and exotic species, the evaluation of fortification walls and pavements may provide insight into ecological conditions and assessment criteria. Understanding wall flora, or cultural landscapes, is essential for interpreting the historical and biological characteristics of any urban habitat.

Keywords: Floral variety, ecosystems, ecological stability, geographical species, vascular flora, foreign species.

INTRODUCTION

The word **"flora"** comes from the Latin name *Flora*, the Roman goddess of plants, flowers, and fertility. The technical term **"flora"** was derived from the name of this goddess during the late sixteenth century. It was first used in poetry to denote the natural vegetation of an area but later came to describe a publication cataloguing the plant life of a particular region. Moreover, the term *Flora* was also used to refer to the flowers of an artificial garden during the seventeenth century [7].

The distinction between **vegetation** (the general appearance of a plant community) and **flora** (the taxonomic composition of a plant community) was first made by Jules Thurmann (1849). Prior to this, the two terms were used interchangeably. Plants are grouped into floras based on region (floristic regions), geological period, special environment, or climate. Regions may represent distinct habitats such as mountains or plains. Floras may also refer to the plant life of a historical period, such as fossil flora. Finally, floras may be subdivided according to specific environments:

- **Native flora:** The native and indigenous plants of a particular area.
- **Agricultural and horticultural flora (garden flora):** Plants deliberately cultivated by humans.
- **Weed flora:** Traditionally, this classification referred to plants regarded as undesirable and studied for their control or eradication. Today, the term is used less frequently because it includes weedy species, invasive species (which may or may not be weedy), and native or introduced non-weedy species that are agriculturally undesirable. Many native plants previously considered weeds have since been recognized as beneficial or even essential to various ecosystems.

Here are five key benefits of plants:
Improve Air Quality and Produce Oxygen:

Through photosynthesis, plants absorb carbon dioxide and release oxygen, thereby improving air quality. Many indoor plants, such as the spider plant, are also effective in removing airborne pollutants, including formaldehyde and benzene.

Reduce Stress and Anxiety:

Interacting with nature and caring for plants can have a calming effect, reducing stress and improving psychological well-being.

Boost Productivity and Concentration:

Studies have shown that the presence of plants in workplaces and educational environments enhances concentration, stimulates creativity, and improves overall productivity.

Provide Essential Nutrition and Medicine:

Plants are the primary source of food, supplying essential nutrients through fruits, vegetables, cereals, and grains. In addition, many medicinal compounds are derived from plants and are widely used in healthcare.

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Support Ecological Stability:

Plants help prevent soil erosion, support biodiversity by providing habitats for numerous organisms, and contribute to climate regulation through carbon sequestration.

The flora of a particular area or geological period can be documented in a publication known as a flora (often capitalized as *Flora* to distinguish the publication from the vegetation itself). Floras generally require specialized botanical knowledge for effective use. Traditionally, floras were published as books, although many are now available on CD-ROMs and online platforms.

Simon Paulli's Flora Danica (1648) is probably the first publication titled *Flora* that described the plant life of a specific region. It primarily documented medicinal plants growing in Denmark. Flora Sinensis, written by the Polish Jesuit Michał Boym, is another early example of a work entitled *Flora*. Despite its title, however, it described not only plants but also certain animals found in China and India [7,10].

A published flora often contains diagnostic keys, commonly in the form of dichotomous keys, which require the user to repeatedly examine a plant and choose between two alternative characteristics until the correct identification is reached (Figure 1).

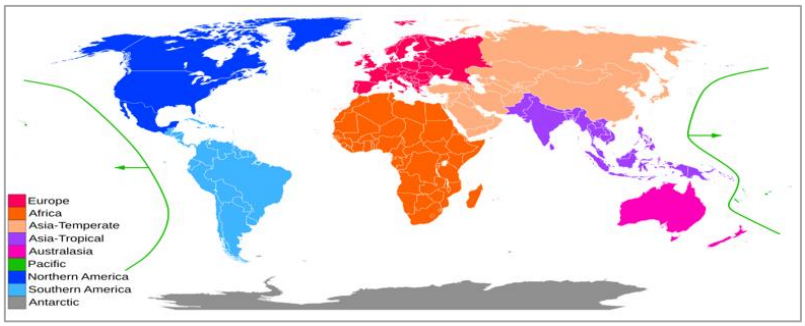

Figure 1

Sustaining Life and Health
Oxygen and Air Quality:

Flora acts as the "lungs of the Earth" by releasing life-sustaining oxygen while absorbing carbon dioxide. Fauna completes this natural cycle by releasing the carbon dioxide required by plants for photosynthesis.

Medicine:

A vast number of modern medicines, antibiotics, and therapeutic compounds are derived directly from plant extracts and animal by-products.

Basic Necessities:

Nearly all essential human needs—including food (grains, fruits, vegetables, dairy products, and meat), clothing (cotton and wool), and raw materials (such as timber for housing)—are derived directly or indirectly from flora and fauna.

Maintaining Ecological Balance
Food Chains:

Flora produces the foundational energy through photosynthesis that supports all faunal life. Fauna, in turn, helps regulate plant populations and contributes to organic decomposition, thereby recycling essential nutrients back into the soil.

Pollination and Seed Dispersal:

Animals such as bees, birds, and insects play a crucial role in pollinating agricultural crops and dispersing seeds, thereby ensuring the continuous regeneration of both natural forests and agricultural ecosystems.

Economic and Aesthetic Value
Livelihoods and Tourism:

Rich biodiversity supports local and global economies through ecotourism. National parks, wildlife sanctuaries, and botanical gardens generate employment opportunities and contribute significantly to economic development.

Aesthetic Appeal:

The beauty of natural landscapes, diverse wildlife, and colorful plant life enhances the quality of human life by providing opportunities for recreation, mental relaxation, and inspiration for art and culture (Figure 2).

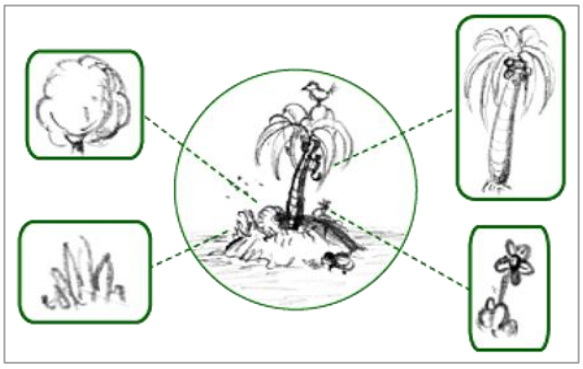

Figure 2. Simplified schematic of an island's flora showing all plant species highlighted in boxes.

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Floral Analysis

Survey Purpose and Approach

The primary purpose of this study was to assess the biological environment under the framework of the **Environmental Impact Assessment (EIA)** and to assist in the decision-making process by ensuring that the proposed project options are environmentally sustainable. EIA identifies methods for improving environmental performance by preventing, minimizing, or compensating for adverse impacts before the construction and operational phases. The present floral assessment of the proposed project was based on an extensive field survey supported by secondary information collected from various government and non-government sources.

Objectives of the Study

The objectives of the present study were as follows:

- To conduct a detailed study of the floral elements within the proposed project site.
- To assess the occurrence of scheduled species, including rare, endangered, critically endangered, endemic, and vulnerable species, within the proposed site.
- To identify ecologically significant locations and features.
- To establish baseline information on the project area, including descriptions of existing terrestrial, wetland, and aquatic vegetation.
- To assess the potential impacts of the project during the construction and operational phases on the biological environment.

Activities Undertaken During the Study

Floral Survey

- Identification and documentation of tree, shrub, herb, climber, and fern species.
- Assessment of species diversity using appropriate diversity indices.
- Analysis of scheduled species.
- Study of habitats and microhabitats for faunal elements within the project site and surrounding areas.

Survey Methodology for Analysis of Flora

The floral assessment of the proposed project was carried out through an extensive field survey of the study area during the pre-monsoon season. The ecological assessment was conducted by a multidisciplinary team of functional area experts. Plant species were identified with the assistance of secondary sources, including the **DVD – *Flowering Plants of Kerala*** published by the **Kerala Forest Research Institute (KFRI)**. In addition to specimen identification, information regarding the vernacular names of plant species was collected from local inhabitants and verified using the KFRI database.

To maximize the documentation of plant diversity, the entire project area was divided into different sampling sections. Sampling sites were selected based on land-use pattern, topography, and floristic composition. Primary field data were collected and analyzed to characterize the vegetation with respect to species composition and structural attributes. Diversity measurements were used to determine the richness of plant species, whereas density measurements indicated the number of individuals of each species present within the study area. Species diversity is considered one of the most reliable indicators of community structure and is highly sensitive to environmental disturbances and ecological stress.

FINDINGS OF FLORAL ASSESSMENT

The floral assessment revealed a total of 55 plant species belonging to 28 plant families. Angiosperms comprised 55 species, including 15 tree species (including saplings), 11 shrub species, 19 herb species, and 8 climber species. In addition, two species of Pteridophytes (ferns) belonging to the family Adiantaceae were recorded. The most dominant plant family was Leguminosae, represented by 10 species, followed by Compositae and Malvaceae. One tree species, *Artocarpus hirsutus*, is endemic to the Southern Western Ghats, while one shrub species, *Tabernaemontana alternifolia*, is endemic to the Western Ghats.

The study site contained a total of 58 plant species, comprising:

1. **Trees:** 5 species
2. **Tree saplings:** 13 species
3. **Shrubs:** 11 species
4. **Herbs:** 19 species
5. **Climbers:** 8 species
6. **Ferns:** 2 species

The plant species (trees, tree saplings, shrubs, herbs, climbers, and ferns) recorded from the project site are presented in **Table 1**.

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Table 1: Floral Species Recorded from the Project Site (List of Trees)

S. No.	Botanical Name	Common Name	Family	Habitat	Distribution	No.	Status
1	*Albizia saman* (Jacq.) Merr.	Mazha Maram	Leguminosae	Cultivated as an avenue tree	Native to Central and South America	1	Exotic
2	*Trema orientalis* (L.) Bl.	Pottaama	Ulmaceae	Dry and moist deciduous forests, also found in plains	Tropical Africa, Asia, and Australia	6	Native
3	*Carica papaya* L.	Papaya	Caricaceae	Cultivated	Native to Tropical America	1	Exotic
4	*Macaranga peltata* (Roxb.) Müll. Arg.	Vatta	Euphorbiaceae	Moist deciduous and secondary forests, also found in plains	India, Sri Lanka, and Andaman Islands	9	Native
5	*Cocos nucifera* L.	Coconut (Thengu)	Arecaceae	Cultivated	Cultivated throughout the tropics	1	Cultivated

Exploration of Global Wall Flora

Several research studies focusing on ancient and historic towns around the world have demonstrated considerable taxonomic and life-form diversity among wall flora. Although studies conducted in the ancient city of Varanasi, India, reported the dominance of native woody dicotyledonous angiosperms, other investigations in different parts of the city revealed the predominance of therophytes, mainly alien species.

An inventory of the vascular flora of metropolitan Rome, Italy, recorded numerous taxa that are not native to the Italian flora. Similarly, the vascular wall flora of Anatolian Istanbul represents a unique urban ecological habitat because of the coexistence of Euro-Siberian, Mediterranean, Eastern Mediterranean, Irano-Turanian, and other phytogeographical elements. Studies on the walls of historic buildings in Şanlıurfa, southeastern Turkey, documented a rich diversity of vascular plants ranging from heliophilous to shade-tolerant species, with hemicryptophytes and therophytes being the dominant life forms.

Phytosociological investigations of the wall flora associated with Roman ruins revealed that different plant communities occupy different structural sections of walls. Documentation of the flora at the National Architectural Reserve of the Old Fortress Wall on Antique Pautalia and Medieval Velbuzhd indicated a gradual decline in species diversity from the base to the top of the walls. Annual species were more abundant on wall surfaces, whereas perennial species were predominantly found at the wall base and surrounding areas, a pattern commonly observed in European and Mediterranean wall floras.

Furthermore, chorological analyses of the vascular flora growing on the walls of Siena, Monteriggioni, Pienza, Grosseto, Arezzo, Massa Marittima, Pitigliano, Sansepolcro, and Cortona demonstrated a predominance of Boreal-Tethyan species over Eurosiberian and Boreal taxa. Species inhabiting these walls are generally ruderal and highly tolerant to environmental stress. Similarly, the wall flora of Gingee Fort and temple towers in Villupuram, Tamil Nadu, consists mainly of herbs, shrubs, trees, and climbers. Studies on the Byzantine walls of Thessaloniki have also documented a rich inventory of vascular plant taxa representing a wide range of life forms.

CONCLUSION

In conclusion, wall flora represents a dynamic ecosystem that plays a significant role in conserving floral diversity, providing habitats for a wide range of plant life forms, and maintaining ecological stability. The study of wall flora also contributes to a better understanding of the historical, cultural, and ecological significance of urban landscapes. Furthermore, the conservation and sustainable management of wall vegetation can support biodiversity preservation while enhancing the environmental and aesthetic value of historic urban environments.

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