



Short Review Paper

Biophilic Design in Urban Microenvironments: Enhancing Well-being in High-Density Residential Areas

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Available online at: www.isca.in

Received 10th August 2025, revised 03rd March 2026, accepted 6th May 2026

Abstract

The impact of biophilic design patterns on well-being and sustainability is a growing area of interest. Research has shown that incorporating natural elements in indoor spaces can significantly improve human health and productivity. Objective of the study was to empirically investigate the effects of the 14 Patterns of biophilic design on occupant well-being. A literature review was used in this study. The literature search was performed based on peer-reviewed papers meeting the inclusion. The descriptive analysis provided an overview of biophilic design research conducted in residential area and fed into refining a biophilic design framework with the inclusion of additional elements. It was concluded from various finding that the implementing of biophilic design in high-density urban areas not only improves the physical and psychological health of the residents but also enhances the ecological sustainability of the urban micro- environment. By adopting strategies that integrate both direct and indirect elements of nature, urban developers can transform high-density residential areas into more livable, health-promoting spaces that residents are proud to call home.

Keywords: Biophilic, Indoor, Nature, Occupant, Urban & Residential areas etc.

Introduction

Due to restricted space and the preponderance of manmade buildings, high-density residential areas have proliferated as a result of urbanization, and these surroundings can be harmful to people's health and well-being. Urban residents' disconnection from nature is linked to a number of mental and physical health problems, such as stress, anxiety, and a decline in social cohesiveness. A solution is provided by biophilic design, which brings back natural aspects into urban environments and strengthens the bond between humans and the natural world. Buildings account for around 40% of energy consumption and energy-related carbon dioxide emissions, making them a critical component of sustainable development¹. Since humans spend 90% of our time inside, buildings also have a substantial influence on human health and well-being^{2,3}. Reconnecting with 'nature' has been recognised as one of the most urgent challenges in contemporary urban architecture^{4,5}. The objective of this review article is to investigate the notion of biophilic design, its implementation in urban micro environments, and its capacity to improve the quality of life for inhabitants in residential areas with high densities.

Conceptual Framework of Biophilic Design

The idea that people are inherently drawn to nature—a concept known as biophilia—is the foundation of biophilic design. Evidence from environmental psychology lends credence to this

idea, indicating that being in natural environments can elevate mood, lessen stress, and increase cognitive performance⁶.

Principles of Biophilic Design: Biophilic design principles can be categorized into three main domains: i. Nature in the Space: Including actual natural elements like plants, water features, and daylighting straight into the architectural design. ii. Natural Analogues: Natural analogs refer to the utilization of materials, patterns, and forms, such wood, stone, and organic shapes, that evoke the natural world. iii. Nature of the Space: designing environments that resemble natural settings, such as places with opportunities and havens, or places that promote inquiry and learning.

Biophilic Design in Urban Microenvironments

Urban microenvironments encompass small-scale urban areas like roofs, balconies, and courtyards. In high-density residential regions, when access to expansive natural landscapes may be restricted, these places are essential. By fostering possibilities for natural interaction right in the inhabitants' immediate surroundings, biophilic design in these microenvironments may greatly improve the quality of life for those who live there. A restorative environmental design, also known as biophilic design or positive environmental impact design, is the consequence of combining low environmental impact design with biophilic design in healthcare facilities to really attain sustainability⁸. Based on human nature's biophilia, biophilic

design originated. This idea for designing spaces and environments can improve people's productivity, health, and mental clarity. The concept of biophilic design emphasizes the connection, from a biological perspective, between human health, the built environment, and nature. It can also influence the long-term evolution of healthcare environments⁹.

Table-1: Patterns of Biophilic Design⁷.

Content	Patterns
Nature of the space	Virtual connection with nature
	Non-visual connection with nature
	Non-Rhythmic Sensory Stimuli
	Thermal and Airflow Variability
	Presence of Water
	Dynamic and Diffuse Light
	Connection with Natural Systems
Natural Analogues	Biomorphic Forms and Patterns
	Material Connection with Nature
	Complexity and Order
Nature of the space	Prospect
	Refuge
	Mystery
	Risk/Peril

Courtyards and Shared Gardens: Shared gardens and courtyards provide people with outdoor areas to interact with the environment and one another. It has been demonstrated that the presence of greenery in these places enhances social connections, lessens feelings of crowdedness, and offers psychological respite from the stresses of urban living.

Green Roofs and Vertical Gardens: Vertical gardens and green roofs are creative ways to bring nature into cities with limited horizontal area. These characteristics offer ecological benefits as well, such as mitigating the urban heat island effect, enhancing air quality, and promoting urban biodiversity, in addition to aesthetic and psychological benefits.

Balconies and Indoor Planting: Balconies, which are frequently the only private outdoor spaces accessible to inhabitants in densely populated regions, may be converted into individualized green retreats. Even in the absence of outside space, indoor planting within residences offers people the advantages of nature, such as better air quality and higher mental well-being.

Impact on Well-being in High-Density Residential areas

Physical Health: Numerous advantages to physical health have been associated with the integration of natural components into urban microenvironments. Walking and gardening are among the physical activities that green spaces promote and are crucial for preserving cardiovascular health. Furthermore beneficial to general health are reduced noise pollution and enhanced air quality resulting from biophilic features.

Psychological Well-being: Psychological well-being is significantly impacted by biophilic design. It has been demonstrated that being outside in nature lowers tension, anxiety, and depressive symptoms. Natural light and vegetation improve mood and cognitive performance, encouraging serenity and relaxation.

Social Cohesion: Social connections are facilitated by biophilic urban microenvironments and are essential for fostering a sense of community and social cohesiveness. In high-density residential neighborhoods, shared green spaces promote neighborly relationships and a feeling of community.

Challenges and Opportunities

Challenges: In high-density metropolitan environments, there are a number of obstacles preventing the broad implementation of biophilic design, despite its advantages. These include: i. Cost: Putting biophilic design concepts into practice may be costly, particularly when renovating an old structure. ii. Maintenance: Because natural features need constant upkeep, both individual residents and property management may find this to be a hindrance. iii. Space Restrictions: Because high-density locations sometimes have limited space, incorporating biophilic components without sacrificing other functions might be difficult.

Opportunities: However, these challenges also present opportunities for innovation: i. Policy Support: By encouraging or requiring green areas in urban development, rules and regulations may be used by governments to enhance biophilic design. ii. Technological Advancements: Using biophilic design can be less expensive and complicated thanks to developments in green technology, such as modular green roofs and low-maintenance green walls. iii. Community Involvement: Including locals in the creation and upkeep of biophilic features may promote a feeling of community and guarantee the projects' long-term viability.

Conclusion

In high-density residential areas, biophilic design in urban microenvironments is a viable way to improve well-being. Biophilic design may lessen the negative consequences of urbanization and enhance the quality of life for people by restoring nature into the urban fabric. Subsequent investigations

ought to concentrate on approximating the enduring advantages of biophilic treatments, investigating economical approaches for their execution, and scrutinizing the part played by community engagement in maintaining these programs.

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