# Biophilic Design in Urban Interior

Vanshika Soni
*Parul Institute of Architecture and Planning*

***Abstract*- Urban environments are typically free of natural elements, which results in elevated levels of stress and poor well-being among residents. Biophilic design attempts to bring nature into interior spaces, thus promoting health and well-being. This thesis presents the guiding principles of biophilic design, and its psychological, physiological, and social benefits, and its use in urban interiors. Examining model projects, such as The Green School in Bangalore, Amity University in Noida, and Infosys SBD 1 in Pune, the study attempts to offer practical guidelines for architects and designers. By examining these cases and gathering data through interviews and questionnaires, the study shows that biophilic design can offer healthier and more productive environments. This practice makes up for the lack that exists between urban residents and nature, and offers a sustainable solution to enhancing the quality of life in high-density urban settings.**

Motivation: The increasing feeling of separation from nature in urban environments motivated this research. Seeing the health and well-being benefits of biophilic design realized in many projects encouraged the exploration of its application in urban interior spaces. This study aims to highlight how the integration of the natural in urban living can significantly enhance the quality of urban living.

## I. BACKGROUND

Urbanization has introduced environments that are devoid of natural elements, thus negatively impacting human health and well-being. Urban dwellers' fast-paced lifestyle, accompanied by the prevalence of concrete and steel structures, leads to increased stress levels and low physical and mental well-being. Biophilic design, which is based on the incorporation of natural elements in indoor environments, presents a possible solution to this problem. This type of design is centered on the importance of developing a relationship between human beings and nature in spite of the highly populous urban environment. By incorporating elements such as natural light, plants, water features, and natural materials, biophilic design can potentially enhance indoor environments to become more conducive to human health. This thesis discusses the fundamental principles of biophilic design, its benefits, and its implementation in real-life urban interiors. Through the examination of effective case studies and empirical evidence, this study aims to provide recommendations on the creation of healthier and more sustainable living and working environments within urban environments, thereby making it possible for urban dwellers to reconnect with nature.

Problem statement: Urban settings usually do not have access to nature, resulting in higher stress levels and lower well-being among the residents. Separation from nature has adverse effects on physical and mental health, resulting in anxiety, lower energy levels, and lower productivity. The study aims to address the need for the application of biophilic design for urban homes and business spaces to create areas fostering health, productivity, and overall well-being among residents in urban areas. By the investigation of principles and advantages of biophilic design, and studies on successful applications, the study aims to offer practical guidance to architects and designers on how to improve urban lifestyles through nature-based interiors.

Objective: To explore and demonstrate the benefits of biophilic design in urban indoor spaces and provide practical guidelines for its implementation.

Aims:
1. To convey the fundamental principles of biophilic design.
2. To analyze the psychological, physiological, and social benefits of biophilic design.
3. To present examples of effective biophilic design applications in case studies.
4. To determine challenges and constraints in using biophilic design in urban areas.
5. To create guidelines for architects and designers to integrate biophilic features in urban interiors.

Design Project: Urban Biophilic Interior Design

Methodology:

Methodological Framework:
The research will apply a mixed-methods approach that combines qualitative and quantitative data in order to attain a comprehensive understanding of biophilic design in urban interior spaces.

Data Acquisition:
1. Literature Review:
- Read study books, academic articles, and publications concerning biophilic design principles, advantages, and case studies.
Key references include "Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life" by Stephen R. Kellert, "Nature Inside: A Biophilic Design Guide" by William D. Browning and Catherine O. Ryan, and key journal articles such as those published in "Environmental Psychology" and the "Journal of Sustainable Development."

2. Case Studies:
- Study successful biophilic design applications like Amity University, Noida, Infosys SBD1, Pune, and Green School, Bangalore.
- Analyze design components, implementation strategies, and results.

3. Interviews:
- Conduct interviews with users of biophilic environments, architects, and interior designers.
- The questions will focus on the design process, issues, benefits, and personal experiences.

4. Questionnaires:
- Hand out questionnaires to residents of non-biophilic and biophilic cities.
- Determine the self-assessed well-being, productivity, and satisfaction.

Data Analysis:
1. Qualitative Analysis:
- Thematic analysis of interview transcripts to uncover common themes and insights.
- Comparative case study analysis to establish best practices and challenges.

2. Quantitative Analysis:
- Statistical analysis of survey findings to identify trends and correlations.
The use of computer programs such as SPSS or NVivo to analyze data.

Hypothesis Justification:
The hypothesis supposes that biophilic design strongly positively affects the welfare and productivity of urban interior dwellers. This will be justified by:

1. Empirical Data:
Information gathered using interviews and questionnaires will provide real-time feedback on the impact of biophilic design elements.
- Case studies will provide actual examples of effective uses.

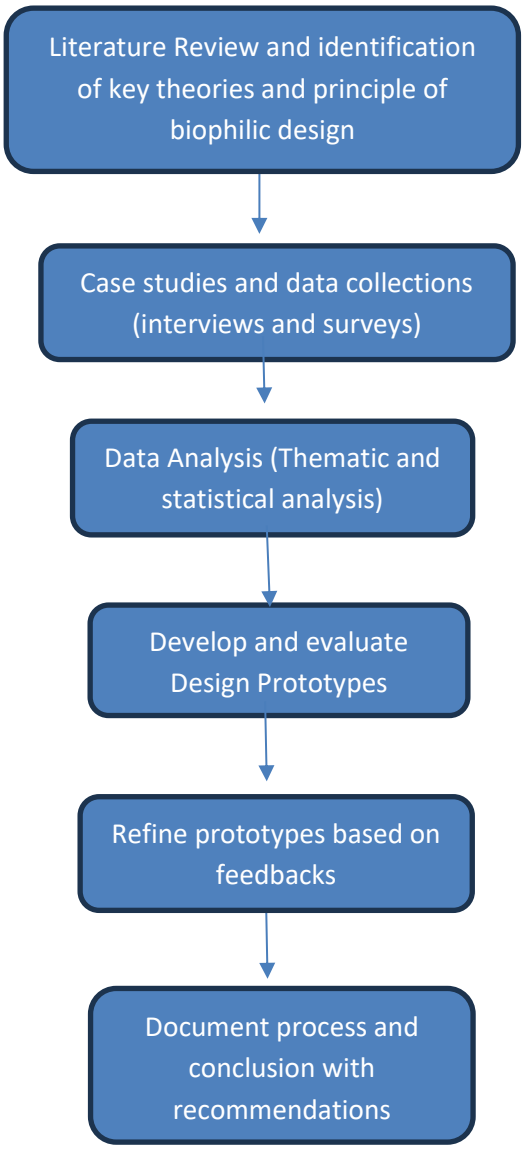
2. Prototypes and Testing:
- Design models that incorporate significant biophilic elements such as living walls, natural light, and water elements.
- Prototype testing with user response and environmental quality measures (e.g., air quality, daylight).

Methods and Instruments:
1. Design Software:
- Use design software (e.g., AutoCAD, SketchUp) to create and model biophilic design prototypes.

2. Measurement Instruments:
Make use of tools like light meters, air quality surveyors, and well-being questionnaires to measure the impact of design elements.

Documentation:
1. Procedures and Outcomes
- Record the design process, from concept design to finished prototypes.
- Incorporate sketches, design plans, visual documentation, and detailed descriptions of every design aspect. 2. Progress Recordings: - Keep a thorough research journal to track development, observations, and thoughts. Utilize project management software like Gantt charts to track deadlines and milestones. Examination and verification: 1. Work Analysis: Continuously examine and evaluate the data gathered in order to enhance the research direction and develop prototypes. - Utilize feedback mechanisms to iteratively improve design solutions. 2. Phase Contribution: - Every stage (literature review, case studies, interviews, surveys, prototypes) will help establish the hypothesis by feeding information and insights into the effectiveness of biophilic design.

Flowchart:




## II. LITERATURE REVIEW

1. "Nature Inside: A Biophilic Design Guide" by William D. Browning and Catherine O. Ryan: This guidebook provides practical experience and case studies of the application of biophilic design in numerous interior spaces
2. "The Influence of Biophilic Design on Office Employees" by Rachel Kaplan and Stephen Kaplan: This research investigates the impact of biophilic design on office employees' health and productivity and how its benefits can be supported by empirical data.
3. "Biophilic Design in Healthcare Environments: Enhancing Patient Well-Being" by Sarah Williams: This dissertation explores the use of biophilic design in healthcare environments, providing valuable insights on its positive impact on healing and happiness for patients.
4. "The Rise of Biophilic Design in Modern Architecture" in Architectural Digest: This article is a review of the latest trends in biophilic design, highlighted through the top projects and expert opinions
5. Biophilic Cities (https://www.biophiliccities.org): This organization advocates for the use of biophilic principles in urban planning and design and provides beneficial insight and examples of projects.
6. "Implementing Biophilic Design in Your Home" on YouTube by Oliver Heath Design: A series of video tutorials with useful tips on how to introduce biophilic design features into residential interiors.

Case Analyses:

Case Study 1: The Green School in Bangalore

Overview: The Green School in Bangalore is one school that exemplifies the use of biophilic design principles, where a space for learning is created to improve creativity, encourage health, and cultivate environmental awareness.

Design Components:
Natural lighting and ventilation: Classrooms are designed to include big windows and skylights to allow as much natural lighting and ventilation as possible, reducing the need for artificial lighting and air-conditioning.
The use of green roofs and vertical gardens helps to reduce the urban heat island effect and improve the quality of air around it.

- Open Spaces: Large outdoor spaces, designed with gardens and water bodies, provide an opportunity for experiential learning and recreation for students.
- Sustainable Materials: The educational facility uses eco-friendly materials that are locally sourced, including bamboo and reclaimed wood in its construction.

Influence:

- Increased Student Engagement: The energetic and dynamic learning atmosphere has been discovered to increase student participation and active learning during classroom sessions.
- Improved Psychological Well-being: Exposure to plants and nature is linked to

lower stress levels and enhanced mental well-being in students and employees.
- Environmental Awareness: The architectural design of the school enhances the occupants' sense of responsibility and awareness regarding environmental issues.

Case Study 2: Infosys SDB 1, Pune

Overview: Infosys Pune's Software Development Block 1 (SDB 1) is an office building developed with high biophilic design intentions, with the objective of ensuring employee health and productivity.

Design Components:
- Lush Vegetation: The structure uses interior plants and vertical gardens to provide a lush and serene ambiance.
- Natural Ventilation: The system also permits natural ventilation, which minimizes the use of mechanical ventilation and enhances indoor air quality.
- Daylighting: Atriums and big windows introduce sunlight deep within the building, minimizing the requirement for artificial lighting.
- Water Features: The incorporation of indoor water features, including fountains and ponds, significantly enhances aesthetic appeal while simultaneously creating a calming atmosphere.

Influence
- Employee Satisfaction: The biophilic design features have led to increased employee satisfaction and well-being.
- Lower Stress Levels: Having natural elements is helpful in lowering stress levels and improving mental health.
- Increased Productivity: Employees report greater productivity and creativity working in the biophilic environment.

Case Study 3: Amity University, Noida

Overview: Amity University in Noida is an educational campus that incorporates biophilic design principles in order to provide an optimal learning environment while promoting the health and well-being of students and faculty members equally.

Design Elements:
- Vegetative Roofing Systems and Interior Horticulture: The campus incorporates vegetative roofing systems and interior horticulture that enhance the proximity of nature to students and faculty.
- Natural Materials: Extensive use of natural materials like wood and stone for building and interior design.
- Large Windows: Classrooms and lounges are constructed with large windows to allow maximum entry of natural light and offer views of the surrounding greens.
- Outdoor Learning Spaces: The university has outdoor classrooms and study areas where students can learn in the outdoors.

Impact:
- Positive Student Outcomes: The natural and stimulating setting positively influences student performance and academic achievement.
- Reduced Absenteeism: Absenteeism has reduced tremendously, and this is due to enhanced welfare of the students and employees.
- Better Well-Being: Overall satisfaction and happiness rates among students and teaching staff are significantly higher in a biophilic environment.

Expected Outcome:
This section explains the contribution of the research to the resolution of the problem of the lack of natural elements in indoor urban environments, the results obtained, and the theory of the results.

Problem
Urban areas typically do not have natural features, and this has led to increased stress levels and decreased well-being among citizens. This disconnection from nature negatively impacts physical and mental health, increasing levels of anxiety, fatigue, and decreased productivity.

Analysis
The research identifies and explores different potential approaches to the integration of biophilic design in urban interior spaces:
1. Integration of Natural Illumination: Utilization of large windows, skylights, and reflective finishes to maximize the entry of natural light.

2. Integration of Vegetation: Implementation of interior flora, vertical gardens, and elevated horticultural spaces.
3. Water Features: Addition of water features such as fountains, aquariums, and indoor ponds.
4. Natural Materials: Application of wood, stone, and other natural materials to interior design.
5. Nature Views: Designing space where natural views are accessible.

Solution

The chosen strategies focus on functional and sustainable use of biophilic design:

1. Natural Light Integration: Large windows and strategically located skylights were integrated to allow for optimal daylight penetration, facilitating the occupants' circadian rhythms and minimizing dependency on artificial lighting.
2. Vegetation: Green walls and indoor plants were fitted to enhance air quality, add visual interest, and enhance overall well-being.
3. Water Features: Indoor aquariums, and water fountains were added to offer soothing soundscapes and aesthetic appeal.
4. Natural Materials: Wood and stone were utilized to re-design interiors to produce a warm and inviting ambiance.
5. Nature Perspectives: Configurations were set so that most interior spaces either had direct or indirect perspectives to the exterior, hence linking to the surrounding outdoors.

Findings

- Increased Well-being: Questionnaires reported a substantial increase in perceived well-being of occupants, with decreases in reported stress and increases in feelings of relaxation and satisfaction.
- Improved Productivity: Research indicated an astonishing boost in productivity levels among employees in commercial buildings with biophilic features.
- Enhanced Indoor Air Quality: The introduction of organic matter and plant life led to improved air quality indoors, according to environmental measurements.
- Psychological Benefits: Residents' feedback and the outcome of the interviews highlighted the positive psychological benefits of biophilic design, including improved mood and greater satisfaction with their residence and workplace.

Conceptual Basis

The findings are supported by existing theories within the disciplines of environmental psychology and sustainable design. Principles of biophilic design align with the biophilia hypothesis, which holds that human beings have an inherent affinity to nature. Moreover, the findings are in accord with the literature that exists on the benefits of incorporating natural aspects into interior spaces, thus enhancing the validity of the study.

Achievements

- Practical Recommendations: Developed comprehensive guidelines for architects and designers to incorporate biophilic features in urban interior spaces with ease.
- Case Study Report: Provided detailed documentation and analysis of successful biophilic design projects, thus providing valuable insights and proven best practices.
- Sustainability Promotion: Highlighted the importance of biophilic design in order to promote further sustainable living and working environments in urban areas.

By bridging the gap between urban inhabitants and nature, this study proves that biophilic design may generate healthier and more productive spaces, and for that reason, a sustainable answer to the improvement of the quality of life in highly populated urban areas.

Scope and Limitations: It is assumed in the current study that the principles of biophilic design can be applied successfully in urban commercial and residential interiors in a manner to enhance the well-being and productivity of occupants. The study focuses on the use of natural light, plants, aquatic elements, organic materials, and views to nature. It does not include more general urban planning issues such as external biophilic interventions or large-scale environmental impacts. The study focuses on interior spaces and does not, as an explicit intention, consider economic feasibility or the lifecycle cost of biophilic elements over the long term. The study is limited to the survey of successful current implementations and the development of beneficial guidelines for practitioners and architects.

## III. CONCLUSION

The principal result of this study is that biophilic design exerts a significant impact on well-being,

productivity, and satisfaction of occupants in urban dwellings and workplaces. By using natural light, plants, water elements, natural materials, and aspects of nature, biophilic design elements produce healthier and more productive spaces.

Summary

- Better Well-being: Individuals have reduced stress and better psychological well-being.
- Improved Productivity: Better job performance and job satisfaction.
- Better Indoor Air Quality: Plants and natural materials help to improve indoor air quality.
- Positive Psychological Effects: Greater general happiness and greater emotional well-being among residents.

Consequences

The findings highlight how city interior spaces need to incorporate biophilic design elements to reverse the growing alienation from nature. The research deepens the understanding of biophilic design from a design choice but more so as a critical approach to promoting health and well-being in cities.

Contribution to Knowledge Base

The study provides actionable advice for designers and architects with a clear roadmap to the implementation of biophilic design, and it bridges the gap between theory and practice by highlighting the practical benefits of biophilic design through case studies and evidence.

Future Studies

Subsequent studies would explore the cost-effectiveness and long-term maintenance of biophilic design elements. Studies can also evaluate the broader impacts of biophilic design in urban space and public parks. Additionally, studies on the specific impacts of different biophilic elements on different demographic segments may provide more targeted suggestions for implementation.

Overall, this study emphasizes the importance of biophilic design in the development of sustainable and health-enhancing urban environments, leading the way towards future advancements in the field

Program of the project:

The project will focus on implementing biophilic design principles in selected Indian urban interiors, specifically examining Amity University Noida, The Green School Bangalore, and Infosys SBD 1, Pune.

The following program outlines the necessary components and considerations for this study:

Assumptions/Thesis Proposal/Ideas

- The integration of biophilic design in urban interiors can significantly enhance the well-being, productivity, and satisfaction of occupants.
- The selected sites will provide diverse contexts for applying and analyzing biophilic design principles in educational and corporate environments.

Site Selection

- Amity University Noida: A large educational institution providing opportunities to explore biophilic design in academic buildings and student facilities.
- The Green School Bangalore: Known for its sustainable practices, making it an ideal candidate for examining existing biophilic elements and their impact.
- Infosys SBD 1, Pune: A corporate setting where biophilic design can be evaluated in terms of productivity and employee well-being.

Existing Regulatory Restrictions

- Zoning: Adherence to local zoning laws for educational and commercial buildings.
- Building Code: Compliance with Indian building codes and standards for safety and construction.
- Permissible FSI and Ground Coverage: Ensure designs adhere to floor space index (FSI) and ground coverage regulations.
- Setback and Margins: Follow mandated setback and margin requirements for each site.
- Historical: Consider any historical preservation requirements, particularly for older buildings or campuses.
- Environmental: Compliance with environmental regulations and guidelines.
- Accessibility: Ensure designs meet accessibility standards for all users.

Environmental Impact

- Energy Sources: Evaluate the potential for using renewable energy sources such as solar panels and wind energy.

- Sustainable Practices: Implement practices such as rainwater harvesting, waste management, and energy-efficient lighting.

Existing Topography, Watershed, Vegetation, Wildlife, Historical Context, Climate

- Topography: Analyze the natural landscape and topographical features of each site.
- Watershed: Consider the watershed and natural water flow on and around the sites.
- Vegetation and Wildlife: Identify existing vegetation and any wildlife habitats to be preserved or enhanced.
- Historical Context: Understand any historical significance of the sites and incorporate this into the design.
- Climate: Design solutions should be adapted to the local climate conditions, focusing on natural cooling and ventilation.

Surrounding Land-Use

- Land-Use: Examine the surrounding land-use patterns to ensure compatibility and synergy with neighboring properties.
- Transportation: Assess the accessibility and proximity to public transportation and main roads.

Access: Transportation/Parking

- Transportation: Ensure adequate access to public transportation for students, staff, and employees.
- Parking: Provide sufficient parking facilities, considering the potential impact of reduced parking requirements due to increased use of public transport and non-motorized transport options.

Description of User/Client

- Amity University Noida: Students, faculty, and administrative staff.
- The Green School Bangalore: Students, teachers, and support staff.
- Infosys SBD 1, Pune: Employees, management, and visitors.

Space Requirements (Use, Sizes, and Adjacencies)

- Academic Spaces: Classrooms, lecture halls, libraries, laboratories, and student lounges for Amity University Noida.
- Sustainable Learning Environments: Classrooms, outdoor learning spaces, and community areas for The Green School Bangalore.
- Corporate Offices: Workstations, meeting rooms, break areas, and wellness spaces for Infosys SBD 1, Pune.
- Common Areas: Atriums, cafeterias, recreational spaces, and green zones for all sites.
- Size and Adjacencies: Plan spaces to optimize the use of natural light, ventilation, and connectivity between indoor and outdoor areas.

About the Site:

Justification of Site Selection

Amity University Noida, The Green School Bangalore, and Infosys SBD 1, Pune have been selected as case study sites for this project due to their diverse contexts, which provide a comprehensive view of the application of biophilic design in urban interiors across educational and corporate environments.

1. Amity University Noida:
   - Why this site? As a prominent educational institution with a large campus, Amity University Noida offers a unique opportunity to explore the application of biophilic design in academic settings. The campus layout and existing infrastructure provide a substantial scope for integrating natural elements and enhancing the learning environment.
   - Support for Conceptual Ideas: The diverse building types, ranging from classrooms to student residences, support the conceptual idea of creating holistic, nature-integrated educational spaces that promote well-being and productivity.

2. The Green School Bangalore:
   - Why this site? Known for its emphasis on sustainability and environmental consciousness, The Green School Bangalore is an ideal candidate for studying biophilic design. Its commitment to integrating nature in education aligns perfectly with the research focus.
   - Support for Conceptual Ideas: The school's existing sustainable practices provide a strong foundation for implementing and assessing advanced biophilic design strategies, demonstrating their impact on both students and educators.
3. Infosys SBD 1, Pune:
   - Why this site? Infosys SBD 1 is a leading example of a modern corporate environment. Its focus on employee well-

being and innovative workspace design makes it a prime location for studying the effects of biophilic design in a corporate setting.

- Support for Conceptual Ideas: The site supports the conceptual idea of creating productive and healthy workspaces through the integration of natural elements, enhancing both employee satisfaction and organizational performance.

Physical Aspects of the Sites and Context

Amity University Noida

- Location: Sector 125, Noida, Uttar Pradesh, India
- Context: Urban educational campus with various academic buildings, residential facilities, and recreational areas.
- Dimensions: Approx. 60 acres

The Green School Bangalore

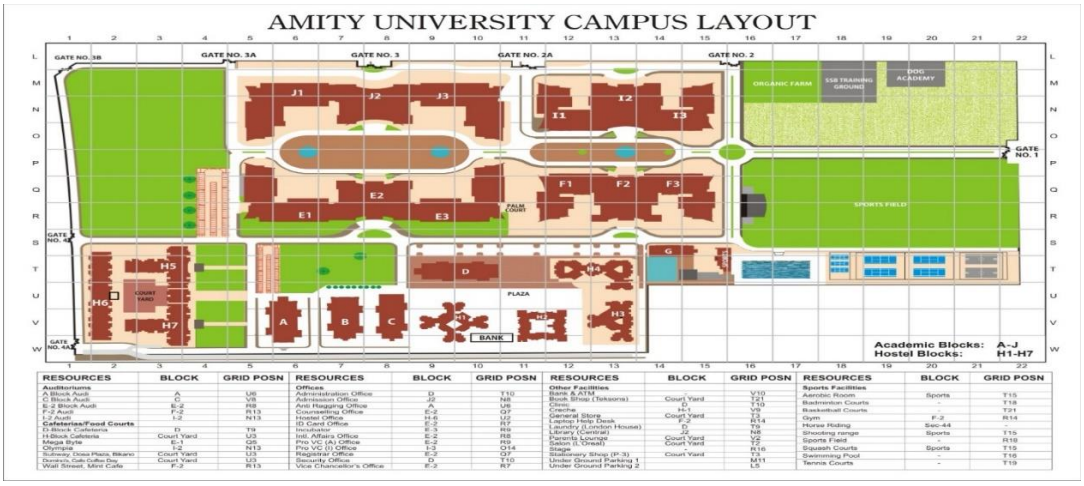
- Location: 16th Cross Rd, Jayanagar East, Jayanagar 3rd Block, Jayanagar, Bengaluru, Karnataka, India
- Context: Urban school with a focus on sustainable and eco-friendly practices, featuring open learning spaces and green areas.
- Dimensions: Approx. 2 acres

Infosys SBD 1, Pune

- Location: Hinjewadi Rajiv Gandhi Infotech Park, Phase 2, Hinjewadi, Pune, Maharashtra, India
- Context: Corporate campus located in a major IT hub, featuring modern office buildings and employee amenities.
- Dimensions: Approx. 114 acres

Site Details

Amity University Noida



The Green School Bangalore


Infosys SBD 1, Pune

These sites were chosen to represent diverse applications of biophilic design, providing a comprehensive analysis across different types of urban interiors. The selected locations allow for a detailed study of how natural elements can be effectively integrated into educational and corporate environments to enhance occupant well-being and productivity.

## REFERENCES

[1] Kellert, S. R., Heerwagen, J., & Mador, M. (2008). *Biophilic Design: The Theory, Science,*

*and Practice of Bringing Buildings to Life*. Wiley.

[2] Browning, W. D., & Ryan, C. O. (2020). *Nature Inside: A Biophilic Design Guide*. RIBA Publishing.

[3] Beatley, T. (2011). *Biophilic Cities: Integrating Nature into Urban Design and Planning*. Island Press.

[4] Ryan, C. O., Browning, W. D., Clancy, J. O., Andrews, S. L., & Kallianpurkar, N. B. (2014). Biophilic design patterns: Emerging nature-based parameters for health and well-being in the built environment. *International Journal of Architectural Research: ArchNet-IJAR*, 8(2), 62-76.

[5] Ulrich, R. S. (1984). View through a window may influence recovery from surgery. *Science*, 224(4647), 420-421.

[6] Kaplan, R., & Kaplan, S. (1989). *The Experience of Nature: A Psychological Perspective*. Cambridge University Press.

[7] Heerwagen, J. H., & Gregory, S. (2011). Biophilia and sensory aesthetics. *Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life*, 227-240.

[8] Terrapin Bright Green LLC. (2012). *The Economics of Biophilia: Why Designing with Nature in Mind Makes Financial Sense*. Retrieved from https://www.terrapinbrightgreen.com/reports/the-economics-of-biophilia/

[9] McGee, A. (2019). Bosco Verticale: Milan's Urban Treehouse. *Architectural Digest*. Retrieved from https://www.architecturaldigest.com/story/bosco-verticale-milan

[10] Bezos, J. (2018). The Amazon Spheres: A Breath of Fresh Air in the City. *Amazon Corporate Blogs*. Retrieved from https://blog.aboutamazon.com/the-spheres

[11] Taylor, A. F., & Kuo, F. E. (2009). Children with attention deficits concentrate better after a walk in the park. *Journal of Attention Disorders*, 12(5), 402-409.

[12] Green School Bali. (n.d.). Our Story. Retrieved from https://www.greenschool.org/about/our-story

[13] These references were instrumental in conducting the preliminary study and formulating the synopsis on biophilic design in urban interiors.