Architectural Dimensions and Beyond

www.adb.reapress.com

Arch. Dim. Bey. Vol. 2, No. 4 (2025) 291–304.

Paper Type: Original Article

Biophilic Design and Urban Resource Management: A Comprehensive Approach Toward Sustainable Development

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Citation:

Received: 05 March 2025 *Revised: 13 June 2025* *Accepted: 08 September 2025*	Tabari, M. (2025). Biophilic design and urban resource management: A comprehensive approach toward sustainable development. *Architectural dimensions and beyond,* 2(4), 291-304.

Abstract

The rapid growth of urbanization, the crisis of natural resources, and the consequences of climate change have intensified the need to identify and implement innovative approaches to urban management. Biophilic design, as an approach based on the structural and functional connection between humans and nature, can—through the application of indicators such as natural light, natural ventilation, native vegetation, the presence of water elements, and biomimetic patterns—positively influence energy reduction, water-use optimization, biodiversity enhancement, air quality improvement, and citizens' mental well-being. This study aims to define a theoretical–practical framework for integrating biophilic design and urban resource management using a descriptive–analytical method, a systematic review of scientific literature, and a comparative analysis of domestic and international case studies. The findings indicate that the purposeful overlap of biophilic design principles with resource management strategies not only enhances environmental performance and optimizes resource consumption but can also serve as a practical pathway toward sustainable development and increased resilience in metropolitan areas.

Keywords: Biophilic design, Urban resource management, Sustainable development, Green architecture, Urban resilience.

1 | Introduction

The rapid growth of urbanization, excessive resource consumption, and climate change have underscored the need to adopt innovative approaches to urban management. Today, cities—functioning as centers of human, economic, and cultural activity—face escalating environmental and social challenges. Increasing population density, the expansion of residential and industrial zones, and the growing demand for resources have imposed additional pressure on both urban and natural ecosystems. Meanwhile, climate change—with its

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https://doi.org/10.48314/adb.v2i4.45

adverse effects such as rising average temperatures, extreme weather events like floods and droughts, and rising sea levels—has further complicated these issues. Under such circumstances, biophilic design has emerged as a forward-thinking approach that emphasizes establishing a deep, constructive connection between humans and nature, offering a holistic, sustainable solution to these challenges. Rather than seeking to separate or dominate nature, this approach strives to integrate natural patterns, forms, processes, and characteristics into the urban built environment. The primary goal of biophilic design is to create spaces capable of simultaneously and harmoniously meeting ecological and human needs, thereby enhancing the physical and mental well-being of inhabitants, increasing productivity, and improving the overall environmental performance of cities [1]

Contemporary metropolises face a complex combination of environmental crises and management challenges that seriously threaten their sustainability. The scarcity of vital resources such as freshwater, air pollution from fixed and mobile sources, and the continuous decline of green spaces due to physical expansion represent only part of these problems. Additionally, the phenomenon of urban heat islands has led to higher ambient temperatures and, consequently, increased energy consumption for indoor cooling—placing further stress on urban energy networks [2].

These conditions not only reduce citizens' quality of life but also weaken urban resilience against climate-related crises such as droughts, floods, and heatwaves. Conventional urban management approaches often fail to provide comprehensive responses to these multifaceted issues, relying instead on short-term or sectoral solutions. Biophilic design, by integrating natural elements and processes into the fabric and structure of cities, offers significant potential to mitigate these challenges [1].

2 | Theoretical Foundations

2.1 | Biophilia

Biophilia is a key concept upon which biophilic design is founded. Introduced by Erich Fromm (1964) and later expanded by Edward O. Wilson [3], it refers to the innate human tendency to seek connections with nature and other forms of life. This connection is rooted not only in biological and evolutionary dimensions but also in psychological, emotional, and cultural aspects of human existence [4].

2.1.1 | Evolutionary and Biological Roots of Biophilia

From an evolutionary perspective, humans have spent thousands of years living in natural environments. This long-term adaptation has shaped perceptual sensitivities and physiological responses to natural patterns, forms, colors, and sounds. Wilson [3] argues that this connection represents a biological need essential to human survival and well-being. Research in neuroscience and physiology provides evidence of the positive impacts of exposure to nature — such as reduced stress indicators (lower heart rate, blood pressure, and cortisol levels), improved attention and cognitive restoration, and enhanced mood and vitality [5].

2.1.2 | Psychological and emotional dimensions of biophilia

Biophilia extends beyond a mere physiological reaction; it encompasses profound psychological dimensions. It includes place attachment, emotional bonds with the natural world, and aesthetic appreciation of natural elements. Interactions with nature can foster feelings of awe, serenity, vitality, and a sense of connection to something greater than oneself. These experiences are particularly vital in urban environments, where disconnection from nature is often prevalent [6]

2.1.3 | Cultural expressions of biophilia

Throughout history, humanity has consistently reflected nature in art, literature, architecture, religion, and cultural traditions. Natural patterns, plant and animal symbols, and green spaces hold a special place in many cultures. These cultural manifestations illustrate the enduring importance of biophilia in the human

experience. In today's increasingly urbanized world, where the gap between humans and nature is widening, there is a growing need to revive these connections within everyday urban life [5].

2.1.4 | The concept of nature deficit

Richard Louv [4] introduced the term "Nature Deficit Disorder" to describe the negative consequences arising from reduced exposure of children to nature. This phenomenon, more prevalent in urban societies, can lead to physical, educational, and behavioral problems. The concept highlights the urgency of integrating nature into urban living environments for the well-being of future generations [8].

2.2 | Biophilic Design: Integrating Nature into the Built Environment

Biophilic design is an approach in architecture and urban planning that seeks to integrate natural elements and experiences into built environments to enhance both human well-being and ecosystem health.

This approach goes beyond mere plant addition; it aims to establish multisensory, perceptual, and emotional connections with nature through design [5].

Table 1. Review of articles and analysis of the main dimensions of biophilia.

Main Dimension	Selected Article	Brief Description of Indicators
Biophilia (love of nature)	Gaekwad et al. [1]. A meta-analysis of emotional evidence for the biophilia hypothesis.	This article examines the biological–evolutionary connection between humans and nature, analyzing emotional evidence supporting the biophilia hypothesis. It is relevant to indicators such as vitality, improved attention, and physiological effects.
Physical health	Yin et al. [2] Health Impacts of Biophilic Design from a Multisensory Perspective.	This study explores the effects of biophilic design—particularly visual and sensory connections with nature—on both mental and physical health. It relates to indicators such as reduced heart rate/blood pressure and enhanced mood.
Place attachment	Friesinger et al. [9]. The significance of the social and material environment to place attachment and quality of life.	This research highlights how the physical (access to nature) and social environments contribute to place attachment and quality of life, aligning with indicators such as sense of belonging and emotional connection to nature.
Interaction with nature (nature connection)	Martin et al. [6]. Nature contact, nature connectedness, and associations with health, well-being, and pro-environmental behaviours.	Using large-scale data, this study investigates the types and qualities of human contact with nature and their associations with health and pro-environmental behaviors, using indicators such as the frequency and quality of interaction with nature.
Human–nature relationship	Ives et al. [10]. Human–nature connection: a multidisciplinary review. sustainability science.	A multidisciplinary review of the human–nature connection, addressing the theoretical foundations and conceptual indicators related to nature connectedness.

Table 1. Continued.

Main Dimension	Selected Article	Brief Description of Indicators
Mental health	Jimenez et al. [5]. associations between nature exposure and health.	This article provides evidence linking exposure to nature with physical and mental health, physical activity, and sleep quality. It is relevant to indicators such as reduced risk of heart disease, improved mood, and increased physical activity.
Nature-related traditions (cultural dimensions)	Zelenski et al. [11]. Nature connection: providing a pathway from personal to planetary health.	This paper discusses the emotional, spiritual, and cultural dimensions of nature connection and illustrates how relationships with nature promote personal and planetary well-being. It corresponds to indicators such as representation of nature in art/literature and cultural traditions.
Health problems – nature deficit	Darcy et al. [12]. Understanding the role of nature engagement in supporting health and well-being in those with a pre-existing health condition during the first UK lockdown.	This study investigates how reduced engagement with nature during lockdown affected people with pre-existing health conditions. It relates to indicators such as reduced nature contact and increased health issues caused by nature disconnection.

Table 2. Summary of nature-related indicators through key concepts and biophilia dimensions.

Main Dimension	Key Concept	Key Indicators
Biophilia (love of nature)	Biological–evolutionary roots	Physiological responses to nature (reduced heart rate and blood pressure); positive effects on mental health (reduced stress and anxiety); improved concentration and attention; sense of vitality.
Place attachment	Psychological–emotional dimensions	Sense of place; emotional connection to nature; aesthetic experience; sense of awe; feeling of calmness; sense of belonging.
Interaction with nature	Nature connection	Frequency and quality of interaction with nature; knowledge of plant and animal species; understanding of natural processes; direct experience of nature (e.g., walking, gardening).
Mental Health	Impact on health	Physical health indicators (reduced heart disease, strengthened immune system); mental health indicators (reduced depression, improved mood); better sleep quality; increased physical activity.
Nature-related traditions	Cultural dimensions	Representation of nature in art, literature, and architecture; presence of natural symbols in culture; nature-related customs and traditions.
Health problems	Nature deficit disorder	Reduced contact with nature; adverse effects on child and adult development; increased health problems caused by nature disconnection.

2.2.1 | Principles and patterns of biophilic design

The key concepts of biophilic design are derived from research on human perception and behavior. Stephen Kellert [8], one of the pioneers in this field, identified 18 biophilic design attributes grouped into three main categories :

Nature in the Space

Creating a direct presence of nature within a space. This includes:

I. Natural light: Sunlight, patterns of light and shadow, and dynamic lighting changes.
II. Air and ventilation: Airflow, natural ventilation, and indoor air quality.
III. Water: Visual, auditory, or tactile experiences of water.
IV. Plants: Presence of living plants (both indoor and outdoor).
V. Animals: Attracting birds and beneficial insects through design.
VI. Seasonal changes: Visible variations throughout the year (e.g., leaf fall, blooming).
VII. Views of natural landscapes: Access to natural scenery through windows or openings.

Natural Analogues

Establishing indirect connections with nature through imitation of natural forms, materials, and processes. This includes:

I. Biophilic patterns and textures: Use of natural materials and biomimetic forms (e.g., leaf, wood, or stone patterns).
II. Natural colors: Incorporation of the color palette found in nature.
III. Connection to natural systems: Simulation of natural cycles such as water circulation or ventilation.
IV. Natural forms and geometry: Use of organic, curved, and fractal forms.
V. Nature-inspired lighting: Lighting that mimics sunlight and natural shading.

Nature of the Space

Fostering a spatial and experiential connection with nature through the sense of place, landscape, and emotion. This includes:

I. Refuge spaces: Safe, comfortable, and restorative environments.
II. Sense of discovery: Opportunities for exploration and surprise.
III. Perceived risk or danger: Balancing excitement and safety in design.
IV. Community connection: Nature-inspired social spaces encouraging interaction.
V. Harmony and order: Spatial coherence and aesthetic balance.

2.2.2 | Benefits of biophilic design

Extensive research has demonstrated that biophilic design provides significant benefits for both humans and the environment:

I. Health and Well-being: Improves physical health (reduces diseases, promotes physical activity) and mental health (reduces stress, anxiety, and depression); enhances focus, cognitive performance, and productivity.
II. Urban Resilience: Supports stormwater management, mitigates urban heat island effects, improves air quality, and increases biodiversity.
III. Economic Value: Enhances property values, attracts tourism, and reduces healthcare costs.

IV. Social Interaction: Creates more attractive public spaces and encourages community engagement and social connections [6].

Table 3. Biophilic design: key areas and indicators.

Main Dimension	Subdimension / Key Principle	Key Indicators
Natural elements	Nature in the space	Light: access to and variety of natural light, sunlight simulation; Air: natural ventilation, air quality, and flow; Water: presence of water elements (sound, visual, tactile); Plants: live plants, green walls, green roofs; Animals: presence of wildlife; Seasons: display of seasonal changes; Views: sightlines to nature
Patterns	Natural analogues	Patterns and textures: natural materials and patterns (fractal geometry), natural colors, simulation of natural cycles, organic forms, natural lighting
Place	Nature of the place	Shelter and tranquil spaces, opportunities for exploration, balance of excitement and safety, spatial harmony, nature-inspired social spaces
Health promotion	Health and well-being benefits	Stress reduction, mood improvement, increased focus and productivity, physical health enhancement
Ecological management	Environmental benefits	Reduction of urban heat island effect, improved air quality, rainwater management, increased biodiversity, and carbon sequestration
Investment attraction	Economic value	Increased property value, attracting investment, reduced operational costs (energy, health)
Measurement	Evaluation indicators	Biophilic Index, Biophilic Design Standard, assessment of user experience quality

2.2.3 | International frameworks

Various global organizations and institutions have provided frameworks and guidelines for biophilic design. The Biophilic Index and the Biophilic Design Standard are among these frameworks, helping to evaluate and promote this approach. Additionally, initiatives such as the Biophilic Design Alliance are expanding knowledge and the application of these principles.

2.3 | Urban Resource Management: Sustainability in Megacities

Urban resource management refers to the planning, implementation, and monitoring of the optimal use of various resources (water, energy, materials, space, land, and human capital) in urban environments, to achieve sustainable development and enhance citizens' quality of life.

2.3.1 | Concept of sustainable urban development

Sustainable urban development is a multidimensional approach based on three pillars: economic, social, and environmental. Its goal is to meet the needs of the present generation without compromising future generations' ability to meet their own needs. At the urban scale, this means creating cities that are economically prosperous, socially equitable, and environmentally healthy and resilient.

2.3.2 | Key Resources in Urban Management:

I. Water Resource Management: provision of drinking water, wastewater management, rainwater harvesting and reuse, water consumption reduction, and protection of water resources.

II. Energy Resource Management: improving energy efficiency in buildings and transportation, using renewable energy, and reducing greenhouse gas emissions.

III. Waste Management: reduction of waste generation, recycling, composting, and sanitary disposal.

IV. Land and Space Management: planning for compact urban development, preservation of green spaces, and prevention of urban sprawl.

V. Transportation Management: promoting sustainable transportation (walking, cycling, public transport), reducing reliance on private cars.

VI. Human and Social Capital Management: enhancing citizen participation, improving social services, increasing health and well-being [13].

2.3.3 | Global trends in urban resource management

Recent trends in urban resource management emphasize systemic approaches, circular economy, smart cities, and increased urban resilience.

I. Circular Economy: transition from a linear "produce-consume-dispose" model to one where resources remain in the economic cycle as much as possible.

II. Smart Cities: use of information and communication technology to improve urban operations, deliver public services, and enhance quality of life.

III. Urban Resilience: the capacity of urban systems to withstand shocks and stresses (e.g., natural disasters, climate change, economic crises) and recover quickly.

IV. Nature-Based Solutions (NBS): leveraging ecosystems and natural processes to solve urban challenges, such as creating green spaces for stormwater management and heat reduction [5]

2.3.4 | Link Between Urban Resource Management and Biophilic Design:

Biophilic design can play a significant role in achieving sustainable urban resource management goals. Integrating natural elements into cities not only enhances environmental quality and human well-being but can also directly impact resource management:

I. Water Management: green roofs, vertical gardens, and permeable urban spaces (parks, green areas) help absorb rainwater, reduce runoff, and relieve pressure on sewer systems.

II. Energy Management: vegetation on façades and roofs can provide shading and cooling through evapotranspiration, reducing the need for artificial cooling and optimizing energy consumption. Increasing green spaces also mitigates the urban heat island effect.

III. Waste Management: urban gardens and green spaces that allow local food production reduce reliance on long supply chains and excess packaging.

IV. Land Use Management: biophilic design promotes efficient use of space through multifunctional areas that combine functional and environmental benefits [7].

3 | Global Trends in Sustainable Development and Connection to Biophilic Design

Sustainable development is a global goal pursued by the United Nations and other international organizations. The Sustainable Development Goals (SDGs) provide a comprehensive framework for achieving a better and more sustainable future for all. In this context, biophilic design acts as a powerful tool and approach that can contribute to many of these goals.

3.1|Sustainable Development Goals and Biophilic Design:

I. Good Health and Well-being: directly related, as biophilic design improves mental and physical health, reduces stress, and enhances quality of life.

II. Clean Water and Sanitation: green roofs, rain gardens, and permeable green spaces aid in stormwater management, reduce water pollution, and relieve pressure on water and wastewater systems.

III. Affordable and Clean Energy: tree shading, green roofs, and natural ventilation can reduce cooling energy consumption.

IV. Sustainable Cities: Biophilic design is a key pillar for creating resilient, livable cities, reducing heat-island effects, improving air quality, and increasing public green spaces.

V. Climate Action: reduces carbon emissions through lower energy use and increases carbon sequestration via vegetation.

VI. Life Below Water: better stormwater management and reduced polluted runoff protect aquatic resources and ecosystems.

VII. Life on Land: increasing green spaces and biodiversity in cities helps protect and restore terrestrial ecosystems and habitats [4].

3.2|Emerging trends in sustainable urbanism

I. Return to Nature: a movement emphasizing integration of nature and biophilic elements throughout urban planning, from building design to city-wide planning.

II. Resilient Cities: biophilic design enhances urban ecosystems' ability to absorb water, cool air, and improve environmental quality, increasing city resilience to climate change and other crises.

III. Circular Economy in Cities: integrating biophilic design with circular economy principles, such as using natural and renewable materials in construction and nature-based waste management systems.

IV. Urban Health and Well-being: increasing attention to the link between citizens' health and urban environmental quality, with biophilic design as a key solution.

V. Technology and Nature: using modern technologies (sensors, AI, augmented reality) to monitor, manage, and enhance biophilic elements in cities [8].

Table 4. Key indicators of urban resource management.

Main Dimension	Subdimension / Key Area	Key Indicators
Urban Resource Management	Water resource management	Per capita water consumption and quality, water recycling and efficiency, per capita wastewater generation and treatment, urban surface permeability, stormwater management
	Energy resource management	Per capita energy consumption, share of renewable energy, energy intensity, greenhouse gas emissions, energy efficiency in buildings and transport, and the role of green spaces in reducing energy use
	Waste management	Per capita waste generation, recycling and composting rate, sanitary landfill ratio, reduction of incoming waste, and energy recovery from waste
	Land use and spatial management	Population density, green space ratio, accessibility to public spaces, urban sprawl index, preservation of agricultural and natural lands, and brownfield regeneration

Table 4. Continued.

Main Dimension	Subdimension / Key Area	Key Indicators
	Transportation management	Share of public transport, cycling and walking, use of private cars, transport-related air quality, and sustainable transport infrastructure
	Sustainable development and resilience	Quality of life index, HDI, urban resilience index, SDG indicators, social participation, health, and well-being
	Emerging trends	Implementation of circular economy, NBS, smart city initiatives, and reduction of the urban heat island effect
	Connection with biophilic design	Integration of biophilic elements (green roofs, green walls, urban trees) into infrastructure, impact on reducing water and energy consumption, and improvement of air quality

4 | Findings and Analysis of International Case Studies

This section analyzes findings on biophilic design and urban resource management, drawing on successful international examples to demonstrate how these approaches are implemented in practice.

4.1 | The Impact of Biophilic Design on Well-being and Health

Numerous studies have shown that integrating biophilic elements into work, educational, and healthcare environments significantly improves mood, reduces stress, and enhances concentration and productivity.

Example A: International Cases

Parkroyal on Pickering, Singapore:
This hotel, with its vertical gardens and extensive sky terraces, creates a lush and tranquil environment in the heart of the city. Studies have shown that exposure to such green spaces reduces employee stress and provides guests with a satisfying and restorative experience.

St. George's Hospital, UK

The hospital's design features large windows overlooking green spaces, inner courtyards with vegetation, and the use of natural materials—all of which contribute to reduced anxiety among patients and staff and accelerate recovery rates.

4.2 | Biophilic Design and Resource Management

Integrating biophilic elements into urban infrastructure directly impacts resource management.

Water Management:

High Line, New York City

This linear park, built on a former elevated railway, uses dense vegetation and rainwater management systems to absorb and filter water, helping reduce stormwater runoff and alleviate pressure on the city's sewage system.

Green Roofs in Hamburg, Germany:

Hamburg is a pioneer in implementing city-scale green roofs. These installations absorb significant rainfall, mitigate urban flooding, and cool the city during summer, reducing energy consumption for cooling.

Energy management

Masdar City, UAE: Although not purely biophilic in nature, Masdar City applies principles such as shading, natural ventilation, and vegetation to minimize cooling needs in hot, arid climates. This approach has led to a substantial reduction in energy use.

Tree-lined streets, singapore: As part of its "City in a Garden" vision, Singapore incorporates abundant trees in streets and public spaces. These trees provide shading and evaporative cooling, lowering street-level and building temperatures, and reducing energy demand for air conditioning.

4.3 | Urban Resilience and Biophilic Design

NBS, a key component of biophilic design, enhances urban resilience to climate change.

Houston Flood Resilience, USA: Following Hurricane Harvey, Houston invested heavily in nature-based strategies such as wetland restoration, floodable parks, and green roofs. These measures have significantly improved flood absorption capacity and mitigated storm impacts [13].

Copenhagen Climate Adaptation, Denmark: Copenhagen has launched innovative projects such as Cloudburst Parks, designed to store and gradually release stormwater during heavy rainfall, thereby enhancing the city's resilience to extreme weather events.

4.4 | Challenges and Opportunities

Despite its many benefits, implementing biophilic design at an urban scale faces several challenges:

Challenges

I. Initial Costs: biophilic projects may require substantial upfront investment.
II. Specialized Expertise: need for expert knowledge in design, implementation, and maintenance.
III. Resistance to Change: limited acceptance among policymakers and the public.
IV. Ownership and Management: Long-term maintenance and ownership of green spaces pose governance challenges.

Opportunities

I. Rising Public Awareness: growing attention to environmental and health issues.
II. Supportive Policies: development of regulatory and financial incentives to promote biophilic design.
III. Technological Innovation: use of technology to optimize design and management.
IV. Cross-Sector Collaboration: partnerships among government, private sector, and civil society.

5 | Final Conceptual Model: Integrating Biophilic Design and Urban Resource Management for Sustainable Development

The conceptual model below illustrates the interrelationships and pathways between biophilic design and urban resource management, aiming to achieve sustainable development and enhance urban resilience. (A text-based explanation is provided instead of a visual diagram.)

Model Components

I. Core Pillars

Biophilia: the innate human affinity for nature.

Biophilic Design: integration of natural elements and patterns into the built environment.

Urban Resource Management: sustainable management of water, energy, waste, land, and related resources.

II. Inputs

Global Sustainable Development Trends: SDGs, climate change, and urbanization.

Policy Priorities: urban planning, regulations, investments.

Technology: advanced ICT, artificial intelligence, and new materials.

Stakeholder Participation: civil society, private sector, citizens.

III. Processes and Interactions

Biophilic Design as a Tool for Resource Management:

Water: green roofs, rain gardens, permeable surfaces → reduce runoff, filter and store water.

Energy: tree shading, green roofs, natural ventilation → reduce cooling energy demand, mitigate heat islands.

Waste: urban gardening, local composting → reduce waste generation, promote circular economy.

Land & Space: parks, green spaces, urban ecosystems → efficient land use, increased biodiversity.

Transportation: green pedestrian and cycling corridors → promote sustainable mobility.

Urban Resource Management through a Biophilic Approach:

Budget allocation for green and biophilic projects.

Development of building codes with biophilic requirements.

Integration of NBS into infrastructure.

Promotion of environmental culture and connection with nature.

IV. Mediating Factors

Urban Resilience: the capacity of cities to withstand and recover from environmental and social shocks.

Health and Well-being: physical and mental health, quality of life.

Social Interaction: enhancement of public spaces and community engagement.

Urban Biodiversity: an increase in plant and animal species within the city.

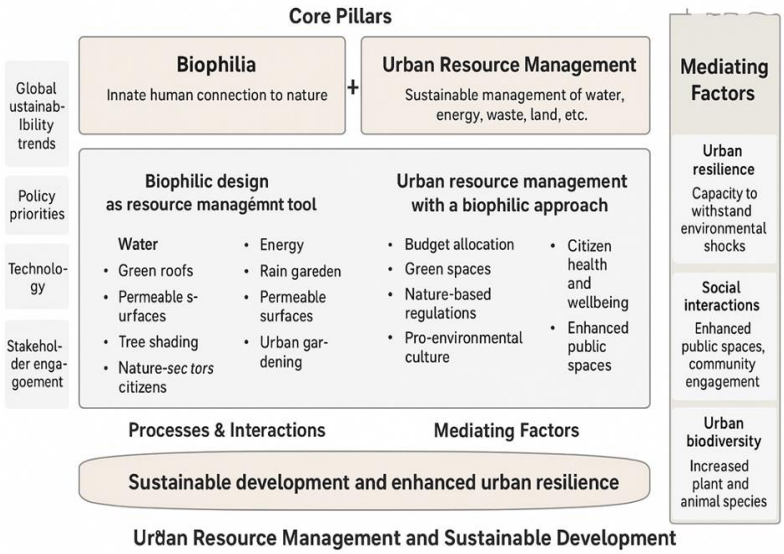

Fig. 1. Framework of biophilia and urban resource management for urban sustainability and resilience.

Outputs and Outcomes

Sustainable Cities: achieving SDG goals and reducing environmental impacts. Resilient Cities: withstanding climate change and natural disasters. Healthy and Livable Cities: improving quality of life and public well-being. Green Economy: creating new economic and employment opportunities. Deeper Human–Nature Connection: enhancing awareness and responsibility toward the environment.

Key Pathways of the Proposed Model

I. Biophilic design, through the incorporation of components such as natural light, natural ventilation, vegetation, and water features, optimizes resource management (water, energy, waste). This, in turn, reduces environmental impacts and contributes to sustainable development.

II. By increasing green spaces and enhancing urban ecosystems, biophilic design improves citizens' health and well-being, promotes biodiversity, and consequently strengthens urban resilience.

III. The integration of sustainable urban resource management and biophilic design creates a synergistic effect that accelerates progress toward achieving the SDGs.

IV. Input factors such as supportive policymaking, technological innovation, and social participation act as key enablers of biophilic design and sustainable resource management.

This model demonstrates that biophilic design is not merely an aesthetic approach but a strategic framework for improving urban resource management and achieving sustainable, resilient development. The integration of these two domains—supported by sound policy and stakeholder collaboration—can lead to cities that are economically viable, socially equitable, and environmentally healthy.

6 | Conclusion

This study aimed to provide a comprehensive and up-to-date analysis of the interrelationship between biophilic design and urban resource management within the framework of sustainable development, expanding the theoretical foundation across three key domains.

A deeper examination of the concept of biophilia —its roots in biology and psychology and its manifestation in biophilic design—highlights the importance of integrating natural elements into the built environment. It was observed that biophilic design goes beyond aesthetics, serving as a powerful tool to enhance human health and well-being, increase urban resilience, and improve sustainable resource management.

Global trends in sustainable development—particularly the United Nations SDGs—provide a clear framework for guiding efforts toward a sustainable future. Biophilic design directly or indirectly contributes to many of these goals, including good health and well-being, clean water, affordable and clean energy, sustainable cities, and climate action.

By analyzing dimensions and indicators across these three domains, this research demonstrated how biophilic approaches can be integrated with urban resource management strategies, including water, energy, waste, and land use.

Successful international case studies highlighted the significant potential of biophilic design to improve quality of life, reduce environmental impacts, and increase urban resilience to contemporary challenges such as climate change. Despite implementation challenges—such as high initial costs and the need for technical expertise—emerging opportunities, including rising public awareness, supportive policies, and technological advancements, pave the way for broader adoption of this approach.

The final conceptual model presented an integrated framework illustrating how the synergy between biophilic design and urban resource management can lead to more sustainable, healthy, and resilient cities. The model emphasizes that achieving this vision requires a systemic, integrative, and participatory approach involving multiple stakeholders.

Ultimately, this study underscores the importance of prioritizing the integration of nature into urban design and management as a fundamental investment for a sustainable future. Further research—particularly quantitative evaluations of biophilic design impacts on resource management and resilience indicators within Iran's cultural and geographic context—can enhance the practical application of this approach at the national level.

Conflict of Interest

The authors declare that they have no conflict of interest regarding the publication of this manuscript.

Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Funding

This research received no external funding.

Reference

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