Bagh-e Nazar
DOI: 10.22034/BAGH.2025.499293.5743

Bagh-e Nazar, *22*(145), 21-36 / 2025
Persian translation of this paper entitled:
تحلیلی بر نقش طراحی بیوفیلیک در خلق معماری حساس به اقلیم و متناسب با فرهنگ در ایران
is also published in this issue of journal.

Original Research Article

An Analysis of the Role of Biophilic Design in Creating Climate-Responsive and Culturally Attuned Architecture in Iran*

Elham Raisi[1], Jamshid, Davtalab[2**], Mohsen, Ghasemi[3], Maliheh, Norouzi[3]

1. Ph.D. Candidate in Architecture, Department of Architecture, Zahedan Branch, Islamic Azad University, Zahedan, Iran.
2. Associate Professor, Department of Architecture, Faculty of Art and Architecture, University of Zabol, Zabol, Iran.
3. Assistant Professor, Department of Architecture, Bam Branch, Islamic Azad University, Bam, Iran.

Received: 16/01/2025 Accepted: 11/05/2025 Availableonline: 22/06/2025

Abstract

Problem statement: Rooted in the Biophilia Hypothesis, biophilic design seeks to intelligently weave natural elements into the built environment to enhance sustainability, human well-being, and the human-nature connection. Nevertheless, despite its innovative potential, the widespread adoption of biophilic principles in Iran has been constrained by challenges such as increasing urban density, the persistence of traditional construction practices, and various cultural and policy-related barriers.

Research objective: This study aims to evaluate the environmental, energy, and cultural performance of biophilic design across three representative Iranian cities—Yazd (hot and arid climate), Tabriz (cold and semi-arid climate), and Rasht (humid climate)—by integrating computational simulations with expert interviews.

Research method: For the quantitative analysis, high-resolution climatic data were sourced from reliable databases such as Meteonorm and NASA's POWER database. These datasets were then analyzed using advanced simulation tools like Ecotect Analysis and Grasshopper-Ladybug. In the qualitative phase, semi-structured interviews were conducted with seven experts selected through purposive and snowball sampling methods, aiming to explore the challenges and opportunities associated with implementing biophilic design in the Iranian context.

Conclusion: The research findings highlight the substantial benefits of biophilic principles in enhancing building performance and the quality of the built environment. For example, in Yazd, the strategic deployment of passive cooling techniques resulted in a remarkable 30% reduction in energy consumption. In Tabriz, improvements in building insulation led to a 20% enhancement in energy efficiency. Similarly, Rasht witnessed a 30% increase in water use efficiency, marking a significant stride toward water resource sustainability. Nonetheless, broader implementation of biophilic strategies in Iran faces obstacles such as economic constraints, limited public awareness, and fragmented, inconsistent policy frameworks.

Keywords: *Biophilia, Biophilic Design, Climate-Responsive Architecture, Vernacular Iranian Architecture.*

Introduction

In recent decades, the escalation of environmental crises and climate change has elevated concepts such as sustainability and human-centered design to core priorities within contemporary architectural discourse (Girard, 2021, 754). Among the prominent approaches

* This article extracted from Ph.D. thesis of "Elham Raisi" entitled "An Analysis of the Role of Biophilic Design in Creating Climate-Responsive and Culturally Attuned Architecture in Iran" that under supervision of Dr. "Jamshid Davtalab" and in consultation of Dr. "Mohsen Ghasemi" and Dr. "Maliheh Norouzi" which has been done at Department of Architecture, Zahedan branch, Islamic Azad University, Zahedan, Iran in 2025.

** Corresponding author: +989155420657, jdavtalab@uoz.ac.ir

emerging from this shift is biophilic design, which emphasizes humanity's innate inclination to connect with nature (Kellert et al., 2011). By integrating natural elements and ecological systems into built environments, biophilic design not only meets environmental criteria but also significantly enhances the physical and mental well-being of users (Kellert, 2018). In essence, biophilic design offers a multidimensional response to the critical needs of contemporary architecture, particularly in advancing environmental resilience and improving users' quality of life (Barbiero & Berto, 2021). In Iran, with its remarkable climatic diversity and rich architectural heritage, biophilic design is not merely a necessity but also a unique opportunity. Traditional Iranian architecture—evident in features such as windcatchers (badgirs), qanats, and Persian gardens—stands as a brilliant testament to harmonious interaction with the natural environment (Yousefzadeh et al., 2020; Heidari & Davtalab, 2022 & 2024; Oveisi et al., 2020; Heidari & Davtalab, 2020a&b). These elements not only efficiently address climatic conditions but also embody the cultural and spiritual values of Iranian society (Ghorbani Param et al., 2020). Nevertheless, the profound transformations in urban lifestyles, the widespread adoption of modern technologies and materials, and the erosion of traditional practices have introduced new challenges to contemporary Iranian architecture (Ghadimzadeh, 2022; Javanmard et al., 2024). The country's diverse climates—ranging from the central arid deserts to the humid northern and southern regions—often present contradictory demands for climate-responsive design. Moreover, the cultural fabric of Iran, which emphasizes privacy, familial social interaction, and symbolic connections with nature, adds further layers of complexity to architectural processes (Kheiri et al., 2021). Given these varied and often challenging conditions, this study seeks to identify and analyze the key components of biophilic design and propose a framework for integrating these elements with Iran's indigenous architectural values. The aim is not only to promote environmental sustainability but also to reinforce cultural identity. Against this backdrop, the central research question arises: How can biophilic design principles be integrated into contemporary Iranian architecture in a manner that accommodates the country's climatic diversity, aligns with its cultural values and indigenous identity, and effectively addresses the challenges of environmental sustainability and urbanization?

Research Background

A broad overview of the literature on biophilic design reveals that existing research can generally be classified into three main categories: first, studies focusing on theoretical foundations and conceptual frameworks; second, works analyzing health-related and well-being outcomes associated with the integration of natural elements into architectural spaces; and third, research emphasizing practical strategies and the cultural and climatic adaptation of biophilic design. Given the breadth of this field, the following review highlights selected representative examples from each category.

Theoretical Foundations and Conceptual Frameworks

Zhong et al. (2024), in their article "A Review of Sustainable Spaces: The Evolution of Biophilic Design" in Modern Architecture, trace the conceptual development of biophilic design and underscore the urgent need for cohesive guidelines to operationalize this approach effectively. Their findings indicate that integrating natural elements within built environments not only improves users' physical and mental health but also significantly enhances their sense of place and environmental connection. Similarly, Zare and colleagues (Zare et al., 2021), in their study, "A Systematic Review of the Concept and Implementation of Biophilic Design in Architecture", emphasize the critical role of natural light, vegetation, and biomorphic forms in boosting cognitive performance. They also highlight the absence of standardized operational protocols as a major barrier to the broader adoption of biophilic strategies.

• Health-related research and well-being outcomes

Hong and Chang (2021), in their article Evaluating the Health Benefits of Biophilic Evidence-Based Environments, use empirical data to demonstrate that dynamic natural lighting and vegetation in workplace environments can reduce employee stress by up to 30% and significantly enhance productivity. They also stress the importance of non-visual elements such as natural sounds and tactile surfaces in fostering tranquility, while pointing to the lack of standardized assessment tools as a critical gap. Zhong et al. (2022), in their research "The Impact of Biophilic Design on Resident Well-Being in High-Density Urban Environments", reveal that providing green views and access to daylight within densely populated residential complexes markedly improves mental health indicators and residential satisfaction. Their findings suggest that creating semi-open spaces enriched with diverse vegetation and eco-friendly materials not only improves air quality but also strengthens users' emotional connection to urban environments.

• Practical strategies and climatic/cultural adaptation

Watchman (2020), in the article Implementing Biophilic Design in Schools in Cold Climates, shows that the integration of natural light and vegetation into educational spaces enhances students' cognitive performance by 20%. They emphasize the need for creative design solutions that balance natural ventilation with energy conservation and highlight the critical importance of aligning architectural forms with cold-climate imperatives for the success of biophilic interventions. Fukumoto et al., (2024), in their case study, "The Impact of Indoor Biophilic Elements on User Satisfaction in Green Office Buildings: A Study from China", report that introducing natural patterns—such as indoor plants, reflective daylighting, and biomimetic materials—greatly increases workplace environmental satisfaction. They argue that cultural and regional differences significantly influence the effectiveness of biophilic strategies and that culturally sensitive personalization is key to maximizing the success of such designs. This body of research collectively illustrates that the integration of biophilic elements into contemporary design is not merely an aesthetic enhancement but a transformative, cross-disciplinary strategy with significant implications for health, well-being, and sustainability. Nevertheless, persistent challenges remain, including the absence of comprehensive strategic guidelines, a lack of robust quantitative evaluation models, and insufficient attention to cultural and climatic diversity. Accordingly, beyond advancing theoretical models, it is critical to develop cohesive, localized operational strategies to fully unlock the transformative potential of biophilic design in creating built environments that holistically address both human and environmental needs.

Theoretical Framework

In contemporary interdisciplinary sciences, concepts such as biophilic design, landscape ecology, and continuous architecture are no longer isolated perspectives aimed merely at achieving sustainability and human-centeredness; rather, they represent evolutionary approaches that, both theoretically and practically, establish a profound and foundational bond between humans and nature within constructed environments (Kellert & Calabrese, 2015; Pour Haghverdi et al., 2025). This theoretical framework seeks to offer a comprehensive approach, grounded in conceptual developments in ecology and design and informed by the aesthetics of sustainability, that integrates biological, cultural, and physical dimensions across all levels of planning and design.

• From environmental sustainability to a multidimensional landscape perspective

Initially, sustainability was largely framed around the conservation of natural resources and minimizing human impact on ecosystems (World Commission on Environment and Development, 1987). However, recent studies show that sustainability extends beyond ecological concerns, placing cultural, social, and even aesthetic dimensions at the core of creating sustainable landscapes (Meyer, 2008; Hemmati, 2016). While traditional models of sustainable development emphasize the overlap among environment, economy, and society, a more holistic vision asserts that aesthetics, spirituality, and human needs must be woven into ecological considerations (Wu, 2013). Recent research highlights that leveraging the cultural and symbolic capacities of "nature" within urban spaces not only revives and sustains historical identities but also deepens users' sense of place (Nassauer & Opdam, 2008). Thus, today's landscape sustainability is not confined to reducing energy consumption or conserving biodiversity but also aims to imbue environments with meaning and enrich users' lived experiences (Sabokro et al., 2024).

• Landscape ecology and the human-environment nexus: theoretical horizons and practical approaches

Landscape ecology, integrating principles from geography, ecology, and design, strives to provide a framework that acknowledges the complexities of ecological systems while embracing the human being as an intrinsic, interactive agent within the ecosystem (Troll, 1968; Wu & Hobbs, 2007). Research identifies three key levels in landscape ecology:

1. Horizontal Level (Conceptualization and Macro Principles):

- A holistic view of space as a mosaic of natural and cultural systems (Forman, 1995).
- Integration of historical, perceptual, and identity layers alongside physical form (Makhzoumi, 2000).
- Recognition of humans as active participants in ecological processes (Leitao & Ahern, 2002; Masnavi et al., 2021).

2. Vertical Level (Planning and Design Process):

- Site analysis emphasizing natural-cultural characteristics.
- Assessment of ecological and social potentials and constraints.
- Development of integrated strategies that balance conservation, functionality, and aesthetics.
- Pilot implementation and continuous performance monitoring.

3. Mediatory Level (Strategic Implementation Principles):

- Structural strategies such as restoring hydrological flows in urban valleys and establishing green wildlife-human corridors (Espinosa et al., 2016; Sabokro et al., 2024).
- Functional strategies like designing multifunctional urban spaces that simultaneously deliver ecological services (air purification, flood control) and enhance social interactions (Jun, 2023).
- Semantic strategies that emphasize historic-cultural values of river valleys through indigenous symbols and signs (Mahan & Mansouri, 2017).

• Biophilic design and the restoration of humanity's innate bond with nature

Emerging schools of thought build upon the genetic predisposition of humans to affiliate with nature (biophilia) (Joye & De Block, 2011; Kellert et al., 2011). Biophilic design seeks to systematically integrate biomorphic patterns, natural light, water elements, and vegetation into built environments, fostering environments where users experience physiological comfort and psychological well-being, including feelings of tranquility, safety, and meaningful social interaction (Zhong et al., 2022). Extensive research demonstrates that systematic incorporation of biophilic elements into schools, hospitals, and offices reduces mental stress, enhances creativity, and improves productivity indicators (Ghaziani et al., 2021). At an urban scale, biophilic design introduces green corridors, rooftop gardens, and organically inspired courtyards to merge indigenous traditions with sustainability values (Soderlund & Newman, 2015). In the context of Iran's rich architectural heritage—where traditional elements such as windcatchers, qanats, and gardens exemplify nature integration—there is fertile ground for synergy between biophilic innovations and climatic-cultural principles (Hajitaher et al., 2024; Davtalab & Heidari, 2020; Pour Haghverdi et al., 2025; Davtalab et al., 2025).

• Continuous architecture: integrating temporal and spatial dimensions

Continuous architecture offers yet another lens for blending constructed landscapes with nature (Seyedi & Hemmati, 2023). Contrary to late modernist models that stress the separation of the built form from natural and historical contexts, continuous architecture seeks a deeper fusion of time and place:

- Temporal Continuity involves referencing the site's spiritual and cultural heritage, creating a historical-cultural continuum without merely replicating the past (ibid., 2023).
- Spatial Continuity refers to the seamless integration of built structures with the topography, vegetation, and biotic systems of the region, dissolving boundaries

between "building" and "landscape" so that the new form appears as an extension of geography itself (Hemmati & Seyedi, 2021).

The main campus of Koç University in Istanbul exemplifies this approach, skillfully blending symbolic elements of Turkish culture—such as sequential courtyards and mass-space systems from Ottoman architecture—while addressing the demands of modern higher education (Seyedi & Hemmati, 2023).

• Aesthetics of sustainability: beyond imitating natural forms

Although many "sustainable" projects are limited to visually mimicking natural forms or inserting greenery, newer approaches emphasize aesthetics as a strategic tool for enhancing environmental awareness and users' emotional connections with nature (Meyer, 2008; Hemmati, 2016). Dynamic visual appeal and the experiential reading of natural processes take precedence. Instead of merely replicating nature's shapes, successful designs embed ecological processes into built forms, enabling citizens to experience the vitality and variability of living cycles (Shi et al., 2018). Case studies, such as Duisburg Park in Germany and Yanweizhou Park in China, demonstrate that successful sustainable designs not only remediate environmental degradation but also cultivate cultural and social bonds with users. For instance, at Yanweizhou Park in Jinhua (China), flood control processes are interwoven with cultural festivals and dragon symbolism, fostering a strong collective engagement with environmental stewardship (Perepichka & Katsy, 2016).

• Implementation mechanisms at urban and landscape scales

To operationalize this multidimensional sustainability framework at large scales—such as metropolitan river-valley systems—a set of strategic guidelines is essential (Sabokro et al., 2024):

1. Structural Management: Identifying critical zones for hydrological restoration and vegetation revival; integrating green and blue infrastructures into the urban fabric (Sabbion, 2017; Espinosa et al., 2016).

2.Functional Management: Designing multifunctional urban spaces that combine ecological functions (water purification, temperature regulation) with social services (recreation, education) (Smith et al., 2021; Sabokro et al., 2024).

3. Semantic and Aesthetic Management: Highlighting historical and cultural dimensions of river valleys

Through symbolic elements, utilizing courtyards, gateways, and pedestrian paths to enhance user interaction with the natural-historical landscape (Hemmati, 2017; Mirgholami et al., 2016).

4. Participatory Processes: Engaging local stakeholders and the public to foster a stronger sense of place attachment and shared responsibility for ecological and heritage conservation (Decker & Chase, 1997; Keshtkaran, 2019) (Fig. 1).

Research Methodology

This study adopted a mixed-methods approach to evaluate the performance and applicability of biophilic design across diverse climatic contexts in Iran. Data collection, modeling, and analysis were conducted in two complementary and continuous phases: First, quantitative analyses were carried out through computational simulations; second, key themes and components were extracted via semi-structured interviews. The quantitative component focused on environmental simulations using computational tools. By selecting traditional architectural typologies from the cities of Yazd, Tabriz, and Rasht as case studies, the research investigated how traditional Iranian architecture responds to the country's varied climatic conditions. Climatic data for the simulations were sourced from reputable databases, including Meteonorm, NASA's POWER database, and the Iran Meteorological Organization (IRIMO), to extract parameters such as solar radiation, humidity, wind patterns, and temperature fluctuations. Historical climatic data from 2000 to 2022 were utilized to ensure that the simulations reflect contemporary climatic conditions and are relevant to modern architectural applications. The collected data provided a robust basis for modeling through Ecotect Analysis and Grasshopper-Ladybug software. Using these tools, the study comprehensively simulated the thermal performance, daylight availability, and energy efficiency of buildings impacted by biophilic

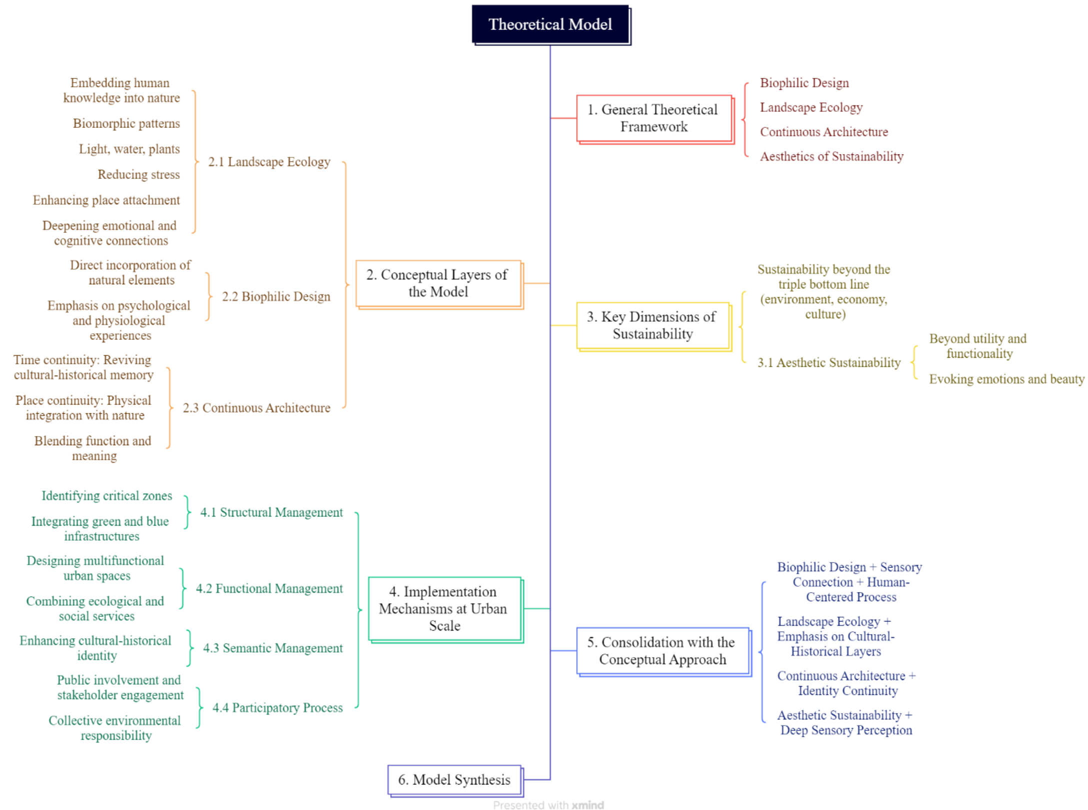

Fig. 1. Theoretical Model of the Study. Source: Authors.

interventions. Key features under examination included windcatchers, courtyards, green walls, and pitched roofs. For example, Grasshopper-Ladybug was used to model the impact of reflective surfaces in reducing solar heat gain and enhancing indoor lighting quality in Yazd, while Ecotect Analysis evaluated the thermal properties of thick stone walls in Tabriz and their effects on indoor thermal comfort.

Quantitative indicators extracted and analyzed included:

- Energy consumption (kWh/m²)
- Indoor temperature variations (°C)
- Humidity control efficiency (%)
- Carbon dioxide emissions (kg/m²)

In the qualitative phase, deep qualitative data were collected through semi-structured interviews with seven experts. These experts—comprising architects and designers with a minimum of 15 years' experience in sustainable architecture in Iran—were selected through purposive and snowball sampling. Selection criteria included in-depth familiarity with traditional architectural elements such as windcatchers and qanats, as well as a solid command of contemporary biophilic design principles. Initially, a network of professionals was identified; subsequently, further participants were recruited based on expert recommendations to ensure a diversity of perspectives. Each interview lasted between 45 and 70 minutes and was conducted either in person or virtually, depending on participant availability. All conversations were audio-recorded with prior informed consent and transcribed verbatim. Qualitative data were then coded and analyzed using NVivo 12 software, following Braun and Clarke's six-phase thematic analysis framework to ensure both depth and reliability of interpretation (Table1).

Research Findings

Evaluating the Performance of Biophilic Design: A Comparative Analysis of Energy Efficiency and Environmental Indicators Across Diverse Iranian Climates (Yazd, Tabriz, Rasht)

This section presents a comparative and quantitative assessment of how biophilic design principles influence architectural performance in three climatically distinct

Table 1. Data Used for the Evaluation of Biophilic Design Interventions in Selected Cities. Source: Authors.

Parameter	Yazd	Tabriz	Rasht
Climate Type	Hot and Arid	Cold and Semi-Arid	Humid
Average Annual Temperature (°C)	23.1	11.5	16.9
Average Humidity (%)	35	50	85
Annual Solar Radiation (kWh/m²)	2100	1500	1200
Wind Speed (m/s)	4.5	3.8	2.7
Building Orientation	North–South	East–West	East–West
Thermal Conductivity of Materials (W/m·K)	0.7 (Brick)	1.1 (Stone)	0.9 (Wood)
Vegetation Coverage (%)	10	35	55
Use of Natural Ventilation	High (Windcatchers)	Low	Moderate
Roof Slope (°)	5	10	35
Shading Strategies	Shading devices & vegetation	Minimal Shading	Shading and Green Walls
Water Features	Central Courtyard Pools	None	Rainwater Collection Systems
Annual Cooling Load (kWh/m²)	80	50	70
Annual Heating Load (kWh/m²)	40	110	60
Annual Lighting Load (kWh/m²)	20	25	30
Maximum Indoor Temperature (°C)	35	28	32
Minimum Indoor Temperature (°C)	18	12	16

Iranian cities—Yazd (hot-arid), Tabriz (cold semi-arid), and Rasht (humid). Grounded in computational simulation and environmental modeling and informed by the rich cultural context of each city, the analysis employed Ecotect Analysis and Grasshopper-Ladybug software to simulate thermal, daylighting, and environmental performance across vernacular architectural typologies. Key traditional biophilic elements—windcatchers, central courtyards, green walls, and pitched roofs—were analyzed for their measurable impact on indoor thermal comfort and visual quality. The outcomes are summarized in Table 2 below.

- **Yazd: hot and arid climate**

Traditional architecture in Yazd exemplifies climate-responsive design through the integration of biophilic elements such as windcatchers, shaded courtyards, and high-albedo materials. These strategies not only improve thermal comfort by reducing indoor temperatures by up to 6°C but also cut energy consumption by 30%, significantly reducing reliance on mechanical cooling. Appropriate placement of reflective surfaces and optimized openings enhance natural daylight by 35%, while preventing excessive heat gain. Water features in courtyard spaces serve dual roles—as microclimate regulators and as cultural-historical signifiers, reflecting water's symbolic and practical significance in Iranian architecture. These results affirm that energy-efficient, environmentally attuned design strategies can simultaneously enhance human comfort and preserve cultural identity.

- **Tabriz: cold and semi-arid climate**

In the cold mountainous climate of Tabriz, architectural strategies emphasize thermal insulation and compact spatial organization. Case study analysis revealed that thick masonry walls and small apertures play a critical role in minimizing heat loss during winter, leading to a 20% reduction in energy use and a 4°C increase in indoor warmth. Despite moderate daylight levels (~25%), the combination of minimal openings with thermal mass achieved a balance between visual comfort and thermal performance. The collective nature of traditional Tabrizi architecture, characterized by enclosed communal spaces, aligns well with the ethos of biophilic design. However, the region's cold climate limits the feasibility of modern biophilic interventions such as green roofs or vertical gardens, suggesting the need for innovative adaptations.

- **Rasht: humid climate**

In the humid, rain-prone environment of Rasht, biophilic strategies prioritize moisture control and enhanced natural ventilation. Traditional architectural forms—elevated buildings and steeply pitched roofs—are now being merged with contemporary systems such as vertical

Table 2. Comparative Assessment of Energy, Environmental, and Cultural Integration Metrics in Biophilic Architectural Interventions across Climatic Zones. Source: Authors.

City (Climate Zone)	Biophilic Interventions	Energy Savings (%)	Indoor Temp Reduction (°C)	Daylight Improvement (%)	Humidity Regulation (%)	CO (%)	Reduction	Water Use Efficiency (%)
Yazd (Hot-Arid)	Vegetation, Windcatchers, Central Courtyards	30%	6°C	35%	15%		20%	25%
Tabriz (Cold-Semi-Arid)	Insulated Thick Walls, Minimal Openings	20%	4°C	25%	10%		15%	10%
Rasht (Humid)	Elevated Forms, Sloped Roofs, Green Spaces	25%	3°C	20%	25%		18%	30%

greenery and rainwater harvesting. These combined approaches have led to a 25% reduction in energy consumption and a 25% improvement in indoor humidity regulation. Expanding vegetation in and around buildings not only improves thermal and visual comfort but also strengthens the psychological bond between occupants and nature, resulting in a more positive and holistic living experience.

Fig. 2 clearly illustrates the significant influence of biophilic design interventions on energy performance and thermal comfort across Iran's varied climatic regions. In the hot-arid context of Yazd, traditional elements like windcatchers and shaded courtyards proved highly effective, lowering indoor temperatures by 6°C and reducing energy use by 30%. These findings highlight the relevance of vernacular models as templates for contemporary design, particularly in mitigating urban heat island effects. In Tabriz, compact forms and thermally massive walls contributed to 20% energy savings and a 4°C rise in winter interior temperatures. This demonstrates the value of thermal mass in cold climates, though the relatively lower energy efficiency compared to Yazd underscores the need to integrate advanced technologies like hybrid insulation and solar heating systems. In Rasht, dense vegetation and vertically layered architecture reduced temperatures by 3°C and saved 25% in energy usage. Passive cooling and strategic shading were central to enhancing thermal conditions. Expanding the use of green façades and rooftop gardens is proposed as a viable path forward for improving environmental quality in humid urban contexts.

Analysis of Indoor Environmental Quality: Natural Lighting and Humidity Regulation

Fig. 3 illustrates the significant impact of implementing biophilic design principles on the quality of interior environments, particularly in improving natural lighting and maintaining optimal humidity levels. In the hot-arid climate of Yazd, the strategic use of central courtyards and reflective surfaces led to a remarkable 35% increase in natural lighting. This demonstrates that daylight can serve as a critical factor in balancing energy efficiency and visual comfort, especially in regions with high solar exposure. In the cold semi-arid climate of Tabriz, compact design and minimized openings contributed to a 25% enhancement in daylight availability. The design effectively struck a balance between maximizing natural light and preserving indoor thermal energy. However, the relative humidity improvement was modest at just 10%, indicating the need for supplementary mechanical ventilation systems to optimize indoor air quality. In humid Rasht, steeply pitched roofs and elevated structures significantly improved humidity regulation, with a 25% increase recorded. However, the enhancement in natural lighting was limited to 20%, largely due to persistent cloud cover and heavy rainfall. This highlights the need for developing moisture-resistant skylighting systems to optimize daylight access without compromising building durability.

Environmental Sustainability Impacts: CO^2 Reduction and Water Efficiency

Fig. 4 reveals that biophilic design not only enhances

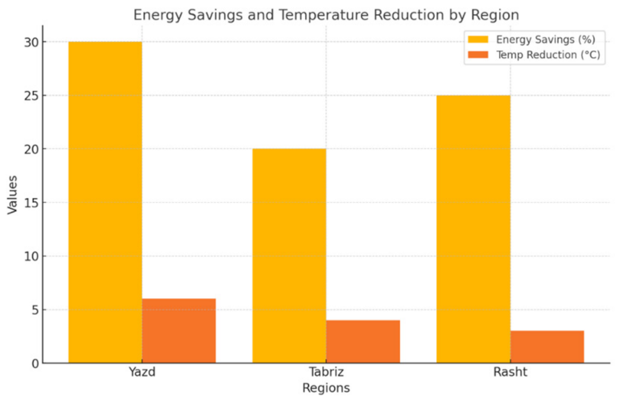

Fig.2. Energy Savings and Indoor Temperature Reduction. Source: Authors.

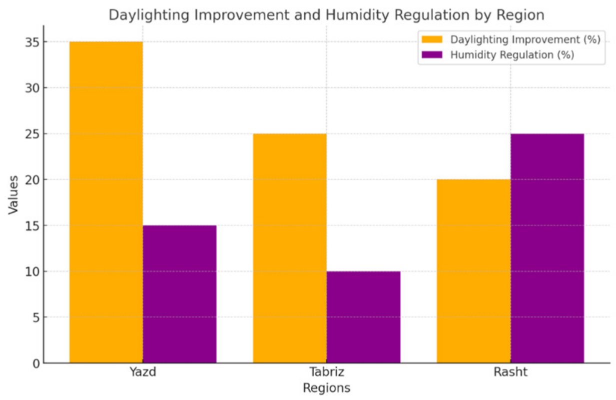

Fig. 3. Improvement in Natural Lighting and Humidity Regulation. Source: Authors.

human comfort but also substantially contributes to environmental health by reducing greenhouse gas emissions and improving water use efficiency. In Yazd's hot-arid context, passive cooling strategies—such as windcatchers and central courtyards—were pivotal in achieving a 20% reduction in CO² emissions and a 25% increase in water use efficiency. These results underscore how traditional architecture can serve as an effective model for sustainable resource management in arid regions. Integrating modern water management technologies with traditional irrigation systems could further optimize water use and safeguard groundwater resources. In Tabriz's cold semi-arid climate, the reduction in CO² emissions (15%) and water use efficiency improvement (10%) were comparatively lower, reflecting climatic constraints and a lack of comprehensive water management strategies. Although thermal insulation significantly reduced energy consumption, there is an urgent need to address water management as an underexplored opportunity in biophilic design within this region. In Rasht's humid climate, the integration of rainwater harvesting systems and dense green infrastructure led to a notable 30% improvement in water use efficiency. Additionally, an 18% reduction in CO² emissions, primarily due to passive cooling and natural ventilation, highlights the critical role of nature-based interventions in mitigating environmental impacts in humid urban settings.

Comparative Effectiveness of Biophilic Design Across Climatic Contexts

Finally, Fig. 5 presents a comparative visualization of the overall effectiveness of biophilic design strategies across the three studied climatic regions in Iran. Yazd demonstrates outstanding performance in energy savings, natural lighting enhancement, and CO2 reduction, primarily through the smart utilization of traditional elements such as windcatchers and shaded courtyards. Nevertheless, regulating humidity remains a challenge, suggesting a need for complementary strategies like evaporative cooling systems. Tabriz achieved commendable results in thermal management and cultural compatibility. However, the relatively weak performance in water efficiency and humidity control signals the importance of integrating modern natural resource management technologies into future biophilic interventions. Rasht emerges as a model of successful climatic adaptation through high water use efficiency and improved humidity regulation. However, the comparatively lower performance in CO² reduction and natural lighting enhancement indicates that biophilic design strategies in humid climates require further optimization to enhance energy efficiency and visual comfort.

Summary of Sub-Study One and Two

In the first sub-study, using quantitative methods, the impact of traditional biophilic elements—such as windcatchers, central courtyards, green walls, and pitched roofs—on the thermal and visual comfort of interior spaces was systematically evaluated. Building upon these findings, the second sub-study adopted a qualitative approach, employing semi-structured interviews with seven architectural experts to identify the challenges and opportunities for implementing biophilic design principles across Iran's diverse climates. These interviews aimed

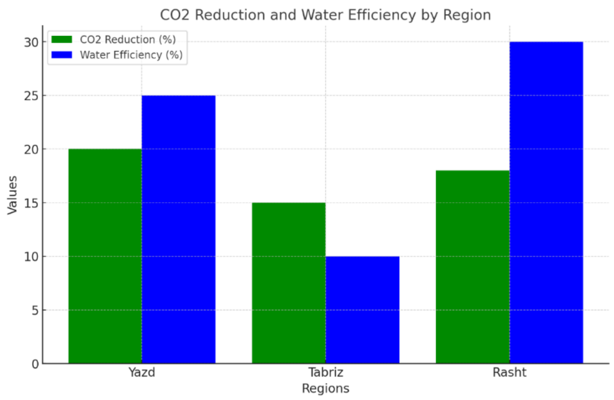

Fig. 4. CO2 Reduction and Water Use Efficiency. Source: Authors.

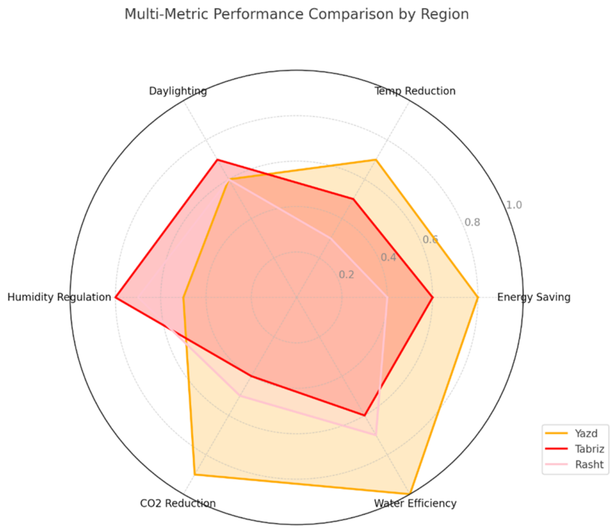

Fig. 5. Radar Chart: Multicriteria Comparative Analysis. Source: Authors.

to bridge contemporary knowledge with the collective wisdom of Iran's vernacular architecture, offering practical pathways for advancing sustainable design practices. The key themes, codes, subcategories, and critical factors derived from the expert interviews are presented in Table 3. These findings provide an expert-driven and nuanced understanding of the obstacles and potentials confronting Iranian architects in leveraging biophilic design toward more sustainable and human-centered built environments.

The flowchart presented in Fig. 6 visualizes the complex network of barriers and strategies identified by participating experts that challenge the implementation of biophilic architectural principles across Iran's diverse climates. At the core of these challenges lie the dominance of traditional construction methods and the high cost of sustainable technologies. Rooted in a long-standing reliance on materials such as concrete and steel, these issues have been exacerbated by the rapid pace of urbanization and the lack of supportive frameworks for architectural innovation. To navigate this complex situation, the flowchart proposes practical and scalable solutions, such as the smart retrofitting of older buildings and financial support for eco-friendly materials. These strategies aim to strike a balance between preserving Iranian architectural identity and embracing the advantages of contemporary sustainable design. Among the effective, implementable solutions proposed for fostering biophilic architecture in Iranian cities are:

-The transformation of existing facades into vertical gardens.

- The deployment of intelligent shading systems on building exteriors.

These interventions not only address immediate urban infrastructure needs but also align with the country's climatic and economic constraints. Moreover, offering financial incentives—such as tax exemptions and green investment facilities—and promoting extensive collaboration between the public and private sectors are seen as crucial steps toward establishing a sustainable financial ecosystem. This would facilitate the scaling up of green modular systems from pilot projects to practical, national-level solutions. In densely populated metropolises such as Tehran, challenges like extreme urban density and cultural resistance to urban innovation have posed significant hurdles to biophilic projects. The flowchart recommends the implementation of modular vertical gardens and the development of community-driven green corridors as effective solutions for high-density areas. By maximizing limited urban space, these strategies can simultaneously enhance environmental quality and foster a greater sense of belonging and civic participation among residents. In parallel with physical interventions, broad educational campaigns and urban exhibitions are proposed to reduce cultural resistance and promote biophilic architectural concepts. By emphasizing the health and psychological benefits of biophilic environments, these initiatives would help build public support for sustainable urban transformation. Additionally, establishing feedback

Table 3. Key Themes, Codes, and Proposed Strategies Derived from Expert Interviews. Source: Authors.

Themes	Codes	Proposed Strategies
Barriers to Biophilic Adoption	- Traditional construction methods - Shortage of skilled professionals - High costs of sustainable technologies - Limited space in dense urban areas - Predominance of concrete and steel in construction - Lack of biophilic education in architectural curricula - Insufficient budgets for retrofitting existing buildings - Technical challenges in applying green solutions to compact cities	- Development of affordable, eco-friendly materials - Integration of biophilic principles into architectural education - Smart retrofitting strategies tailored to urban density - Pilot green facade projects for high-density areas
Cultural and Social Resistance	- Perceived mismatch between biophilic design and urban living - Misconceptions about the inefficacy of green solutions - Limited public knowledge of biophilic benefits - Neglect of traditional aesthetics - Lack of awareness of biophilic impacts on health and the environment - Decreased natural engagement due to urban lifestyles	- Public awareness campaigns showcasing successful biophilic projects - Design of small-scale green spaces suited for modern lifestyles - Adaptation of Persian gardens into contemporary urban housing
Climatic Challenges	- Over-reliance on active systems - Urban designs poorly aligned with local climates - Technical difficulties in specific climatic zones - Lack of passive cooling strategies in hot regions - High maintenance needs for green roofs in humid areas - Inefficiency of poorly insulated buildings in cold climates	- Reviving traditional technologies such as windcatchers and qanats - Formulating climate-specific biophilic design guidelines - Supporting the long-term maintenance and economic viability of sustainable solutions
Policy and Institutional Gaps	- Fragmented urban development policies - Absence of mandatory green design regulations - Lack of financial incentives - Omission of sustainable design standards in public housing - Poor enforcement of energy-efficient construction laws - Limited support for sustainable urban projects	- Revising urban regulations to prioritize passive systems - Offering financial incentives like tax breaks and green subsidies - Strengthening collaboration among architects, policymakers, and planners
Potential Opportunities for Biophilic Integration	- Reviving indigenous knowledge - Repurposing underutilized spaces - Community participation in green space development - Redesigning Persian gardens for contemporary housing - Converting unused urban land into green corridors - Encouraging public engagement in green urban initiatives	- Merging traditional and modern water management technologies - Developing micro-parks and urban greenways - Implementing modular retrofit projects for older buildings
Education and Professional Training	- Lack of biophilic training in university programs - Insufficient research funding - Limited interdisciplinary collaboration - Outdated academic curricula - Weak knowledge exchange between architects and environmental experts - Lack of exposure to international green practices	- Updating academic curricula to emphasize sustainable design - Establishing interdisciplinary knowledge networks - Conducting professional workshops focused on green architecture principles

loops between pilot projects and local communities would enhance public awareness and create a fertile ground for deepening and expanding biophilic principles within cities. One of the principal obstacles to the expansion of biophilic architecture in Iran remains the fragmented urban policy landscape and the lack of integrated approaches within architectural education. The flowchart stresses the urgent need for the development of coherent, high-level policies focused on sustainable urban development and calls for strengthened cooperation among government agencies and relevant disciplines. In higher education, updating architectural curricula to incorporate biophilic

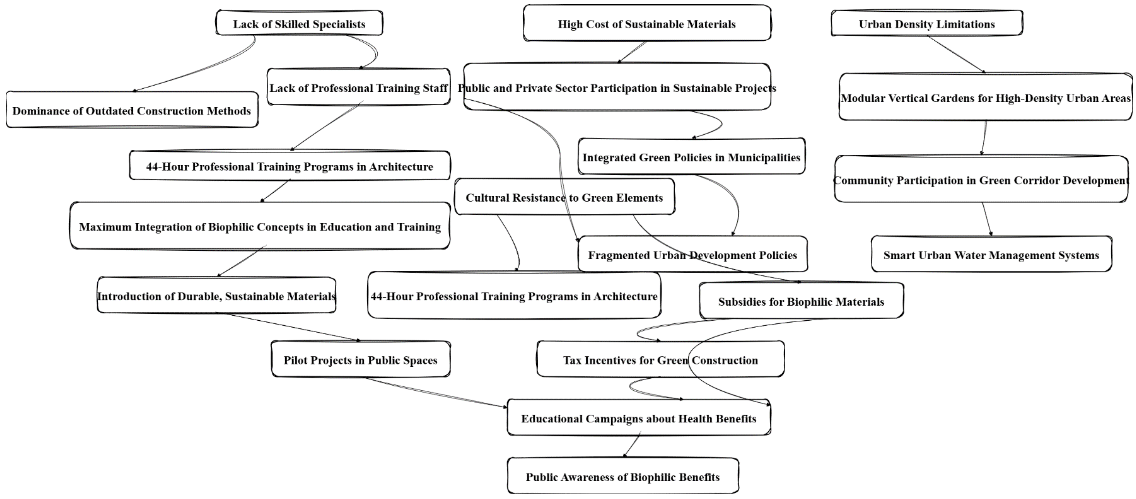

Fig. 6. Final Model of Biophilic Design's Impact in Creating Climate-Responsive and Culturally Attuned Iranian Architecture (Source: Authors)

concepts and applications would be pivotal in preparing a new generation of architects attuned to the importance of human-nature interaction. Furthermore, establishing knowledge-based, interdisciplinary networks between architecture, urban planning, and environmental sciences would foster the exchange of expertise and the generation of innovative solutions tailored to Iran's unique cultural and climatic contexts. Ultimately, the flowchart demonstrates that aligning governmental support policies, private sector engagement, and grassroots initiatives can create a positive synergy, enabling the widespread adoption of biophilic design projects. Such an integrated approach paves the way for transforming Iran's built environment toward environmental sustainability, enhanced quality of life, and the broader cultural diffusion of sustainable architectural practices.

Discussion

The analytical process of examining biophilic design within Iran's climatic and cultural contexts reveals a multilayered interplay of environmental, spatial, and social dimensions. The research background demonstrated that although existing studies have established strong theoretical foundations and emphasized health-related outcomes, there remains a significant gap in the localization and practical implementation of biophilic principles adapted to Iran's diverse climatic and cultural settings (Zhong et al., 2024; Zhong et al., 2022). In this context, the integration of landscape ecology and biophilic design offers a foundational strategy—not only for enhancing users' physical and mental well-being but also for revitalizing Iran's rich cultural and historical values (Kellert & Calabrese, 2015; Pour Haghverdi et al., 2025). A deeper reflection on Iran's traditional architecture reveals that biophilic values were deeply embedded in historical built environments: from the design of Persian gardens and qanats to windcatchers and central courtyards. These elements illustrate both the unbreakable bond between humans and nature and the ingenious climatic and cultural responses embedded in historical architecture (Adeli, 2013; Fukumoto et al., 2024). Field data and in-depth interviews with experts indicate that strengthening these traditional principles within the contemporary urban fabric could guide the development of Iranian cities toward landscape sustainability—a sustainability model that values aesthetic and symbolic dimensions alongside energy and environmental concerns (Meyer, 2008; Hemmati, 2016). Iranian traditional architecture has long exemplified a harmonious integration with natural phenomena such as light, wind, water, and vegetation (Haji-Taher et al., 2024). For instance, in hot-arid climates, the strategic combination of shaded courtyards, reflective water features, and thick walls significantly reduced interior temperatures while creating contemplative and symbolic spaces. Such models can be aligned with both direct (light, water, vegetation) and indirect (biomorphic forms) patterns of biophilic design, allowing the welfare and meaning-driven advantages of traditional architecture to synergize with modern ecological approaches (Kellert et al., 2011; Zhong et al., 2021). Although there is a fundamental alignment between biophilic design principles and Iran's indigenous architectural practices, large-scale urban application faces serious obstacles, such as high population density, economic constraints, and cultural resistance to change (Zhong et al., 2022; Watchman, 2020). Some interviewees highlighted the rigidity of current regulations and public unawareness of biophilic benefits—a finding consistent with Hong and Chang's (2021) research emphasizing the need for public discourse and awareness-building. Challenges also stem from an entrenched reliance on conventional materials (concrete and steel) and the absence of mandatory regulations supporting the use of natural elements (Mahan & Mansouri, 2017). Empirical findings confirm that although traditional Iranian architecture historically demonstrated exemplary efficiency in water management and climate adaptation, modernization today demands technological upgrading (Mirgholami et al., 2016; Sabokro et al., 2024).

For instance:

- In cold climates such as Tabriz, biophilic design could integrate adapted green roofs and smart energy control technologies (e.g., IoT-based monitoring systems) to effectively bridge tradition and innovation (Fukumoto et al., 2024).
- In humid regions like Rasht, modular green corridors and vertical gardens can help lower ambient temperatures and enhance users' sense of place (Perepichka & Katsy, 2016).

Nonetheless, fragmented urban development approaches and the underrepresentation of biophilic principles in architectural and urban planning curricula have caused valuable opportunities for environmental sustainability to be overlooked (Tabrizi-Noor et al., 2016; Keshtkaran, 2019). Global experiences indicate that integrating scientific and operational interventions, educating a new generation of architects, and enacting supportive policies for biophilic design can rapidly transform urbanization trends (Decker & Chase, 1997; Jun, 2023). Moreover, the practical realization of such macro visions necessitates expanding cooperation among governmental organizations, the private sector, and civil society to implement pilot projects and scalable models (Espinosa et al., 2016). The evidence suggests that biophilic design, particularly when combined with landscape ecology and continuous architecture, offers not only effective responses to environmental and energy challenges but also enriches urban space with deeper layers of meaning and aesthetics (Meyer, 2008; Seyedi & Hemmati, 2023). The findings of this study reveal that adapting biophilic strategies to Iran's diverse historical and cultural contexts—from the hot deserts of Yazd to the cold regions of Tabriz—unlocks significant potential for energy savings, psychological health enhancement, and cultural identity restoration. Furthermore, emphasizing participatory frameworks (involving citizens and local stakeholders), particularly in dense urban areas, will facilitate the broader dissemination of biophilic solutions (Smith et al., 2021). Ultimately, the study underscores the necessity of simultaneous advancement across four critical dimensions—structural, functional, semantic, and participatory—to overcome existing barriers and to leverage indigenous knowledge alongside modern technologies for a more sustainable and human-centered urban future in Iran. Achieving this vision depends not only on binding policies and incentivization strategies but also on embedding interdisciplinary educational frameworks and giving special attention to Iran's profound cultural heritage. What emerges most profoundly from this research is that biophilic design is not simply a technical solution or a decorative approach to energy efficiency; rather, it is a comprehensive, humanistic, and culturally rooted philosophy. Through the fusion of Iran's enduring architectural wisdom with the demands of contemporary life, biophilic design offers a novel vision for the future of sustainable architecture and urbanism (Fig. 7).

Conclusion

This article explored the latent potential of biophilic design as an innovative strategy to address the complex climatic, cultural, and environmental challenges facing Iranian architecture through an analytical and integrative approach. By combining computational simulations with in-depth qualitative analyses derived from semi-structured expert interviews, the study provides a clear and comprehensive picture of the performance of biophilic

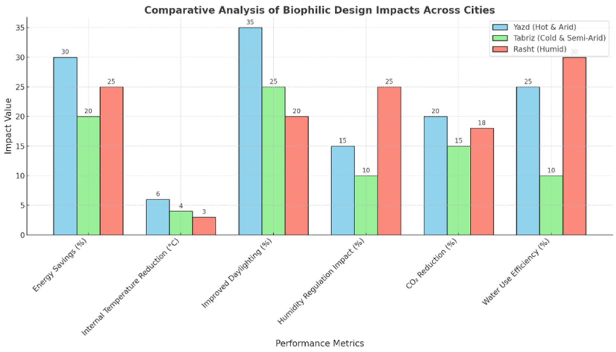

Fig. 7. Comparative Analysis of Biophilic Design Performance Metrics Across the Studied Cities (Yazd, Tabriz, Rasht). Source: Authors.

design across three distinct climatic regions of Iran: Yazd, Tabriz, and Rasht. The findings emphasize the significant advantages of integrating Iran's indigenous architectural wisdom with modern biophilic design principles. These advantages include substantial improvements in energy efficiency, enhanced thermal and visual comfort, and a marked reduction in environmental degradation. These results are consistent with the research of Kellert et al. (2011) and Wei et al. (2024), underscoring the adaptability and effectiveness of biophilic design in creating sustainable built environments that are harmonized with both culture and nature. The study highlights the pivotal role of elements such as windcatchers, courtyards, and elevated structures in effectively addressing complex climatic challenges. High-precision computational simulations using advanced tools such as Ecotect Analysis and Grasshopper-Ladybug quantitatively validated these advantages. For instance:

- Passive cooling strategies in Yazd led to a 30% reduction in energy consumption.
- Thermal insulation techniques in Tabriz resulted in a 20% reduction in CO^2 emissions.
- Rainwater harvesting systems in Rasht improved water use efficiency by 30%.

These findings demonstrate that biophilic design, when intelligently adapted to local climatic and cultural conditions, can significantly contribute to the sustainability and livability of urban environments. However, the qualitative analysis also clearly reveals serious barriers to the widespread adoption of this approach, including the continued reliance on conventional construction methods, the high cost of sustainable materials, and fragmented urban policies. Expert recommendations emphasize the urgent need for systemic reforms in architectural education, the integration of coherent urban policies, and the provision of financial incentives to overcome these challenges and promote the broader implementation of biophilic interventions throughout Iran. Future research should focus on expanding interdisciplinary collaborations to integrate emerging technologies, such as IoT-based smart systems and parametric design tools, with the core principles of biophilic architecture. Additionally, the large-scale implementation of pilot projects and longitudinal studies assessing the long-term impacts of these interventions on urban sustainability and the quality of life of residents are of particular importance.

References list

- Adeli, S. (2013). The relationship between nature and architecture from the perspective of Islamic ontology: A study of traditional houses in the central plateau of Iran, focusing on four prominent houses in Yazd, Nain, and Kashan. *Comparative Art Studies, 3*(5), 103-116.
- Barbiero, G., & Berto, R. (2021). Biophilia as evolutionary adaptation: An onto-and phylogenetic framework for biophilic design. *Frontiers in psychology, 12,* 700709. https://doi.org/ 10.3389/fpsyg.2021.700709
- Davtalab J, Heidari A. & Torshabi, K. (2025). Formulating guidelines and requirements for context-based rural housing design; Case Study: Rural Housing in Sistan, Iran. *CEER, 35*(2): 0091-0113. https://doi.org/10.59440/ceer/202238
- Davtalab J, Heidari A. (2020). A Numerical and Analytic Study of the Humidity Impact of Kharkhona on Vernacular Sistan Housing. *Journal of Housing and Rural Enviroment, 39*(169), 89-100. doi:DOI: 10.22034/39.169.89
- Decker, D. J., & Chase, L. C. (1997). Human dimensions of living with wildlife: A management challenge for the 21st century. *Wildlife Society Bulletin, 25*(4), 788-795.
- Espinosa, P., De Meulder, B., & Ollero Ojeda, A. (2016). River restoration and rehabilitation as a new urban design strategy: Learning to re-see urban rivers. *The International Journal of the Constructed Environment, 7*(3), 57-73. https://doi.org/10.18848/2154-8587/CGP/v07i03/57-73
- Forman, R. T. (1995). *Land mosaics: the ecology of landscapes and regions.* Cambridge university press.
- Fukumoto, H., Shimoda, M., & Hoshino, S. (2024). The effects of different designs of indoor biophilic greening on psychological and physiological responses and cognitive performance of office workers. *Plos one, 19*(7), e0307934.

• Ghadimzadeh, S. (2022). Challenges of Applying Traditionalist Thought and Necessity of Rethinking in Contemporary Iranian Architecture. *National Studies Journal, 23*(90), 139-160. https://doi.org/10.22034/rjnsq.2022.302160.1316

• Ghaziani, R., Lemon, M., & Atmodiwirjo, P. (2021). Biophilic design patterns for primary schools. *Sustainability, 13*(21), 12207. https://doi.org/10.3390/su132112207

• Ghorbani Param, M. R., Bavar, C., & Mahmoudinejad, H. (2021). Comparative study of the effect of biophilic architecture on design of traditional and modern houses (Case study: Gorgan city). *Quarterly of Geography & Regional Planning, 10*(40), 535- 555. https://doi.org/ 20.1001.1.22286462.1399.10.4.31.8

• Girard, L. F. (2021). The evolutionary circular and human centered city: Towards an ecological and humanistic "re-generation" of the current city governance. *Human Systems Management, 40*(6), 753-775. https://doi.org/10.3233/HSM-211218

• Hajitaher, N., Amirhajiloo, S., & Neyestani, J. (2024). Principles of Climate Responsive Architecture in Qajarid Residential Architecture in Ashtian, Iran. *Parseh J Archaeol Stud. 8(*27), 337-361. https://doi.org/10.22034/PJAS.8.27.337

• Heidari, A., & Davtalab, J. (2020a). The Role of Kharkhona in Temperature Adjustment in Rural Houses of Sistan: An Effective Means for Improving Architecture Sustainability. *Journal of Sustainable Architecture and Urban Design, 7*(2), 55-67. https://doi.org/10.22061/jsaud.2020.5724.1553

• Heidari, A., & Davtalab, J. (2020b). A Study of the Impact of Kharkhona on Wind Speed in the Vernacular Housing of Sistan Region. *Geography and Territorial Spatial Arrangement, 10*(35), 49-64. https://doi.org/10.22111/gaij.2020.5451

• Heidari, A., & Davtalab, J. (2022). A Study of the Wind's Role in Shaping the Man-made Landscape of Sistan and the Methods of Utilizing and Dealing with it Based on Historical Sources. *The Monthly Scientific Journal of Bagh-e Nazar, 19*(106), 33-44. https://doi.org/10.22034/bagh.2021.283839.4870

• Heidari, A., & Davtalab, J. (2024). Effect of Kharkhona on thermal comfort in the indoor space: A case study of Sistan region in Iran. *Energy and Buildings, 318*, 114431. https:// doi.org/10.1016/j.enbuild.2024.114431

• Hemmati, M. (2017). Aesthetics of sustainability; the relation of aesthetics and environmental sustainability. *MANZAR, 8(*35), 82-89. https://www.manzar-sj.com/article_43493.html?lang=en

• Hung, S. H., & Chang, C. Y. (2021). Health benefits of evidence-based biophilic-designed environments: A review. *Journal of People, Plants, and Environment, 24*(1), 1-16. https://doi.org/10.11628/ksppe.2021.24.1.1

• Javanmard, Z., Davtalab, J., Nikpour, M., & Sivandipour, A. (2024). Integrating machine learning and parametric design for energy-efficient building cladding systems in arid climates: Sport hall in Kerman. *Journal of Building Engineering, 97*, 110693. https://doi.org/10.1016/j.jobe.2024.110693

• Joye, Y., & De Block, A. (2011). 'Nature and I are two': A critical examination of the biophilia hypothesis. *Environmental Values, 20*(2), 189-215. https://doi.org/10.3197/096327111X12997574391724

• Jun, J. (2023). Towards sustainable urban riverfront redevelopment: Adaptability as a design strategy for the Hangang riverfront in Seoul. *Sustainability, 15*(12), 9207. https://doi.org/ 10.3390/su15129207

• Kellert, S. R. (2018). *Nature by design: The practice of biophilic design.* yale university press.

• Kellert, S. R., Heerwagen, J., & Mador, M. (2011). *Biophilic design: the theory, science and practice of bringing buildings to life.* John Wiley & Sons.

• Kellert, S., & Calabrese, E. (2015). *The practice of biophilic design.* Retrieved from https://shorturl.at/V1iU1

• Keshtkaran, R. (2019). Urban landscape: A review of key concepts and main purposes. *International Journal of Development and Sustainability, 8*(2), 141-168. https://isdsnet.com/ijds-v8n2-06.pdf

• Kheiri, A., & Rezaeizadeh Mahabadi, K. (2021). Investigating and presenting climate-friendly design solutions in hot and humid areas based on traditional architecture in new residential buildings(Case study: Sistan and Baluchestan coast). *Quarterly of Geography & Regional Planning, 11*(42), 215-226. https://doi.org/20.1001.1.22286462.1400.11.2.12.2

• Kheiri, A., & Rezaeizadeh Mahabadi, K. (2021). Strategies for climate-responsive design in hot and humid regions based on traditional architecture in new residential buildings (Case study: Sistan and Baluchestan coastlines). *Geography Regional Planning, 11(*42), 215–226. https://doi.org/20.1001.1.22286462.1400.11.2.12.2

• Leitao, A. B., & Ahern, J. (2002). Applying landscape ecological concepts and metrics in sustainable landscape planning. *Landscape and urban planning, 59*(2), 65-93. https://doi.org/10.1016/S0169-2046(02)00005-1

• Mahan, A., & Mansouri, S. A. (2017). The Study Of "Landscape" Concept with an Emphasis on the Views of Authorities of Various Disiplines. *Bagh-e Nazar, 14*(47). https://www.bagh-sj.com/article_45081.html?lang=en

• Makhzoumi, J. M. (2000). Landscape ecology as a foundation for landscape architecture: application in Malta. *Landscape and urban planning, 50*(1-3), 167-177. https://doi.org/10.1016/S0169-2046(00)00088-8

• Masnavi, M. R., Motedayen, H., Saboonchi, P., & Hemmati, M. (2021). Analyses of landscape concept and landscape approach from theoretical to operational levels: a review of literature. *MANZAR, 13*(57), 22-37. https://doi.org/10.22034/manzar.2021.283818.2128

• Meyer, E. K. (2008). Sustaining beauty. The performance of appearance: A manifesto in three parts. *Journal of landscape Architecture, 3*(1), 6-23. https://doi.org/10.1080/18626033.2008.9723392

• Mirgholami, M., Medghalichi, L., Shakibamanesh, A., & Ghobadi, P.

(2016). Developing criteria for urban river restoration based on Biophilic and water sensitive approaches. *MANZAR, 8*(36), 20-27. https://www.manzar-sj.com/article_44723.html

• Nassauer, J. I., & Opdam, P. (2008). Design in science: extending the landscape ecology paradigm. *Landscape ecology, 23*(6), 633-644. https://doi.org/10.1007/s10980-008-9226-7

• Oveisi Keikha Z, Kavosh H, Heidari A, Davtalab J. (2020). A Typology of Sistan's Vernacular Housing in Terms of Open and Closed Space Formation. *JHRE. 39*(171), 61-72. https://doi.org/10.22034/39.171.61

• Perepichka, A., & Katsy, I. (2016). *How Landscape Infrastructures Can Be More Resilient*. Positive Practice of Wetland Urban Adaptation to Stormwater Extreme Events in China. no. September: 0–11.

• Perini, K., & Sabbion, P. (2017). Urban river restoration. In K. Perini & P. Sabbion (Eds.), *Urban sustainability and river restoration: Green and blue infrastructure (pp. 76-92). John Wiley & Sons Ltda*. https://doi.org/10.1002/9781119245025

• Pour Haghverdi, N., Davtalab, J., Ghasemi, M., & Norouzi, M. (2025). Identifying Challenges and Opportunities for the Integration of Bionic Architecture with Traditional Vernacular Practices (A Case Study of Bam City). *Bagh-e Nazar, 22*(142), 5-26. https://doi.org/10.22034/bagh.2025.486616.5698

• Sabokro, D., Saboonchi, P., & Hemmati, M. (2023). Application of landscape ecology to develop a conceptual model for planning urban rivers (case study: Darakeh River). *MANZAR, , 15*(65), 62-71. https://doi.org/10.22034/manzar.2023.288452.2133

• Seyedi, S. A., & Hemmati, M. (2023). On Time and Place Continuity, An Investigation and Analysis of the Idea of "Continuous Architecture" on the Main Campus of Koç University. *MANZAR, 15*(63), 86-97. https://doi.org/10.22034/manzar.2022.345727.2196

• Shi, S., Kondolf, G. M., & Li, D. (2018). Urban river transformation and the landscape garden city movement in China. *Sustainability, 10*(11), 4103. https://doi.org/10.3390/su10114103

• Smith, A., Vodicka, G., Colombo, A., Lindstrom, K. N., McGillivray, D., & Quinn, B. (2021). Staging city events in public spaces: an urban design perspective. *International Journal of Event and Festival Management, 12*(2), 224-239.

• Soderlund, J., & Newman, P. (2015). Biophilic architecture: a review of the rationale and outcomes. *AIMS environmental science, 2*(4), 950-969. https://doi.org/10.3934/environsci.2015.4.950

• Tabrizi Noor, N., Flamaki, M. M., & Bahari Avilagh, M. (2016). An investigation into the interactions of space, culture, and Iranian identity in contrast to the fundamental concepts of Iranian architecture. *Shabak, 4 & 5*(11 & 12), 119-123.

• Troll, C. (1968). Landschaftsökologie.In Tüxen, R. (Ed.), *Pflanzensoziologie und Landschaftsökologie* (pp. 1-21.). Springer.

• Watchman, M., Demers, C. M., & Potvin, A. (2021). Biophilic school architecture in cold climates. *Indoor and Built Environment, 30*(5), 585-605. https://doi.org/10.1177/1420326X20908308

• WCED, S. W. S. (1987). World commission on environment and development. *Our common future, 17*(1), 1-91.

• Wu, J. (2013). Landscape sustainability science: ecosystem services and human well-being in changing landscapes. *Landscape ecology, 28*, 999-1023. https://link.springer.com/article/10.1007/s10980-013-9894-9

• Wu, J., & Hobbs, R. J. (Eds.). (2007). *Key topics in landscape ecology.* Cambridge University Press.

• Yousefzadeh, A., Vafamehr, M., & Mahdinia. (2020). Components of Biophilic Design on Achieving Viability with Emphasis on Islamic Architecture. *Islamic Art Studies, 16-17(*40), 406-429. https://doi.org/10.22034/ias.2020.217477.1172

• Zare, G., Faizi, M., Baharvand, M., & Masnavi. (2021). hospitals in health' patients the affecting that strategies design biophilic of Determination. *Journal of Iranian Architecture & Urbanism, 12*(1), 59-78. https://doi.org/10.30475/ISAU.2020.210114.1318

• Zhong, W., Schröder, T., & Bekkering, J. (2022). Biophilic design in architecture and its contributions to health, well-being, and sustainability: A critical review. *Frontiers of Architectural Research, 11*(1), 114-141. https://doi.org/10.1016/j.foar.2021.07.006

• Zhong, W., Schröder, T., & Bekkering, J. (2024). Implementing biophilic design in architecture through three-dimensional green spaces: Guidelines for building technologies, plant selection, and maintenance. *Journal of Building Engineering, 92*, 109648. https://doi.org/10.1016/j.jobe.2024.10964

HOW TO CITE THIS ARTICLE

Raisi, E.; Davtalab, J.; Ghasemi, M.& Norouzi, M. (2025). An Analysis of the Role of Biophilic Design in Creating Climate-Responsive and Culturally Attuned Architecture in Irant (2025). *Bagh-e Nazar*, *22*(145), 21-36.

DOI: 10.22034/BAGH.2025.499293.5743
URL: https://www.bagh-sj.com/article_220599.html?lang=en