

PIONEER AND ACADEMIC STUDIES IN ARCHITECTURE, PLANNING AND DESIGN



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Within The Scope of Sustainable Architectural Design the Healing Power of Nature: Biophilic Design

Çiğdem Belgin DİKMEN*

ABSTRACT

With the increasing population and the impacts of urban life today, the decreasing interaction between humans, nature, and space has led architects who play an active role in the construction industry to adopt the Biophilic design approach. This approach incorporates the beauty of the natural environment into design, utilizes natural and environmentally friendly building materials, and embraces the healing power of nature. Spaces where we meet various needs and have different experiences influence our emotions and behaviours. Since users cannot be evaluated independently of their environment, they need restorative spaces that support them physically and emotionally, make them feel good, and enhance their health, comfort, and productivity. It has been observed that environments which establish a relationship with nature have a positive effect on users' emotions, thoughts, behavioural patterns, and overall well-being and productivity. The biophilia hypothesis is utilized not only in design-oriented disciplines such as urban and regional planning, architecture, interior architecture, landscape architecture, and fine arts, but also in interdisciplinary studies involving biology, economics, science and technology, and sociology. This study aims to discuss the Biophilic design approach, known for its positive effects on human health, happiness, and productivity, and which focuses on nature and enables interaction with it within the framework of sustainable architectural design. Within the scope of this study, a comprehensive literature review was conducted to establish the conceptual framework; biophilic design was addressed through its design criteria and sub-parameters within the context of nature-human-space interaction, research findings on nature's healing power were included, and design recommendations were presented.

Keywords: Sustainable architectural design, healing power of nature, human health, happiness and productivity, biophilic design principles, biophilic design examples

INTRODUCTION

Since the dawn of humanity, people have existed both in harmony and in struggle with nature. By observing and being inspired by nature, they have attempted to understand the behavioural patterns of living organisms and adapt them to their own lives. While early human designs aimed at imitating nature were largely formal in nature, over time they evolved toward understanding the underlying working principles behind natural forms and incorporating these principles into the built environment. In parallel with increasing urbanization and population growth, the construction industry plays a significant role in the depletion of natural resources and the destruction of the natural environment. Today, the building sector consumes approximately 76% of the energy produced globally and is responsible for

43% of CO₂ emissions. It also significantly contributes to air pollution (Kim and Brown, 2021; Tao et al., 2021) and poor indoor air quality (İbrahim et al., 2021a; 2021b). Furthermore, it exacerbates environmental problems such as climate change, soil erosion, floods, transportation-related issues, and waste management (Ayçam et al., 2024). According to World Bank development indicators, in 2023, 47.75% of the global population resided in rural areas while 52.25% lived in urban areas (World Bank Collection of Development Indicators, 2023). At the current pace of urbanization, it is projected that by 2050, 66% of the world's population will live in urban environments (United Nations, 2014).

Historically, humans spent much of their lives outdoors or closely connected to nature, under natural sunlight. However, due to modern urban lifestyles, people now spend a considerable amount of time in enclosed, unhealthy, and unproductive environments, often detached from the natural world. In many urban contexts, access to natural environments is difficult or even impossible. This reality contradicts the innate human desire to be in nature. Environments lacking interaction with the natural world can lead to physical and psychological discomfort, decreased productivity, and increased vulnerability to illness. The urbanization process, coupled with population growth, has distanced societies from nature. Most recently, the COVID-19 pandemic has made it abundantly clear that humans an inseparable part of the ecosystem have an essential physical and psychological need for nature.

With the increasing population and the effects of urban life today, the diminishing interaction between humans, nature, and built environments has led architects -who play a significant role in the construction sector- to embrace the biophilic design approach. This approach incorporates the beauty of the natural environment into design, utilizes natural and environmentally friendly building materials, and leverages the healing power of nature. The term *biophilia*, derived from the Latin words *bio* (life) and *philia* (love or affinity), meaning "the love of life and living systems," was first introduced by the renowned psychologist Erich Fromm. Fromm defined biophilia as a deep-seated love for life and living beings (Barbiero and Berto, 2021). American biologist Edward O. Wilson, in his book *In Search of Nature*, described biophilia as an innate tendency to focus on life and life-like processes, asserting that humans are instinctively connected to all living systems by nature. Pioneers of biophilic design suggest that throughout human evolution, survival and reproductive success have been closely tied to the connection with life itself, and that this sense of closeness to nature is a universal feeling shared by all humans (Wilson, 1984; 1996; Genç, Arslan Selçuk, and Beyhan, 2018). Wilson emphasized that humans, as part of the natural world, are physically, psychologically, biologically, and spiritually connected to nature, and that this holistic relationship plays a critical role in human mental and physical well-being (Wilson, 1993). In addition to the

biophilia hypothesis, which explains the innate human desire to be in nature as a result of evolution, several other theories -such as the savannah hypothesis (Orians and Heerwagen, 1992), the habitat and prospect-refuge hypotheses (Appleton, 1975), and the preference matrix- (R. Kaplan and Kaplan, 1989) also support the idea that this relationship with nature is a crucial component in promoting human health, creativity, productivity, and well-being (Kellert and Wilson, 1993; Kellert, 2008).

The spaces in which we spend time and meet various needs within urban life significantly influence our emotions and behaviours. Users, who cannot be evaluated independently from their surroundings, require restorative environments that support their well-being, enhance their health, comfort, and productivity, and promote a sense of wellness. In this context, it has been observed that environments that establish a connection with nature have a positive impact on users' emotions, thoughts, and behavioural patterns, while also contributing to their health and productivity (Saylam, 2019). Kellert emphasizes that biophilic design -which integrates nature into the built environment through natural lighting and ventilation, the use of natural materials and nature-evoking patterns, the inclusion of natural elements such as plants and animals, and a focus on the healing power of nature- holds critical importance for users by positively affecting their health, comfort, and performance (Kellert, 2008). The biophilic design approach, which aims to strengthen the relationship between nature, humans, and space, has been embraced in a variety of disciplines including urban and regional planning, architecture, interior architecture, and landscape architecture, as well as in interdisciplinary studies. Key international publications such as *The Biophilia Hypothesis* (Kellert and Wilson, 1993), *Biophilic Design* (Kellert et al., 2011), *14 Patterns of Biophilic Design* (Browning et al., 2014), and *The Practice of Biophilic Design* (Kellert and Calabrese, 2015) have contributed to the broader recognition and research of biophilic design across diverse fields (Arda Akyıldız, 2023).

The biophilic design approach has raised awareness of the benefits of nature-integrated environments for urban dwellers who, due to modern city life, have limited interaction with nature and are often unaware of the environmental damage caused by the construction sector. It highlights that designs incorporating nature can significantly enhance human health, comfort, psychology, productivity, and satisfaction, whereas nature-disconnected designs contribute to unhealthy environments. Therefore, beyond harnessing the healing power of nature in the human-nature-space context, biophilic design also contributes to preventing building-related illnesses, reducing lighting, heating, and cooling loads, lowering carbon footprints, conserving resources, and improving indoor air quality and user satisfaction -through the use of natural and eco-friendly building materials. It is thus recognized as a holistic approach to sustainability, applicable across a

wide spectrum of building typologies -from traditional structures with site-specific features to environmentally certified, smart, and high-tech buildings. Biophilic design is applied not only at the urban scale and in historic environments but also at the single-building scale in residential architecture, as well as in healthcare, education, and office buildings -where human health, comfort, and productivity are of primary concern- as well as in interior design. Recent academic studies examining examples of biophilic design implementations show that, regardless of building function, users feel the need to connect with nature physically and psychologically within the built environment. These studies also reveal that in buildings where nature is valued and incorporated as a design parameter, users' health, comfort, and productivity improve significantly (Kellert, 2008). Biophilic design, especially in healthcare facilities, has been shown to support both the physical and mental recovery of patients and enhance the productivity and satisfaction of healthcare workers. Beyond healthcare settings, the biophilic design approach is also used in residential buildings, accommodation facilities (such as hotels, dormitories, and nursing homes), educational buildings (including preschools and elementary schools), and office environments. Research indicates that buildings integrated with nature have healing effects on users, improve performance, and facilitate easier learning (Gullone, 2000).

This study aims to discuss the biophilic design approach, which focuses on nature within the context of sustainable architectural design, emphasizing the positive effects of being immersed in natural environments on human health, happiness, and productivity. Within the scope of the study, the historical interaction between nature, human beings, and space was examined; a comprehensive literature review was conducted to establish the conceptual framework; findings from research on biophilic design and the restorative power of nature were included; and relevant recommendations were presented.

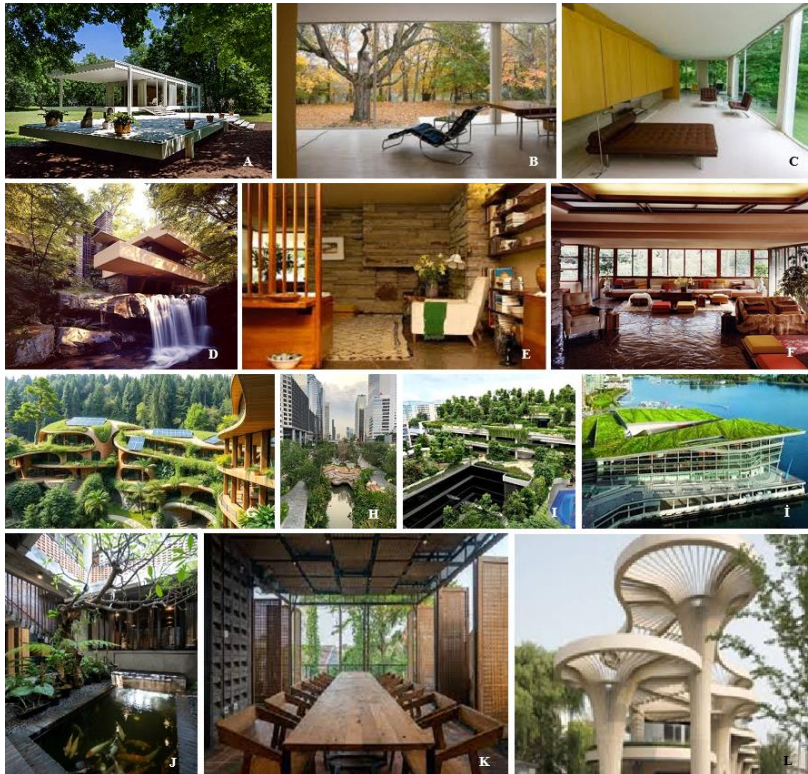
BIOPHILIC DESIGN IN THE INTERACTION BETWEEN NATURE, HUMANS AND SPACE

Throughout human history, people have always interacted with nature, and in early settlement and living space examples, the desire to be close to nature gained priority as a design input. From Antiquity to the present day, architectural design criteria such as designing buildings in harmony with the organic forms found in nature, orienting toward a pleasant view, providing natural lighting and ventilation, incorporating vegetation and water elements around the structure, and using natural building materials have been embraced by architects. The interaction between nature, humans, and space has been valued (Zhong, Schröder, and Bekkering, 2022).

Regardless of culture or lifestyle, many societies have integrated nature into the human environment and sought to benefit from nature's healing power in the built environment. Biophilic design, which draws on nature in an inspiring and restorative way without compromising the functionality of space, creates a balance between nature, humans, and space. This balance may vary depending on users, cultural structures, building types, or the geographical location of the structure. In this context, biophilic design is not a new concept; rather, it may be said to stem from a human intuition encoded in spatial experiences that provide the best possible environment and maintain a connection with nature. In the past, this connection was established across all building types, but today, the interaction between nature, humans, and space has weakened due to increasing population and urbanization. For this reason, examples of buildings from different periods that were implemented using various design approaches and associated with user health are presented to highlight the strong historical bond in the nature-human-space interaction.

As early as the 300s BC, it was believed that patients would find healing by sleeping in temples dedicated to the god of medicine Asclepius, located in areas with natural spring waters and unique landscapes (Gesler, 2003). During the Roman period, especially in military hospitals, attention was paid to natural lighting and ventilation of the spaces (Marcus and Sachs, 2013). In the Middle Ages, under the dominant Scholastic thought, religious structures came to the forefront, and nature was preserved as the unique work of God. In the Seljuk and Ottoman periods, the impact of living spaces on human health was recognized. In "darüşşifas" (healing houses), where illnesses were treated, elements such as natural daylight and ventilation, courtyard arrangements that enabled patients to socialize, water features like fountains in the courtyard, and fragrant flowers and fruit trees were included. These natural features aimed to stimulate the senses through sound, scent, and views, helping patients feel a sense of peace, reducing their pain, and accelerating recovery (Aksoy and Arslan Selçuk, 2021). In the 18th century, it became evident that ward-type hospitals -where many patients were treated in the same space- heightened the risk of infection transmission. In response, pavilion-type hospitals emerged in the 19th century, typically built on large plots of land and consisting of multiple interconnected structures. Early examples of pavilion-type hospitals, such as St. Thomas' Hospital, showed that the presence of nature, natural daylight, and sunlight reduced patients' recovery times (Van den Berg, 2005). Great importance was placed on maximizing daylight, using large windows, and implementing natural and cross ventilation to reduce the spread of infections (Sternberg, 2009), with the aim of enhancing the relationship between nature, humans, and space, and improving the quality of the built environment. Florence Nightingale, who emphasized that the primary principle in healthcare should be "*do no*

harm” and ensuring hygienic conditions, laid the foundation for modern hospitals through her patient care principles (Nagasawa, 2020).



Photograph 1. Nature-Focused Design Examples (Web Based Images 1, Farnsworth House-Mies Van Der Rohe A.B.C.; Web Based Images 2, Waterfall House-F. Lloyd Wright D.E.F.; Web Based Images 3, Sustainable Architecture Themed Design Examples G.H.I.I.; Web Based Images 4 Biofilic Design Samples, J.K.L.)

Following the Industrial Revolution, the Modern Architecture movement also produced building examples that were designed to align with the topography, aiming to exist harmoniously within nature rather than dominate the built environment, and prioritizing ecological sensitivity. In the 20th century, architect Alvar Aalto, who designed buildings using local architecture, construction techniques, and materials, created the Paimio Sanatorium. This healthcare facility is recognized for supporting healing and enhancing social interaction among patients through features such as day rooms, terraces with forest views and fresh air, and a design that responded to patients’ sensory and emotional needs -thus strengthening the interaction between nature, humans, and architecture. As the importance of hygiene and

cross ventilation became clear, and it was understood that poor ventilation contributed to infection transmission and increased mortality, modern healthcare facilities gained significance (Marcus and Sachs, 2013). However, despite advancements in medicine and medical technology, the interaction between users (patients and healthcare workers) and nature can still be overlooked, even in the most technologically advanced hospitals (Sternberg, 2009). In the 21st century, issues such as the preservation of natural resources -energy, water, air, soil, and biodiversity- as well as waste control, have brought sustainable, nature-conscious, green, and certified buildings into focus. In this context, both low-rise and high-rise buildings have featured design elements such as green roofs and green walls, hanging gardens that incorporate nature into buildings, water features and natural landscapes around structures, as well as the use of natural materials and patterns that evoke nature (see Photograph 1).

Biophilic Design Criteria

The concept of biophilic design, introduced to the field of architecture through Kellert's work *Building for Life: Designing and Understanding the Human-Nature Connection* (Kellert and Wilson, 2005), was further developed and widely discussed following the publication of *Biophilic Design* by Kellert, Heerwagen, and Mador in 2011 (Kellert, Heerwagen and Mador, 2011). Recognized as a design approach, biophilic design principles were defined by experts such as Christopher Alexander, Judith Heerwagen, Stephen Kellert, Roger Ulrich, and Rachel and Stephen Kaplan, and structured with the support of Terrapin Bright Green. These principles were organized by Browning and colleagues into three main categories: *Nature in the Space*, *Natural Analogues*, and *Nature of the Space*, with clearly defined sub-parameters (Ryan et al., 2014; Terrapin Bright Green, 2014). Today, these biophilic design principles and their corresponding sub-parameters are globally recognized and can be classified as follows.

The sub-parameters of the *Nature in the Space* criterion include: *visual connection with nature*, *non-visual connection with nature*, *non-rhythmic sensory stimuli*, *thermal and airflow variability*, *presence of water*, *dynamic and diffuse light*, and *connection with natural systems*. The sub-parameters of the *Natural Analogues* criterion are defined as: *biomorphic forms and patterns*, *material connection with nature*, and *complexity and order*. The sub-parameters of the *Nature of the Space* criterion are: *prospect*, *refuge*, *mystery*, and *risk/peril*. These established biophilic design criteria and sub-parameters are globally recognized (Ryan et al., 2014; Terrapin Bright Green, 2014).

▪ Biophilic design aims to provide an environment that supports the well-being of the human being as a biological organism, prioritizing the user's health, productivity, comfort, and satisfaction. The fundamental

conditions required for the successful implementation of biophilic design can be defined as follows:

- Biophilic design requires repeated and sustainable interactions with nature,
- Biophilic design focuses on the human adaptation to the natural world throughout the course of evolutionary history,
- Biophilic design enhances human health, vitality, and overall well-being,
- Biophilic design fosters emotional attachment to specific environments and places and
- Biophilic design promotes positive interactions between people, nature, and the built environment, encouraging a broader sense of connection and responsibility toward both human and natural communities. It supports mutually reinforcing, interconnected, and integrated architectural solutions (Ryan et al., 2014; Terrapin Bright Green, 2014).

MATERIAL AND METHOD

As part of this study, a comprehensive literature review was conducted on biophilic design and the healing power of nature in relation to their effects on human physical and mental health. The findings obtained from the literature were shared, and recommendations were provided for designers regarding the nature-human-space interaction. Research on the effects of biophilic design and the healing power of nature on human physical and psychological well-being forms the basis of this study. It has been observed that studies focusing on the interaction between nature, humans, and space in relation to human health, productivity, and satisfaction are carried out not only by pioneering researchers who contribute to the development of biophilic design principles and their sub-parameters, but also by researchers in health sciences and psychology disciplines. The results of the study are correlated with the sub-parameters of biophilic design criteria (nature in the space, analogues of nature, and the nature of the space).

BULGULAR

The research findings have been correlated with the design criteria of biophilic design (nature in the space, analogues of nature, and the nature of the space) and their sub-parameters (visual connection with nature, non-visual connection with nature, non-rhythmic sensory stimuli, thermal and airflow variability, presence of water, dynamic and diffuse light, connection with natural systems, biomorphic forms and patterns, material connection with nature, complexity and order, prospect, refuge, mystery, risk and peril). Recent academic studies indicate that users generally prefer natural environments over built and enclosed spaces, and that participants with high

stress levels show a stronger preference for natural settings compared to urban ones (Ulrich, 1983; Knopf, 1987; R. Kaplan and Kaplan, 1989; Van den Berg et al., 2003). According to the findings, users who prefer spaces that provide visual access to nature as living and working environments place importance on elements such as views, shade-providing trees, flowering plants, domestic animals, and the presence of water (Orians and Heerwagen, 1992). It has been shown that spaces with visual connections to nature reduce user stress and improve concentration, thereby promoting physical and mental healing (Grahn and Stigsdotter, 2010), and that nature-integrated simulations in windowless environments -even if not as effective as real nature- can elicit positive responses. Research also shows that viewing nature scenes stimulates larger portions of the visual cortex, triggers more pleasure receptors in the brain, and -unlike non-natural scenes- real nature scenes do not significantly reduce user interest over time even with repeated viewing (Biederman and Vessel, 2006). Furthermore, there is evidence that seeing nature within a space and having access to biological diversity such as plants and pets are also beneficial to psychological health and help reduce stress (Fuller et al., 2007).

Barton and Pretty (2010) report that the positive effect on mood and self-esteem is most pronounced within the first five minutes of exercise in a green area. Additionally, research has shown that watching nature for 10 minutes before encountering mental stress regulates heart rate variability and enhances parasympathetic activity supporting internal organs and digestive glands (Brown et al., 2013), and that viewing a forest landscape for 20 minutes after exposure to mental stress normalizes cerebral blood flow and brain activity (Tsunetsugu et al., 2007).

A study conducted by Fuller and colleagues emphasized that the healing effect of nature increases with biodiversity (Fuller et al., 2007). Although integrating nature into the built environment through architectural design is not easy (Friedman et al., 2004), it has been reported that even simulated nature -while not as effective as real nature- can positively impact human health and productivity (Kahn et al., 2008).

Academic studies have shown that interaction between nature, humans, and space, and the integration of natural elements into the built environment, reduce systolic blood pressure and stress hormones as well as negative emotions such as fatigue, sadness, anger, and aggression, while enhancing feelings of happiness (Ulrich et al., 1991). A study by Alvarsson et al. (2010) demonstrated that listening to nature sounds after exposure to urban noise has a faster restorative effect on physical and mental health. Similarly, another study found that moderate ambient noise at 70 decibels has a more positive effect on creativity compared to exposure to lower (50 dB) or higher (85 dB) ambient noise levels (Alvarsson et al., 2010; Mehta et al., 2012).

It has been proven that people tend to prefer environments with fractal structures -those that exhibit internal self-similarity- and that fractal patterns, whether figurative or abstract, automatically suppress physiological responses to stress or external stimuli. This highlights that visually engaging environments can have a beneficial impact on our health (Salingaros, 2012; 2015). Likewise, environments that incorporate natural and eco-friendly building materials such as wood are associated with reduced heart rate and blood pressure among users, as well as increased feelings of health, productivity, and satisfaction.

A study on aromatherapy and post-anaesthesia care showed that patients who received aromatherapy before surgery required significantly less morphine and used 56% less pain medication after surgery (Kim et al., 2007). A study conducted by Ulrich between 1972 and 1981 found that patients recovering from surgery in rooms with views of nature recovered faster, showed more positive progress, and used less pain medication compared to patients in rooms facing a brick wall with no view (Ulrich, 1983). A study by Hunter and colleagues demonstrated that the combination of visual and non-visual stimuli during interactions with nature activates a larger area of the human brain, and this combined stimulation is more effective than presenting visual and non-visual stimuli separately (Hunter et al., 2010).

Due to its dynamic and variable nature, daylight exhibits different spectral distributions throughout the day, which is essential for regulating the circadian rhythm and internal biological clock of humans and other living organisms (Potočnik and Košir, 2020). Since the human circadian rhythm is synchronized with the natural light-dark cycle of the Earth, exposure to artificial lighting in enclosed spaces can lead to disruptions in this rhythm. Therefore, incorporating sunlight and natural lighting into living and working spaces can help prevent circadian rhythm disturbances.

Daylight is associated with health, sustainability, energy savings, visual connection with the outdoors, comfort, productivity, and safety (Diker, 2024). The type and quality of lighting in a space significantly influence eye health and productivity. From a health perspective, daylight provides the necessary light for vision and recognition, reduces eye strain, enhances visual responsiveness, and increases motivation and productivity (Boyce et al., 2003). As daylight offers the richest spectrum of light, it helps reduce visual stress and, when exposed to ultraviolet (UV) rays, contributes to combating infections (Garcia-Hansen, 2006). As a source of vitamin D, sunlight supports calcium absorption essential for bone strength and helps protect against stress, infections, high blood pressure, and even cancer. It is well known that daylight and natural lighting positively impact human psychology by supporting healthy sleep patterns and quality, enhancing feelings of safety and satisfaction, and reducing stress, depression, and seasonal affective disorders.

The use of daylight in buildings contributes to the creation of comfort conditions and user satisfaction, which can be defined as the user's ability to adapt to their environment with minimal energy expenditure and to feel mentally content (Bluyssen, 2009). Daylight helps users establish a connection with the outdoors, preferably with nature, and provides visual comfort (Aries et al., 2010). Naturally lit spaces prevent potential accidents and the formation of crime-prone areas while allowing for physical environmental control, thus offering users a safe, comfortable, and sustainable living environment (Diker, 2024).

Studies investigating the impact of natural ventilation and thermal variability on workers' comfort, well-being, and productivity show that people enjoy moderate levels of sensory variability in their environment including changes in light, sound, and temperature. In contrast, environments lacking sensory stimulation and variability can lead to boredom and passivity (Kim and Brown, 2021).

Research indicates that the presence of water features in a space has a positive effect on users. In a study conducted by Windhager and colleagues in a shopping mall in Austria, an aquarium placed in the toy store window - containing naturally coloured fish and artificial yet natural-looking plants - attracted user attention. It was observed that the presence of water features, animals, and even artificial but natural-looking plants increased user concentration and had a positive impact (Windhager et al., 2011). Access to water features through visual, auditory, or tactile means -or through the simultaneous stimulation of multiple senses- has been shown to reduce stress levels. Being around water enhances concentration, responsiveness to visual stimuli, and memory retention (Biederman and Vessel, 2006; Barton and Pretty, 2010; Hunter et al., 2010), ultimately improving perception.

Research shows that seeing water features, hearing the sound of water, or touching water can reduce stress, promote feelings of calm, and lower heart rate and blood pressure (Alvarsson et al., 2010). Visual preference studies reveal that users prefer images of clean water (Orians and Heerwagen, 1992), and the presence of water features in urban spaces contributes more significantly to improvements in self-esteem and mental health compared to green areas (Barton and Pretty, 2010). Other studies confirm that artificial water features in urban environments are perceived as less enjoyable and less restorative for users (Alvarsson et al., 2010).

Although there is no difference between the geometries found in nature, art, and architecture, and despite contrasting opinions about which fractal dimension is most appropriate for creating a positive effect, it has been understood that the self-similarity characteristic of fractals -which allows similar structures to appear at increasing or decreasing magnifications- reduces stress and has a calming effect on the user (Salingaros, 2012).

Mystery is a spatial condition characterized by the promise of more information, typically presented through partially concealed views or other sensory stimuli that fascinate and attract the individual. It allows for a deeper engagement with the environment. Research emphasizes that people have an inherent need to understand and explore their surroundings, and this need evokes a sense of mystery (R. Kaplan and Kaplan, 1989; Ikemi, 2005). Ikemi notes that the feeling of mystery produces a strong sensation of pleasure -or a similar response- in the brain, and demonstrates that a good mystery condition conceals the boundaries of the object, space, or other information source, encouraging users to explore the space and seek more information about the partially hidden subject (Ikemi, 2005). Another study shows that listening to music can create a quality sense of mystery, triggering feelings of pleasure (Salimpoor et al., 2011).

RESULTS AND DISCUSSION

The biophilic design approach demonstrates that providing natural lighting and ventilation in spaces/buildings, creating a quality landscape with vegetation appropriate to the surrounding environment, orienting the building toward a favourable direction and view, using natural and environmentally friendly building materials such as stone and wood, incorporating natural colours, and including elements such as water and living beings like plants and animals can positively influence the user's physical and mental health by fostering a connection through positive emotions.

Biophilic design can reduce stress, improve cognitive function and creativity, and accelerate healing by increasing comfort levels. Prioritizing the strengthening of the nature-human-space interaction -especially in design-related disciplines- biophilic design provides users with opportunities to live and work in healthier environments that offer less stress and greater overall health, comfort, and productivity (Browning, Ryan, and Clancy, 2014).

When successfully implemented, biophilic design not only delivers a wide range of physical and mental health benefits but also enhances productivity and satisfaction. Physical benefits include increased vitality, productivity, comfort, and satisfaction; reduced blood pressure; decreased symptoms of illness; and faster recovery rates. Psychological benefits include increased satisfaction and motivation, reduced stress and anxiety, and enhanced problem-solving and creativity. Additionally, biophilic design contributes to coping with challenges, improved attention and concentration, enhanced social interaction, reduced negative emotions such as anger and aggression, and the development of a sense of responsibility.

In today's context of modern urban life -where interaction with nature is reduced and the construction sector often overlooks its environmental

impact- the biophilic design approach has raised awareness that nature-integrated designs contribute positively to human health, comfort, psychology, productivity, and satisfaction. In this regard, beyond harnessing the healing power of nature in the context of nature-human-architecture, biophilic design also contributes to preventing building-related illnesses, reducing lighting, heating and cooling loads, minimizing carbon footprint, conserving resources, improving indoor air quality, and enhancing user satisfaction by using natural and eco-friendly materials. Thus, biophilic design is seen as a sustainable design approach with a holistic perspective.

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A Review of Biophilic Design-Oriented Academic Research in the Discipline of Architecture

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ABSTRACT

In the past, people spent a significant part of their lives in nature or in close contact with it, under sunlight and in outdoor environments. However, due to the effects of urbanization, contemporary individuals now spend most of their time in enclosed, unhealthy, and unproductive spaces with artificial lighting and ventilation, far removed from nature. The diminishing interaction between humans, nature, and space under the influence of urban life has led architects -who play a significant role in the construction sector- to adopt the Biophilic design approach. This approach incorporates the beauty of the natural environment into design, uses natural and eco-friendly building materials, and embraces the healing power of nature. Aiming to strengthen the human-nature-space relationship, the Biophilic design approach has been widely accepted not only in architecture but also in various design-related disciplines, and it has increasingly gained prominence with the growing need to reestablish human-nature interaction. This study aims to examine the interaction between nature, humans, and space within the discipline of architecture, and to evaluate academic research on biophilic design through a comprehensive literature review in Turkey. By analysing the biophilic design criteria and their sub-parameters in the field of architecture, the study focuses on research topics and key parameters of biophilic design in academic studies. The findings show that studies in the field of architecture have increased in recent years, and the integration of natural elements and systems into architectural design enhances user experience while fostering broader cultural and ecological awareness. This study contributes to the understanding of biophilic design as an interdisciplinary approach and offers a valuable perspective on the potential for creating sustainable, human centered design, and restorative environments.

Keywords – Architecture, Biophilic Design, Nature-Human-Space Interaction, Literature Review, Academic Research

INTRODUCTION

In the past, human beings spent a significant portion of their lives in nature or in close contact with natural and healthy environments. However, with increasing urbanization and the rise in urban populations, people today spend more of their time in artificial indoor environments, distant from nature and natural elements. This shift has led to a weakening of the human-nature-space interaction and made access to nature and natural surroundings increasingly difficult. The lack of spaces that interact with nature in the built environment, the absence of natural or nature-evoking elements, and the preference for artificial lighting and ventilation over natural alternatives

render users of such spaces unhealthy, unproductive, and unhappy. The spaces in which we spend time and meet various needs in urban life influence our emotions and behaviours, just as users also affect the spaces themselves. Today, due to humanity's growing detachment from nature and the weakening of the nature-human-space relationship, users -who cannot be evaluated independently from the environment they inhabit- require restorative spaces that support their well-being, make them feel good, and positively impact their health, comfort, and productivity. Academic studies have shown that environments designed in interaction with nature positively influence users' emotions, thoughts, and behavioural patterns, and increase their health, productivity, and satisfaction.

The concept of *biophilia*, derived from the Latin word *bio* meaning "life" and the Greek word *philia* meaning "love of" or "affection toward life and living systems," was first introduced by the renowned psychologist Erich Fromm. Fromm defined biophilia as a deep affection for life and all that is alive (Barbiero and Berto, 2021). Later, American biologist Edward Osborne Wilson, in his work *The Biophilia Hypothesis*, described biophilia as an innate tendency to seek connections with life and life-like processes. According to Wilson (1993), as part of the natural world, humans are instinctively connected -physically, biologically, psychologically and spiritually- to other life forms. This part-to-whole relationship with nature plays a vital role in both mental and physical well-being. (Wilson, 1993).

Wilson and other researchers who formulated the *biophilia hypothesis* suggest that the human drive to be in nature and form bonds with living systems is an evolutionary mechanism essential for survival. They argue that this bond is a shared emotional experience common to all humans (Genç, Arslan Selçuk and Beyhan, 2018). Wilson explains the biophilia hypothesis through the interconnectedness of people and the patterns of nature, stating that well-being and satisfaction are closely tied to this part-whole relationship with the natural world. Similarly, other theories that emphasize human-nature interaction highlight that overall well-being and life satisfaction are associated with the natural environment and that human beings inherently need to connect with nature throughout their lives (Wilson, 1984; Kellert and Wilson, 1993; Kellert, 2005: 11).

Pioneering researchers interested in the *biophilia hypothesis* (Ulrich, 1983; Wilson, 1984; 1993; 1986; Kellert and Wilson, 1993; Kellert, 2005; 2008; Browning et al., 2014), along with influential international publications such as *The Biophilia Hypothesis* (Kellert and Wilson, 1993), *Biophilic Design* (Kellert et al., 2011), *14 Patterns of Biophilic Design* (Browning et al., 2014), and *The Practice of Biophilic Design* (Kellert and Calabrese, 2015), have significantly contributed to the broader recognition and dissemination of the concepts of biophilia and biophilic design.

In the publication *The Economics of Biophilia* by Terrapin Bright Green, the essence of the biophilia hypothesis is emphasized as the idea that

our most cherished and emotionally fulfilling memories are those formed in interaction with nature. Recalling these nature-based experiences reinforces feelings of well-being, strengthening their impact over time. Research has demonstrated that this connection with nature is a critical factor in supporting human health, creativity, productivity, and overall well-being, thereby reinforcing the validity of the biophilia hypothesis (Kellert, 2008).

The application of the biophilic design approach in the field of architecture, inspired by the biophilia hypothesis, is linked to the creation of built environments that foster the essential human-nature-architecture relationship. Aiming to enhance and sustain the interaction between humans and nature, biophilic design focuses on maintaining the continuity of the human-nature-space connection. It seeks to strengthen humans' inherent need for proximity and interaction with nature by integrating natural elements into the built environment and designing spaces that reflect a connection with the natural world (Terrapin Bright Green, 2012: 8).

The biophilic design approach -characterized by establishing a connection with nature, reflecting the beauty of natural environments, utilizing natural lighting and ventilation, incorporating natural building materials and nature-inspired patterns, integrating elements such as plants and pets into spaces, and embracing the healing power of nature- positively impacts users' health, comfort, and performance (Kellert, 2008). Beyond design-centred disciplines such as fine arts, industrial design, urban and regional planning, architecture, interior architecture, and landscape architecture, biophilic design also attracts the interest of other fields such as education, biology, and psychology, making it a subject of interdisciplinary research. In the field of architecture, biophilic design is applied not only at the urban and historical site scales but also at the building scale, particularly in structures where human health, comfort, and productivity are prioritized such as healthcare facilities, offices, educational buildings (e.g., preschools, primary schools), hospitality venues (e.g., hotels, student dormitories, nursing homes), residential buildings, and interior spaces. Aiming to strengthen the relationship between humans, nature, and space, biophilic design has been increasingly embraced within architectural practice and has gained traction in academic circles as a response to the growing yearning for nature. Consequently, the number of academic studies focusing on biophilic design - those that incorporate the beauty of the natural environment into design, prioritize natural lighting and ventilation, and emphasize the use of natural and eco-friendly building materials- continues to grow.

This study aims to examine the interaction between nature, humans, and space within the discipline of architecture, and to evaluate academic research on biophilic design in Turkey through a comprehensive literature review. By analysing biophilic design criteria and their sub-parameters, this research focuses on architectural studies in Turkey that address biophilic design based on these essential criteria and parameters. The findings reveal a notable

increase in recent years in architectural studies that integrate natural elements and systems into design, which not only enhance user experience but also foster broader cultural and ecological awareness. This study contributes to the understanding of biophilic design as an interdisciplinary approach and provides valuable insights into its potential to support sustainable, human-centred design and the creation of restorative environments.

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Within the scope of this study, a comprehensive literature review was conducted to identify and evaluate academic studies on biophilic design within the discipline of architecture in Türkiye, published up to June 10, 2025. The material for this study consists of conference and symposium proceedings, journal articles, books and book chapters, as well as postgraduate theses that address the biophilia hypothesis and the concept of biophilic design.

The academic publications identified in the literature review were examined under four main categories:

- Papers presented orally and published in full in conference/symposium proceedings,
- Scientific articles published in peer-reviewed international journals and
- Published books and book chapters

These researches collectively provide a comprehensive basis for evaluating the conceptual development, application areas, and interdisciplinary interaction of biophilic design, serving as essential resources for analysing current trends in the field, particularly in the context of architecture in Türkiye. The findings obtained from the literature review are presented to offer insights and design recommendations aimed at strengthening the interaction between nature, humans, and architectural space. The academic studies reviewed were categorized and interpreted based on established biophilic design criteria - namely, the presence of nature within the space, analogues of nature, and the nature of the space itself- along with their corresponding sub-parameters.

Papers presented orally and published in full in conference/symposium proceedings on Biophilic Design

There are 2 papers focusing on biophilic design that were presented orally and published in full text in conference or symposium proceedings. These studies are summarized in Table 1.

The paper presented by Arslan Selçuk as an invited speaker at PACE 2021, that name is Biophilic Features of Anatolian Darussifas held in Türkiye, and published in the conference proceedings, focuses on the biophilic qualities of Anatolian Seljuk Darussifas during a period when the concept of biophilic design had not yet been defined or widely discussed in architectural circles.

The study discusses the healing aspects of the spatial configuration and organizational layout of these institutions. It reveals how Anatolian Seljuk Darussifas, which hold a significant place among the historical examples supporting nature-human-space interaction in Anatolia, align with the principles of biophilic design (Arslan Selçuk, 2021).

In another paper presented by Meydanoğlu and colleagues at the 3rd International Mardin Artuklu Scientific Research Congress, that name is Goodness from Nature: Biophilic Design is stated that environments lacking a connection with nature can negatively affect users' health, productivity, and satisfaction. As a solution, the paper discusses the components of biophilic design and their relevance in creating healthier built environments (Meydanoğlu et al., 2020).

Table 1. Papers Presented Orally and Published in Full in Conference/Symposium Proceedings on Biophilic Design

Author Name-Surname	Name of the presented and published paper in conference proceeding	Year
Arslan Selçuk, S.	Biophilic Features of Anatolian Darussifas, Pace 2021-Turkey	2021
Meydanoğlu, K., Gülten, A. and Arda Akyıldız, N.	Goodness From Nature: Biophilic Design, in Proceedings of the 3rd International Mardin Scientific Research Congress	2020

Scientific articles published in peer-reviewed international journals on Biophilic Design

There are 25 scientific articles on biophilic design published in peer-reviewed international journals These studies are summarized in Table 2.

In their 2025 article titled *Innovative Office Approach: Activity Based Office (ABO)*, Baş and Kayan emphasize that advancements in information and communication technologies, along with evolving needs and expectations of employees, have led to a re-evaluation of office designs in today's changing work environment. They discuss the concept of the activity-based office as one of the innovative office approaches that aim to unlock employee potential, protect their health, and offer flexibility. Within the scope of the study, the importance of health in innovative office approaches is highlighted, and the concept of a healthy office is addressed through the biophilic design approach, which aims to improve and protect the physical and mental health of employees, and positively influence creativity, productivity, and user satisfaction. The study raises awareness of the biophilic design approach that values natural light, air quality, thermal and acoustic comfort, and includes nature and natural elements (Baş and Kayan, 2025).

The article titled *Evaluation of Anatolian Seljuk Madrassas in Konya Historical City Center in terms of Biophilic Design Criteria*, authored by Dede Kılıç, Incer, and Yılmaz Erdoğan and published in 2025, investigates the

presence of nature-inspired elements in four madrassas located in Konya's historical city centre: Karatay Madrasa, İnce Minareli Madrasa, Sırçalı Madrasa, and Ali Gav Madrasa. These historically and environmentally documented madrassas were analysed based on the 14 biophilic design criteria, and the presence of elements derived from nature as well as nature-conscious design implementations in the buildings was identified (Dede Kılıç, Incer and Yılmaz Erdoğan, 2025).

The article titled *The Impact of the Residential Open and Green Spaces on Well-being: An Analysis of Ten Different Examples from Istanbul and Around the World*, written by Tanrikulu and Aytuğ and published in 2025, emphasizes the impact of environmental factors on physical, mental, and emotional health. The study highlights the importance of design paradigms that promote a lifestyle integrated with the natural environment. Within the framework of the relationship between residential areas and open/green spaces, ten large-scale, nature-themed residential projects from Istanbul and various cities around the world were comparatively evaluated. The study questions to what extent the relationship between nature and users in these projects is realistic and sustainable, and whether the principles of biophilic design have been implemented. As a result, it underscores the necessity of considering the natural environment as an essential element in urban life and emphasizes the importance of integrating green spaces into residential design (Tanrikulu and Aytuğ, 2025).

The article titled *Evaluation of Historical Textures According to Biophilic Design Criteria: Case Study of Safranbolu* by Qurraie and Erarslan (2025) emphasizes the increasing need for integrated and sustainable spaces with nature in modern urban life. The study highlights that even during periods when the concept of biophilia was not yet known, the urban structure of Ottoman cities included healthy environments that enhanced quality of life and established a connection with nature. By examining the Safranbolu settlement through the lens of biophilic design criteria, the study concludes that the area aligns well with these design principles.

Avinç's 2024 article titled *The Impact of Biophilic Design Principles on Office Spaces* aims to investigate the impact of biophilic design principles on office buildings -one of the design approaches developed in response to the increasing detachment from nature caused by rapid urbanization. The article explores how biophilic design, which seeks to establish and strengthen connections with nature, can be implemented in built environments. Within the scope of the study, various office buildings were evaluated using sub-parameters of biophilic design criteria to analyse how these principles are applied in office spaces. The results indicate that design decisions can have positive effects on the health, well-being, and performance of office workers and that biophilic design principles could serve as a guide for wider implementation (Mutlu Avinç, 2024a).

The article titled *The Use of Text-To-Image Generation Artificial Intelligence Tools for the Production of Biophilic Design in Architecture* by Mutlu Avinç, published in 2024, highlights the opportunities that advancements in text-to-image artificial intelligence present for architectural approaches. The study investigates how AI tools that generate images from text prompts can be used to create biophilic office spaces aimed at enhancing comfort and productivity by fostering a connection with nature. Referencing biophilic design criteria, the research explores the use of AI systems to generate architectural solutions aligned with these principles. Within the scope of the study, the Leonardo AI tool was utilized to produce office environments based on biophilic criteria. It was found that when biophilic design prompts were input into the AI system, the generated spaces met biophilic standards. This study marks an important step in integrating biophilic thinking into the early stages of architectural design through AI-supported text-to-image generation. It significantly contributes to the field by demonstrating not only the image generation capabilities of AI but also its potential to align with and enhance biophilic design principles (Mutlu Avinç, 2024b).

In their 2024 article titled *A Studio-Study in Architectural Education: Tunceli Nature Campus Project*, Ceylan and Özcan aim to produce applicable solutions for nature campuses, which prioritize ecological sensitivity and are becoming increasingly widespread. The study focuses on student projects and the design process developed within the second-year Architectural Design Studio at Munzur University's Department of Architecture. The process is discussed in three phases: the analysis of a 49,000 m² site located in the Örenönü area along the Pülümür River; the examination of forest school examples in Turkey and around the world; and research on ecological architecture, sustainable architecture, natural building materials, permaculture, reduction, reuse, recycling, and biophilic design concepts. Of the eight student projects developed based on fundamental design decisions, five were evaluated in the article. The study concludes that the designed spaces offer creative ecological solutions that maintain the philosophy of education in nature without damaging the environment, using natural and demountable building materials and a flexible space approach (Ceylan and Özcan, 2024).

The study titled *Research on Green Facade Applications as a Biophilic Design Approach* by Esgil and Yamaçlı, published in 2024, states that increasing building density and decreasing green spaces negatively impact urban and human life. The research discusses the advantages and disadvantages of biophilic design and green facade applications, which offer vertical green areas in modern cities. It suggests that such applications should be increased to protect and improve human physical and mental health (Esgil and Yamaçlı, 2024).

In their 2024 article titled *Effects of Natural Forms on Architectural Design*, Öner and Saticı discuss how nature and natural forms influence

architectural design and inspire designers. The article explores concepts that emerge from the collaboration between the disciplines of architecture and biology, such as Biomimicry, Biomimesis, Biophilia, and Fractal Geometry. It also addresses the nature-based approach of biophilic design (Öner and Satıcı, 2024).

Özdemir's 2024 article titled *Integrating Nature into Academic Spaces: Biophilic Campus* examines the integration of biophilic design into university campuses, classified according to Linde's campus typologies. In the study, the main campuses of Eskişehir Osmangazi University, Tokat Gaziosmanpaşa University, Anadolu University, Istanbul Technical University, Dokuz Eylül University, and Istanbul University were selected as sample areas. These campuses were evaluated and compared based on biophilic design criteria. The study raises awareness by highlighting the importance of implementing and promoting biophilic design principles within university campuses (Özdemir, 2024).

The article titled *Analysis of Healthcare Buildings According to Biophilic Design Criteria: The Case of Istanbul Başakşehir Çam and Sakura City Hospital* by Susam and Özdemir, published in 2024, emphasizes that the spatial design of healthcare facilities should go beyond therapeutic functions and focus on enhancing the psychological well-being of users. Biophilic design, which aligns with this philosophy, is not only a functional and aesthetic discipline but also one that prioritizes physical and mental wellness. The study investigates how the principles of biophilic design -particularly the aim of establishing an organic connection between nature and interior spaces- are implemented in modern urban hospitals such as Başakşehir Çam and Sakura City Hospital. It also aims to reveal the potential of this design approach within the healthcare sector. The article evaluates the application of the 14 biophilic design criteria in the hospital and assesses the extent to which these principles are followed, as well as their impact on users (Susam and Özdemir, 2024).

The study titled *The Considerations of Biophilic Design Towards Successful Application in Office Building* by Al-Aqqad and Yedekçi, published in 2024, addresses biophilic design elements as one of the critical factors for user health, productivity, and satisfaction in office buildings. The authors emphasize the impact of biophilic design on human well-being and propose a future design strategy for office spaces by employing a descriptive approach to biophilic applications in office environments (Al-Aqqad and Yedekçi, 2024).

The article titled *Integration of Wooden Structures with Biophilic Design: Return to Nature and Sustainability* by Küçüktüvek and Amirov (2024) emphasizes that biophilic design -a concept based on the innate human connection with nature- is becoming increasingly significant in the context of sustainability. It states that biophilic design offers essential theoretical and practical strategies for conceptualizing nature in architecture. The study

explores how biophilic design strengthens the bond between humans and nature and investigates how wooden structures can be integrated into architecture through this design philosophy as a rational interpretation of nature. Within the study, a theoretical framework was developed to understand the dynamics of biophilic design, and three architectural projects were analysed: *The Tree* in Bergen, Norway; *International House* in Sydney, Australia; and *Lorient-Bretagne Sud Railway Station* in Lorient, France. The findings demonstrate how wood can be effectively integrated with biophilic design and highlight the role of timber in creating nature-integrated, energy-efficient buildings that contribute positively to human psychological well-being (Küçüktüvek and Amirov, 2024).

The article titled *Academic Assessment of Biophilic Design* by Özğan and Aluçlu, published in 2023, aims to discuss the contributions of academic studies on biophilic design to individual countries and international collaboration. Within the scope of the study, 346 articles published in 184 journals between 2006 and 2023 and indexed in the Web of Science database were evaluated. The results show which countries have conducted the most academic research on biophilic design and reveal that Turkey ranks 11th among 42 countries with 8 publications (Özğan and Aluçlu, 2023).

In their 2022 article titled *An Assessment at the Interchange of Biophilic Design and Modern Architecture: Carlo Scarpa's Architecture*, Şahin and Satici aim to evaluate the architectural approach of Carlo Scarpa -who was professionally active between 1919 and 1978- in the context of biophilic design. The study focuses on Scarpa's perspective on architecture during a time when modern architecture was transforming the built environment, and explores how his work relates to the efforts that seek to maintain the essential interaction between humans and nature, as seen in biophilic design principles pioneered by Kellert. The study concludes that Scarpa's architectural approach, without compromising the originality of contemporary architectural production, can serve as an example for the creation of buildings that prioritize biophilic design criteria and are intended for happy and healthy occupants (Şahin and Satici, 2022).

The article titled *Sustainable Architectural Design Under the Effect of Global Warming* by Zengin and Yamaçlı, published in 2022, seeks to answer how architectural design should evolve under the impact of global warming and how the sustainability of such designs can be ensured. The study emphasizes that biophilic design can reduce the need for mechanical climate control and energy consumption- thus lowering greenhouse gas emissions. It also highlights the importance of emergency action plans and long-term strategies for addressing climate issues alongside a sustainable architectural design model (Zengin and Yamaçlı, 2022).

In their 2022 article titled *Evaluation of Design Principles Affecting Healing Architecture in Hospitals as a Public Building*, Karaçar and Fidan emphasize that adopting a healing and patient-centered design approach in the

planning and implementation of hospitals -as public buildings- can provide high-quality comfort and functionality for both hospital environments and, more broadly, users of healthcare facilities. The study highlights the importance of evaluating hospitals through biophilic design criteria that positively influence healing and user health (Karaçar and Fidan, 2022).

The article titled *Association of Learning Spaces with Nature: The Example of Kırklareli Zübeyde Hanım Kindergarten* by Minsolmaz Yeler, published in 2022, emphasizes the importance of nurturing children's desire to learn, encouraging their sense of discovery and curiosity, and helping them become self-confident and harmonious individuals by fostering a connection with nature. The study aims to explore how nature can be integrated into preschool learning environments to support children's development in physical, cognitive, and social-emotional domains. Additionally, it seeks to determine how the spaces where children live and learn can be enriched with biophilic elements (Minsolmaz Yeler, 2022).

In their 2021 article titled *Healing Architecture and Gevher Nesibe Darüşşifası: A Biophilic View*, Aksoy and Arslan Selçuk outline design criteria for buildings conceived with the principle of integrating nature into architectural space in accordance with the biophilia hypothesis. The study focuses on the psychological benefits -such as healing, relaxation, and increased motivation- of biophilic design, a contemporary architectural approach, and explores how these align with biophilic elements embedded in the architectural heritage of traditional healing spaces such as the *darüşşifas*. Within the study, definitions and classifications related to biophilic design approaches are reviewed to build a conceptual framework on the therapeutic qualities of space. Specifically, the architectural features of the *Gevher Nesibe Darüşşifası* -recognized as the first of its kind in Anatolia- are analysed in terms of the use of light and sound, material selection, and spatial organization, considering the reflections of the natural environment within the structure. The findings highlight the significance of reinterpreting the healing power of nature in architectural design through the lens of Turkish architectural heritage and suggest the necessity of expanding existing biophilic design classifications with new perspectives rooted in cultural and historical knowledge (Aksoy and Arslan Selçuk, 2021).

The article titled *Evaluation of the Osmaniye Kadirli Municipality Service Building in the Context of Biophilic Design* by Daşkıran and Yeler, published in 2021, focuses on the Kadirli Municipality Service Building, which was designed and constructed in the Kadirli district of Osmaniye following an architectural competition held in 2009. In the study, a conceptual framework was first established through a literature review, addressing the definition of biophilic design, its principles, and its significance particularly in office buildings. Then, the building was analysed through on-site observation in accordance with the principles of biophilic design. According to the findings of the analysis, while the design decisions allowed the building

to establish a strong relationship with nature in its open spaces, nature elements were found to be insufficiently integrated into the interior spaces. Accordingly, suggestions were developed to enhance the interaction of employees with nature within the indoor areas (Daşkiran ve Yeler, 2018).

In her 2021 article titled *At the Edge of Biophilic Design and Technology: New Shopping Venues and Experience*, Girginkaya Akdağ emphasizes the criticism of the fictional and variable identities of cities and spaces designed under the influence of postmodern culture, which acts as a centre of globalization and consumer communication. The study aims to highlight the value of biophilic design elements in shopping spaces of various scales within the city. The findings demonstrate the value of biophilic experiences in urban spaces intertwined with commercial activities and constructed within the city's place-nature-technology pattern (Girginkaya Akdağ, 2021).

The study titled *Sence in the Interior: An Example of Entrance Spaces at Hospitals* by Erbay and Ulusoy, published in 2021, emphasizes that in architecture, the perception of a building through the senses begins with vision, and that the first relationship between the building and its interior is established through entrance spaces, which leave lasting impressions on memory. The study questions how interior spaces are perceived through the senses. For the research, Istanbul Memorial Bahçelievler Hospital was selected as a case study. The study draws conclusions on what design tools can appeal to the senses in interior spaces and how these spaces can be perceived sensorially (Erbay and Ulusoy, 2021).

The study titled *Biophilic Designs for Children with Autism: A Studio Experience* by Minsolmaz Yeler, published in 2021, emphasizes that integrating nature's multifaceted benefits into design is a crucial process that architects should consider. As part of the Architectural Design IV course at the Faculty of Architecture, Kırklareli University, students were tasked with creating biophilic design solutions for children with autism, aiming to meet their needs in environments they inhabit throughout the transition from early childhood to adulthood. The study concluded that the designs developed in relation to selected topics helped architecture students build awareness about special user groups and their spatial needs, and supported their ability to create inclusive design solutions.

The 2018 study by Genç, Arslan Selçuk, and Beyhan titled *Context of Historical Places: Tokat Mustafa Aga Bath* emphasizes that the monumental and civil structures that constitute our cultural heritage include examples aligned with the biophilia hypothesis, which defines humans innate emotional affinity for living beings in nature. Within the scope of the study, the biophilic parameters identified in the Mustafa Aga Bath -among the 14 core biophilic parameters defined in the literature- are discussed through experiences and visual analyses. As a result, it was determined that the Mustafa Aga Bath

contains many biophilic features with healing qualities that can enrich contemporary architecture (Genç, Arslan Selçuk and Beyhan, 2018).

In their 2018 study titled *Biophilic Design and Healing Architecture: Evaluation on Healthcare Buildings* Kaya and Arslan Selçuk discuss the concept of biophilic design, which emerged alongside the biophilia hypothesis suggesting that humans have an instinctive connection with nature. The study emphasizes the interaction between nature, humans, and space, and promotes environments where the beneficial effects of nature are sustained. Within the scope of the study, a literature review was conducted and a conceptual framework was established. Biophilic design practices from past to present were examined through selected examples. Hospital buildings selected from the database created by the Biophilic Design Initiative within the International Living Future Institute were analysed according to biophilic design criteria, and recommendations were made to further develop the use of biophilic design within the discipline of architecture (Kaya and Arslan Selçuk, 2018).

Table 2. Scientific articles published in peer-reviewed international journals on Biophilic Design

Author Name-Surname	Name of the Scientific articles published in peer-reviewed international journals	Year
Baş, K. and Kayan H. Z.	Innovative Office Approach: Activity Based Office (ABO)	2025
Dede Kılıç, S., Incer, B. and Yılmaz Erdoğan, B.	Evaluation of Anatolian Seljuk Madrassas in Konya Historical City Centre in terms of Biophilic Design Criteria	2025
Tanrıkulu, E. F. and Aytuğ, A.	The Impact of the Residential Open and Green Spaces on Well-being: An Analysis of Ten Different Examples from Istanbul and Around the World	2025
Qurraie, B. S. and Erarslan, M. H.	Evaluation of historical textures according to biophilic design criteria: case study of Safranbolu	2025
Mutlu Avinç, G.	The Impact of Biophilic Design Principles on Office Spaces	2024
Mutlu Avinç, G.	The Use of Text-To-Image Generation Artificial Intelligence Tools for the Production of Biophilic Design in Architecture	2024
Ceylan, E. N. and Özcan, G. N.	A Studio-Study in Architectural Education: Tunceli Nature Campus Project	2024
Esgil, M. and Yamaçlı, R.	Research on Green Facade Applications as A Biophilic Design Approach	2024
Öner H. and Satıcı, B.	Effects of Natural Forms on Architectural Design	2024
Özdemir, H.	Integrating Nature into Academic Spaces: Biophilic Campus	2024
Susam, K. and Özdemir, Ş.	Analysis of Healthcare Buildings According to Biophilic Design Criteria: Istanbul Başakşehir Çam and Sakura City Hospital Example	2024
Al-Aqqad, A. and Yedekçi, G.	The Considerations of Biophilic Design Towards Successful Application in Office Building	2024
Küçüktüvek, M. and Amirov, N.	Integration of Wooden Structures with Biophilic Design: Return to Nature and Sustainability	2024

Özğan A.O. and Aluçlu, I.	Academic Assessment of Biophilic Design	2023
Şahin, F. and Satıcı, B.	An Assessment at the Interchange of Biophilic Design and Modern Architecture: Carlo Scarpa's Architecture	2022
Zengin, N. and Yamaçlı, R.	Sustainable Architectural Design Under the Effect of Global Warming	2022
Karaçar, P. and Fidan, A.	Evaluation of Design Principles Affecting Healing Architecture in Hospitals as a Public Building	2022
Minsolmaz Yeler, G.	Association of Learning Spaces with Nature: The Example of Kırklareli Zübeyde Hanım Kindergarten	2022
Aksoy, Z. and Arslan Selçuk, S.	Healing Architecture and Gevher Nesibe Darüşşifa: A Biophilic View	2021
Daşkıran, B. N. and Yeler G.	Evaluation of Osmaniye Kadirli Municipality Building in the Context of Biophilic Design	2021
Girginkaya Akdağ, S.	At the Edge of Biophilic Design and Technology: New Shopping Venues and Experience	2021
Erbay, M. and Ulusoy, S.	Sence in the Interior: An Example of Entrance Spaces at Hospitals	2021
Minsolmaz Yeler, G.	<i>Biophilic Designs for Children with Autism: A Studio Experience</i>	2021
Genç, G. Arslan Selçuk, S. and Beyhan, F.	Evaluation of the Biophilic Concept in the Context of Historical Places: Tokat Mustafa Aga Bath	2018
Kaya, H. and Arslan Selçuk, S.	Biophilic Design and Healing Architecture: Evaluation on Healthcare Buildings	2018

Works Published as Books and Book Chapters on Biophilic Design

There are 6 as a book and book chapters on biophilic design published by international publishing. These studies are summarized in Table 3.

The study titled *Restorative Design Matrix in Elderly Care Facility Settlements in the Light of Biophilic and Universal Design Principles*, published as a book chapter by Doğan Karaman and Arslan Selçuk in 2025, focuses on the creation of alternative housing and living options for the elderly due to changing family structures and needs. It emphasizes the potential of nursing homes to provide accessible, comfortable, and health-promoting environments for elderly individuals. Referring to biophilic and universal design approaches, the study aims to prepare a restorative nursing home design guide for the elderly through an examination of green-certified buildings. Within the scope of the study, how biophilic and universal design parameters can be adapted to nursing homes is discussed with the support of examples from green-certified facilities. Based on the findings and sample projects, a design directive has been developed specifically for elderly care homes (Doğan Karaman and Arslan Selçuk, 2025).

In their 2022 study titled *The Importance of Biophilic Design Parameters in Children's Hospitals and Their Evaluation Through Case Studies*, Arslan Selçuk, Mutlu Avinç, and Coşkun analysed four selected children's hospitals to examine the application of 14 biophilic design criteria.

The study presents how these parameters are applied within hospital settings, supported by analytical evaluations of each case (Arslan Selçuk, Mutlu Avinç and Coşkun, 2022).

In their 2022 study titled *Healing Architecture and Biophilic Qualities of Historical Buildings: The Case of Divriği Turan Melek Darüşşifa*, Aksoy and Arslan Selçuk focus on the biophilic elements present in Divriği Turan Melek Darüşşifa, one of the most significant examples of Anatolian healing complexes. The study highlights the interaction between nature and space by introducing the concept of healing environments in Turkish culture and architecture (Aksoy and Arslan Selçuk, 2022).

The 2022 study by Mutlu Avinç and Coşkun titled *Evaluation of Traditional Dwellings in the Context of the Biophilic Design Approach* aims to assess traditional houses through the lens of biophilic design. The study reveals that traditional dwellings inherently consider natural elements such as climate, prevailing wind, and views, and demonstrates that the use of natural materials and traditional construction techniques in these homes aligns well with biophilic design principles (Mutu Avinç and Coşkun, 2022).

The study titled *Experiencing the Contributions of Contemporary Design Approaches to the Architectural Education Process* by Özer Yaman, published in 2022, discusses contemporary design approaches in architectural education and explores concepts such as biophilic design, biomimetic design, kinetic architecture, and morphogenetic design. Conducted with third-year students from the Department of Architecture at Bingöl University, the study aimed to manage the architectural design process through these selected concepts and observe students' creative processes. Students were tasked with designing a lighting fixture based on the mentioned design approaches. The resulting products were evaluated, and it was concluded that the selected contemporary architectural design approaches positively contributed to managing and guiding students' design processes (Özer Yaman, 2022).

The book chapter titled *Transferring Biophilic and Universal Design Theory to Practice with Learning from Green Buildings: Restorative Design Parameters According to Three Certificated Green Building Case Studies*", published in 2017 by Doğan and Arslan Selçuk, aims to guide the design of assisted living facilities (ALFs) that combine biophilic design -observed to have positive physiological, psychological, and sociological effects on people- with the principles of universal design, which emphasize accessibility and inclusivity for all. Since there is currently no place explicitly called a “biophilic assisted living facility,” the study is supported by nature-oriented design strategies found in Green Building Certification Systems. These certification systems were examined in terms of their alignment with biophilic and universal design, and it was found that three of them include criteria related to the theories discussed in the study. ALF

buildings located in the same region and certified by these systems were selected as case studies. The study explores how and where the principles of biophilic and universal design can be transferred from theory into practice. It also observed to what extent 14 biophilic design patterns are present in the selected ALFs and tabulated how and where each pattern was manifested within these facilities.

Table 3. Works Published as Books and Book Chapters on Biophilic Design (International Publishers)

Author Name-Surname	Name of the books and book chapters by published international publishing.	Year
Karaman Doğan, G. and Arslan Selçuk, S.	Restorative Design Matrix for Elderly Living in Care Home Facilities in the Light of Biophilic Design and Universal Design Principles, in book: Sustainable Ecological Engineering Design	2025
Arslan Selçuk, S., Mutlu Avinç, G. and Coşkun, A.	The Importance of Biophilic Design Parameters in Children's Hospitals and Their Evaluation Through Case Studies	2022
Aksoy, Z. and Arslan Selçuk, S.	Healing Architecture and Biophilic Qualities of Historical Buildings: The Case of Divriği Turan Melek Darülsifas	2022
Mutlu Avinç, G. and Coşkun, A. (2022).	<i>Evaluation of Traditional Dwellings in the Context of the Biophilic Design Approach</i>	2022
Özer Yaman, G.	Experiencing the Contributions of Contemporary Design Approaches to the Architectural Education Process	2022
Doğan, G. and Arslan Selçuk, S.	Transferring Biophilic and Universal Design Theory to Practice with Learning from Green Buildings: Restorative Design Parameters According to Three Certificated Green Building Case Studies	2017

EVALUATION, CONCLUSION AND RECOMMENDATIONS

Recent research on biophilic design has shown that incorporating nature and natural elements into architectural spaces enhances users' well-being and has positive effects on both physical and mental health. Spaces integrated with nature are found to have healing effects on individuals, increase productivity, and facilitate learning. In this context, when academic studies on architecture in Türkiye are evaluated in terms of papers presented orally and published in full in conferences/symposia, articles published in international journals, and books/book chapters, it is observed that biophilic design has increasingly become a prominent topic of interest. Especially between the years 2021 and 2025, there has been a notable increase in both the number of publications and the diversity of topics addressed.

In recent years, academic studies focusing on examples of applied biophilic design have provided evidence that, regardless of the function of the space, users have a physical and psychological need to connect with nature within the built environment. These studies emphasize that when nature is valued and incorporated as a design parameter, it enhances user health, comfort, and productivity. The biophilic design approach -which prioritizes the relationship between people and nature- has been shown to contribute positively to patient recovery and well-being in healthcare facilities, while also improving the productivity and satisfaction of healthcare staff. Today, beyond healthcare architecture, biophilic design is also being explored in the context of traditional dwellings, office spaces, educational institutions, accommodation facilities, historical environments, cultural heritage monuments, and architectural design studio projects. The concept is expanding through interdisciplinary research, attracting increasing attention from a broader range of scholars.

By promoting the use of renewable energy sources such as sunlight and wind for natural lighting, heating, cooling, and ventilation, biophilic design contributes to energy conservation and building economy. It also fosters cohabitation with plants and animals, which has demonstrable positive effects on human health. For these reasons, the application of biophilic principles in certified green buildings, vertical gardens, and sky gardens supports the classification of biophilic design within the scope of sustainability. However, with urban population growth and the accompanying challenges of urban life -such as transportation, waste management, and environmental degradation- people are increasingly forced to live and work in unhealthy environments that lack natural light and ventilation. Therefore, incorporating nature into the built environment and strengthening the interaction between people, nature, and space improves the quality of our surroundings and enhances users' health, creativity, productivity, and happiness.

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