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Biophilic Design: Its Use in Architectural Structures and Different Areas — A Bibliometric Analysis

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Abstract

Biophilic design aims to enhance the connection between individuals and the natural environment by emphasizing natural elements in their living and working spaces. The fundamental principles of biophilic design include the integration of natural light and views, the use of plants and green spaces and a preference for organic forms and natural materials. The application of biophilic design in various domains promotes a balanced and harmonious lifestyle in line with the natural world, offering a range of benefits to both the environment and society. The aim of the study is to reveal the importance of using biophilic features in architectural designs using bibliometric analysis and to draw researchers' attention to biophilic design. In this study, bibliometric analysis was employed to measure and analyze the distribution and interaction of academic research related to biophilic design. The widely used Web of Science database was utilized for bibliometric analysis of scientific studies. Specifically, the bibliometric analysis focused on the most frequently used keywords in the titles of published articles on biophilic design. A total of 346 articles published in 184 journals between 2006 and 2023 were scanned for the subject of biophilic design. The most common keywords in the titles of scientific articles, following the term biophilic, include design, urban, workspace, green, natural, biophilia, architecture, health, environment, and other terms. Bibliometric analysis encompassed the examination of the most frequently used keywords, word cloud, trend keywords across years, keyword networks, and thematic evolution analysis. The analysis revealed that a diverse range of keywords (1165) were employed in the titles, and the frequency of keyword usage increased over time. Additionally, the usage of keywords evolved and changed over the years. These findings demonstrate that biophilic design is a popular and captivating topic that has garnered significant attention from researchers in various scientific fields.

Keywords: *Architecture, Biophilic design, Bibliometric analysis, Natural environment, Urban Design*

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INTRODUCTION

The pace and intensity of modern life are distancing people from nature. Daily routines spent amidst concrete structures leave behind the tranquility of greenery and the beauty of nature (Beatley, 2016). However, the positive effects of nature on humans are a scientifically proven fact (Panagopoulos et al., 2020; White et al., 2019; Karataş, 2020). Biophilic design emerges as an approach aimed at re-establishing this natural connection (Alipour & Khoramian, 2023; DeLauer et al., 2022; Gür & Kaprol, 2022; Söderlund & Newman, 2017).

Biophilic design is a design philosophy that involves integrating elements and principles of the natural world into human-made environments (Sachs, 2022). This approach aims to strengthen the connection between humans and nature, enhance environmental awareness and improve the physical and mental well-being of users (Hung & Chang, 2021). Additionally, it embraces an approach where human senses take precedence; scents, sounds, and textures play a significant role in the design of space (Browning et al., 2014). Biophilic design creates a natural atmosphere by incorporating elements such as colors, forms, patterns, and textures found in nature into both indoor and outdoor spaces (Berto & Barbiero, 2017; Browning & Ryan, 2020; Kellert, 2012). Furthermore, by employing elements like natural light, vegetation, water features, and natural materials, this design approach enhances the quality of life in a space (Bowler et al., 2010; Liu et al., 2021). Biophilic design philosophy aims to enable individuals to live in an environment that is more conducive to health, happiness, and productivity.

When people are in nature or in environments that mimic nature, their mood generally tends to uplift (Söderlund & Newman, 2017). For instance, when a person takes a walk in the forest, they can often feel happier and more energetic due to the tranquility and serenity provided by nature (Özğan & Aluçlu, 2023). Another benefit provided by biophilic design is the reduction of stress levels. An area surrounded by elements such as water or greenery helps alleviate stress and relax the mind (Stavrianos,2016).

Biophilic design has effects that enhance human work concentration and attention. Working in a natural environment or spending time in a space with natural elements often leads to increased focus and attentiveness (Jabbarioun Moghaddami, 2019). Another advantage brought about by biophilic design is the enhancement of productivity (Soderlund & Newman, 2016). The colors, patterns and forms found in nature inspire designers to create new and intriguing concepts (Ertin & Karakaya, 2022).

From a perspective of human health, low blood pressure and heart rate can be considered as positive effects of interaction with the natural environment. Spending time in green spaces or resting in an environment with natural elements often leads to a decrease in blood pressure and a return to normal heart rate (Vincent et al., 2010). Additionally, contact with nature positively contributes to strengthening the immune system.

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Breathing clean air, consuming natural foods and spending time in nature generally contribute to boosting the immune system (Relf, 2009).

Biophilic design offers an effective solution to the disruptions in natural balance caused by industrialization and misguided urbanization. By integrating natural elements into the buildings, individuals strengthen their connection with nature and positively influence their physical and mental well-being (Sinemillioglu et al., 2010). Additionally, this design approach reduces urban stress and enhances livability, thus promoting ecological equilibrium within cities (Beukeboom et al., 2012). Consequently, biophilic design renders living spaces healthier, more serene, and balanced.

The principles of biophilic design are increasingly being embraced in disciplines such as architecture, interior design, landscape architecture, and urban planning (Dijkstra et al., 2008; Hady, 2021; McGee et al., 2019). Furthermore, in the healthcare sector, hospitals and healthcare facilities are employing biophilic design principles to create more serene environments that support healing, while in the field of education, schools are being designed to have greater interaction with the natural environment (Ellegaard & Wallin, 2015; Hady, 2021; Morawski & Dunnington, 2021; Russo & Andreucci, 2023). The effects of biophilic design are also observed in fields such as art, media, industry, agriculture, and tourism (Akyıldız & Olğun, 2021; Chang et al., 2020; Girginkaya Akdağ, 2021; Hähn et al., 2021; Tardast et al., 2021). This design approach has become an integral part of contemporary environmentally-friendly and human-centered designs.

Biophilic design is of great importance in the scientific world because it has positive effects that strengthen people's emotional connection with the natural world and improve quality of life (Peters & D'Penna, 2020). In academic journals and publications, there are many studies and articles on the positive effects of biophilic design on people's health, stress levels, concentration, finding innovative solutions, generating new and original ideas, and its contributions to sustainability and environmental awareness (Peters & Verderber, 2021).

Biophilic design supports an inclusive and sustainable lifestyle through its positive effects on the environment, health, social and economic domains. This design approach serves as a significant tool for enhancing people's quality of life in various areas, supporting projects that promote environmental awareness and ensuring the preservation of the natural environment (Şenozan, 2018). Strengthening our connection with the natural environment and integrating natural elements into our lives, the widespread adoption and implementation of biophilic design are crucial for a more balanced, serene, and satisfying life (Köseoğlu et al., 2023)

Biophilic design is a feasible and flexible approach as it can offer solutions suitable for different cultures and climates. Biophilic design can be applied in hospitals, schools, offices, homes, parks, tourist facilities and many other spaces. In this way, the positive effects of biophilic design can

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be widely spread (Alipour & Khoramian, 2023) Academic journals and publications have published numerous studies and articles on the positive effects of biophilic design on people's health, stress levels, concentration and productivity, as well as its contribution to sustainability and environmental awareness.

Recent research have revealed that biophilic design is increasingly being applied in architecture across different scales and functions. In educational buildings, nature-based spatial elements have been found to increase students' focus and learning performance (Hussein et al., 2022). Biophilic interventions in office buildings have also been found to improve employee productivity and spatial satisfaction (Arif et al., 2021). Comprehensive models have been proposed for the systematic application of biophilic design frameworks at the building scale (Wijesooriya, 2023), and it has been determined that three-dimensional green facades enrich the spatial experience by strengthening the physical and visual connection with the natural environment (Zhong, 2024). The effects of biophilic approaches on energy efficiency, user health, and environmental sustainability have been evaluated using mixed methods (Agboola et al., 2024). Research trends in biophilic design in the field of architecture have also been examined from a bibliometric perspective (Tekin et al., 2025). A study conducted on city hospitals in Turkey shows that architectural models integrating biophilic and patient-centered design positively affect user satisfaction and the recovery process (Özğan, 2025). All these studies show that biophilic design has become a holistic approach that not only strengthens the psychological connection with nature, but also redefines the aesthetic, cultural, and technological dimensions of contemporary architecture, supporting human well-being and environmental sustainability.

MATERIAL AND METHODS

In this study, the development and significance of the subject of biophilic design, as well as the fields, topics, and frequency of academic research, are examined through bibliometric analysis. The methodological flowchart for the bibliometric analysis is presented in Figure 1.

Bibliometric analysis is a research method that examines the quantitative and qualitative characteristics of scientific publications or academic literature (Yang et al., 2024; Rodríguez-Soler et al., 2020; Celik et al., 2021). This type of analysis is used to present visual and numerical data regarding publication trends, publication years, most cited works, contributing countries and institutions, researchers' contributions, methodologies used, and various other features about research conducted on a specific topic or field (Arslan Selçuk & Öztürk Akbıyık, 2023). Bibliometric approaches have garnered a great deal of interest in diverse fields (Bulut and Yıldız, 2024; Çelik and Sarıboğa, 2023), as evidenced with high number of documents as 38.943 from Web of Science Core Collection. Of the documents, 69.41% of the documents have been

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disseminated in last five years, suggesting the increasing trends in bibliometric-aided analyses of the documents (Kulak and Gulmez-Samsa, 2023).

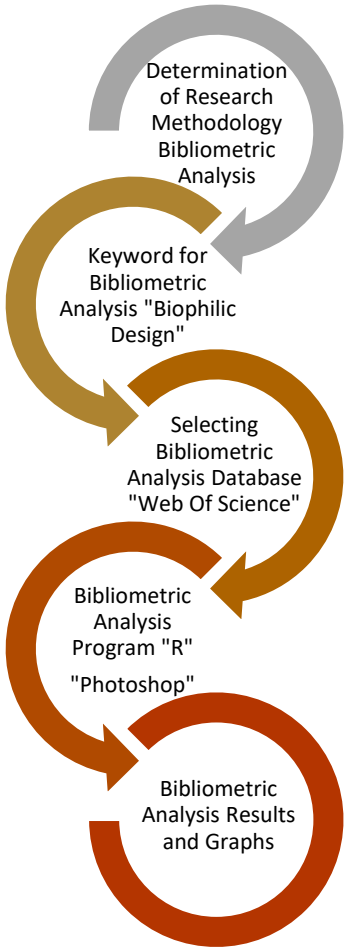

Figure 1. Study method flow chart

Among the primary objectives of bibliometric analysis are the evaluation of the current state of the research field, conducting trend analysis, identifying the journals or conferences where publications occur, understanding the role of countries and academic institutions, performing citation analysis, and determining researchers' contributions. This type of analysis is utilized to discern trends in research areas, strategize publication efforts, and forecast future research directions. Additionally, it serves as a crucial tool for assessing the impact of scientific publications and measuring researchers' academic achievements (Varshabi et al., 2022).

Bibliometric analysis serves as an effective tool for processing large datasets and tracking extensive scientific research (Patra et al., 2006). It evaluates data encompassing the content of scientific studies, citations, years of publication and more. Bibliometric analysis has a broad perspective, covering thousands or even millions of scientific documents. Therefore, when working with large datasets and aiming to analyze

extensive scientific research, bibliometric analysis is employed as a highly effective tool (Farrukh et al., 2020).

The selection of the keyword in bibliometric analysis holds critical importance for the success and validity of the analysis (Özğan & Aluçlu, 2023). At this stage, the identification of the correct keyword dictates the scope and focus of the research. Should incorrect or overly general keywords be chosen, the results of the analysis could be skewed and may not adequately reflect the true objective of the research. For instance, using a more general term like “natural design” instead of “biophilic design” would yield results that are overly broad and ambiguous. Additionally, the correct identification of the keyword ensures that relevant articles and studies are located in the appropriate databases, which is crucial for the comprehensiveness and validity of the analysis. This is also a significant step that greatly influences the success of the analysis.

In bibliometric analysis, the significance of the database is determined by factors such as scope, accuracy, and currency (Kokol et al., 2021).Comprehensive databases are preferred for international research, while databases providing access to leading publications in a specific field are favored for in-depth analyses in that area. Moreover, up-to-date and accurate databases ensure timely and reliable results in the analysis. The selection of a reliable and accurate database is crucial to prevent the distortion of analysis due to incorrect or erroneous data. The most commonly used databases in scientific circles include Web of Science, Scopus, and Google Scholar (Xian & Wang, 2021). One of the most important data sources in this field is Web of Science (Çavdar, 2021). Web of Science is a widely used database that covers extensive datasets, provides access to research in various disciplines, and is commonly used to measure and assess scientific impact (Chen et al., 2022). In this study, the Web of Science database, which is widely used in the scientific environment, was preferred to identify academic studies on biophilic design and to conduct bibliometric analysis. This study is limited to scientific studies conducted in the WOS database between 2006 and 2023. This time period was chosen to demonstrate the importance of biophilic design due to the recent increase in research on the subject.

Many computer programs are used for bibliometric analysis by evaluating the title, abstract and keywords of scientific studies. Each of the computer programs that perform bibliometric analysis has different features and advantages. In bibliometric analysis, various programs such as SPSS, Python, VOSviewer and R are used. SPSS is a widely used program for conducting statistical analyses and can be preferred for the statistical analysis of bibliometric data. Python is a general-purpose programming language used for processing large datasets. In bibliometric analysis, Python is utilized for data cleaning, analysis, and visualization. VOSviewer is a program used for visual analyses. The R program, chosen in this study, is a programming language used for a wide range of analytical processes, including statistical calculations, data

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manipulation, visualization, and modeling. In bibliometric analyses, R is often preferred for processing datasets, conducting analysis, and visualizing results. Particularly when working with large datasets, the flexibility and analytical capabilities of R provide a significant advantage. It is used to visually represent bibliometric data and visualize relationships (Guleria & Kaur, 2021). Researchers and academicians use the R program, which is a powerful analytical tool with its open-source structure, in their studies (Büyükkıdık, 2022). Additionally, the R program, with its extensive library and package support (Bibliometrix, Igraph, and Text Mining), easily performs tasks such as reading, cleaning, analyzing, and visualizing bibliometric datasets (Derviş, 2020). Researchers effectively present their study results thanks to the program's graphing and visualization capabilities tailored to their needs. Being a programming language, R enables automation of repetitive tasks while its ability to conduct complex analyses. Bibliometric analyses conducted with R provide an advantage in terms of the reproducibility of results (Büyükkıdık, 2022).

In this study, R computer program is used to perform bibliometric analysis of academic studies on biophilic design. The data of academic studies conducted between 2006-2023 using the keyword biophilic design in Web Of Science are analyzed bibliometrically using the bibliometrix package in version 4.3.1 of the R program. The data obtained are produced in tables and graphs. The bibliometric analysis data obtained using the R computer program were made more understandable using the photoshop program and presented in the research and findings section.

RESULTS AND DISCUSSION

Title words are an important bibliometric analysis method for analyzing the scientific literature by examining the publication titles of scientific studies on biophilic design (Rons, 2018). This method is used to understand trends, popular terms and developments related to biophilic design by analyzing the words in article titles.

Web of Science database was used for bibliometric analysis. When articles published between **2006 and 2023 using** the keyword biophilic design were searched, **346 articles published in 184 journals** were identified. When the words used in the titles of scientific studies were analyzed using bibliometric analysis method, 1165 words were identified. The 40 most frequently used words and the number of uses are given in Table 1.

In Table 1, the most frequently used words in the titles of scientific articles are listed in order: **Biophilic** 171, **Design** 140, **Urban** 48, and others are included in the table according to their frequency of use. According to the data in the table, it can be deduced that the most commonly used words in the titles of scientific studies are **Biophilic and Design**. Following these, the terms **Urban, Study, Green, Nature,**

Biophilia, Architecture, Health, Environments, Sustainable, Environment, Buildings and others are used.

Table 1. The most frequently used words in the titles of scientific articles and their frequency of use

Keywords Used in the Title	Frequency of Use	Keywords Used in the Title	Frequency of Use
Biophilic	171	Cities	14
Design	140	Well-Being	14
Urban	48	İmpact	13
Study	36	Performance	13
Green	34	Approach	12
Nature	31	City	12
Biophilia	25	İnterior	12
Architecture	24	Restorative	12
Health	23	Cognitive	11
Environments	22	Environmental	11
Sustainable	22	Space	11
Environment	21	Spaces	11
Buildings	17	Virtual	11
Effects	17	Architectural	10
İndoor	16	Framework	10
Planning	16	İnfrastructure	10
Review	16	Pilot	10
Sustainability	15	Potential	10
Urbanism	15	Residential	10
Building	14	Practice	9

Biophilic and Design are among the most frequently used terms in the biophilic design literature. This reveals that researchers are intensely interested in the theoretical foundations and practical applications in this field. Especially considering that biophilic design has developed as a methodology for integrating inspiration from nature with man-made environments, it is to be expected that these terms are frequently encountered.

The integration of green spaces in urban areas and nature in architecture is emphasized by the frequent use of words such as **Urban, Green, Nature** and **Architecture**. The frequency of these terms emphasizes how biophilic design is incorporated into urban planning, sustainable development and architectural practice, and shows that research in this field is centered around these themes.

The potential positive effects of biophilic design on human health and well-being can be understood by the frequency of use of words such as Health, Well-Being, Restorative and Cognitive. These terms reveal that biophilic design does not only have an aesthetic dimension, but also allows for applications that can provide functional and psychological benefits.

The words Sustainable, Sustainability, Environment and Ecological indicate the extent to which biophilic design is intertwined with environmental awareness and sustainability goals. The frequent use of these terms indicates that this approach plays an important role in efforts to preserve ecological balance and produce environmentally friendly solutions.

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Finally, the frequency with which the words Indoor, Interior Space, Space and Spaces are used reflects a growing interest in how biophilic design can be realized in interior spaces and how it can improve the quality of these spaces. The integration of biophilic elements into interior design has the potential to improve the aesthetic and functional quality of our living spaces.

The use of these terms indicates that biophilic design is a multidisciplinary field that intersects with different disciplines such as planning, architecture, health, psychology and environmental sciences. The frequency of these words emphasizes researchers' interest in the multidimensional nature of biophilic design and its potential to bridge various disciplines.

The use of words such as **Virtual, Framework** and **Infrastructure** may indicate a growing interest in the integration of biophilic design in digital environments and technological infrastructures. This is particularly relevant in the post-pandemic era with people spending more time indoors and the rise of technologies such as virtual reality.

Furthermore, words such as **Pilot** and **Potential**, Potential emphasize the new areas of application of biophilic design that are still being explored and the processes of testing the effectiveness of these applications. The use of such a word indicates that the field is developing and that pilot studies are being conducted to evaluate the impact of new biophilic design projects.

The most relevant words in the titles of scientific articles are those that best reflect the content of the articles. These words are used to quickly grasp the content of the articles or studies and identify the key topics. The most frequently used words in the titles of scientific articles on biophilic design are provided in Figure 2.

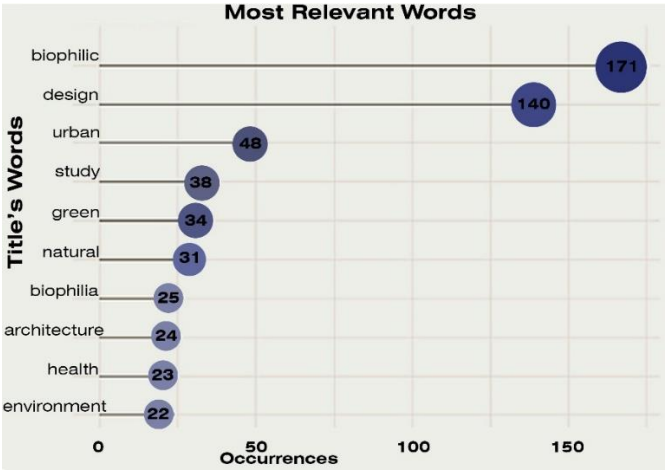

Figure 2. Most Frequently Used Words in Scientific Article Titles

Bibliometric analysis utilizes the most frequently used words in scientific article titles to define key topics, determine trends and focal points, narrow down the research field, and locate similar studies. The Figure 2 shows a frequency plot of the most frequently used terms in the titles of scientific articles on the topic of biophilic design. The X-axis

represents the number of occurrences of the terms and the Y-axis represents the terms themselves. The size of the circles in the graph indicates the frequency of use of the term, which gives researchers an idea of which terms are more dominant in academic discussions in this field. The frequency of these terms reflects which concepts and themes in biophilic design are more prevalent within the research community.

As shown in Figure 2, in the titles of scientific articles related to biophilic design, the term **biophilic** is the most frequently used word, appearing **171 times**, accounting for **17% of the total**. Following biophilic, the terms **Design (14%)**, **Urban (5%)**, **Study (3%)**, **Green (3%)**, **Natural (3%)**, **Biophilia (2%)**, **Architecture (2%)**, **Health (2%)** and **Environment (2%)** are used in the specified proportions, with other terms following suit. This shows that the terms **biophilic** and **design** are of central importance in the biophilic design literature and that terms such as urban, green, nature are important sub-themes in this field.

In addition, terms such as urban, study, and green are also used with significant frequency. This shows that biophilic design is also an important topic in the context of cities and sustainability. The presence of the terms **health** and **environments** points to the relationship between biophilic design and human health and environmental factors.

In bibliometric analysis, word clouds are an effective tool used to visually represent large sets of textual data. These clouds indicate the most frequently occurring words or terms in the text, adjusting the size based on the frequency of the word and providing a visual presentation in different colors. Word clouds are employed to comprehend, highlight, and identify key topics and trends in textual data. The most frequently used word cloud in the titles of scientific articles on biophilic design is presented in Figure 3.

Figure 3. Word cloud of the most frequently used words in scientific article titles.

As seen in Figure 3, the most frequently used words in the titles of studies on this subject are represented by the word **Biophilic** in the largest font size and green color. The word **Design** is in burgundy color, displayed in the second largest font size, followed by words like **Urban** and **Study** in different fonts and colors.

The distribution of trend topics in the titles of scientific articles, based on years, is used to understand the evolution of the subject, identify

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research trends, recognize innovation opportunities, and determine future research directions. These analysis results play a significant role in trends and decision-making processes in scientific research. When the most frequently used words in the titles of scientific articles related to biophilic design are examined through bibliometric analysis, trend topics are used to understand the changing significance, popularity and focus of the subject and field over time. The year-wise distribution of trend topics, representing the most frequently used words in the titles of scientific articles related to biophilic design, is presented in Figure 4.

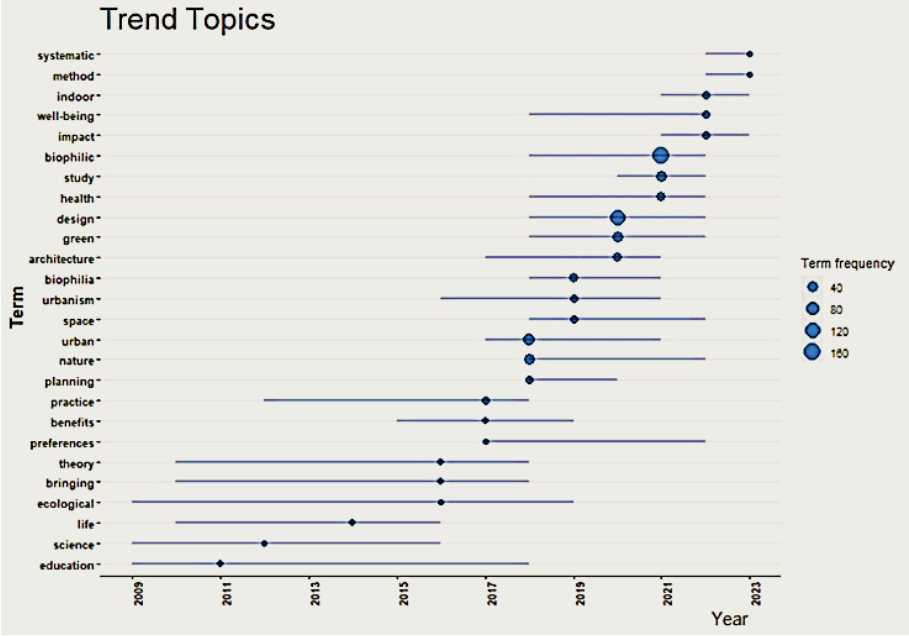

Figure 4. Distribution of the most frequently used trend topics in the titles of scientific articles over the years

Figure 4 is a trend topics scatter plot showing the frequency of use of certain terms over time in scientific article titles related to biophilic design. For each term, it can be seen how the frequency of use has changed in various years from 2006 to 2023. The horizontal lines show the first and last use of the term, while the size of the blue circles above the horizontal line represents the frequency of use of the term in a given year.

In Figure 4, With **Biophilic** appearing in **171** and **Design** in **140** article titles, they are prominently placed due to the publication years of the articles. The terms **Ecological (2009-2019)** and **Education (2009-2018)** have spanned across the years. On the other hand, terms such as **indoor**, **well-being** and **impact** have also been used significantly over time, with the frequency of use of these terms peaking in certain years. For example, the prominence of the term **well-being** in **2017 and 2019** indicates that human well-being and health is a central theme in biophilic design research.

In Figure 4, in the distribution of trend topics term used in the titles of scientific articles on Biophilic Design, the terms **Systematic** and **Method** are at the top, with publication years ranging from **2022 to 2023**. The

noticeable increase in the use of terms such as systematic and method in recent years indicates a growing interest in the development of research methodologies and the adoption of systematic approaches in the field of biophilic design. This suggests that future research may focus on these aspects.

The use of the terms over time shows that biophilic design is not limited to architecture or design, but is also related to other disciplines such as environmental science, psychology and public health. This reveals that biophilic design is a multidisciplinary field and acts as a bridge between these disciplines.

In bibliometric analysis, the co-word network of terms used in article titles is an analysis method used to visualize and understand the relationship and frequency of terms and words in scientific literature. The network of terms used in article titles on Biophilic Design is employed to visualize topic relationships, identify key subjects, comprehend trends and changes in the literature, and define research gaps. The most commonly shared word network in the titles of scientific articles related to Biophilic Design is presented in Figure 5.

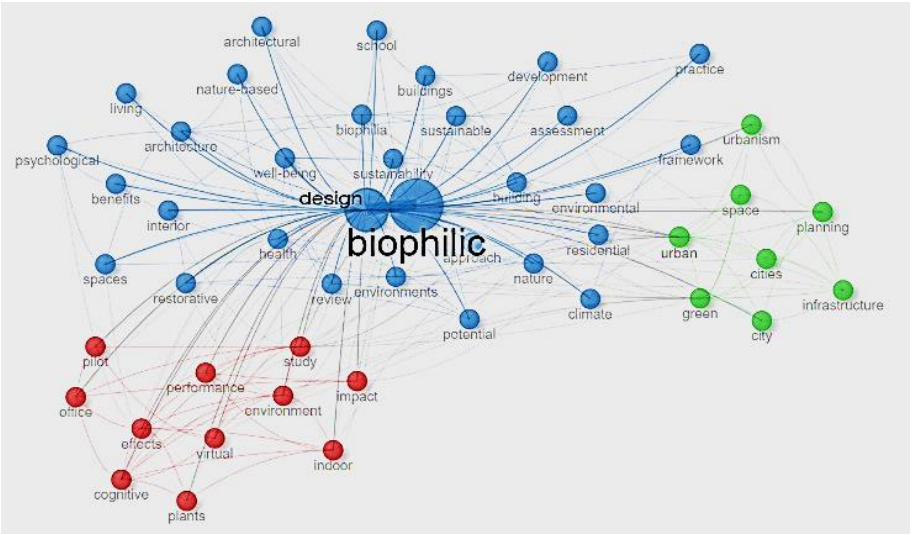

Figure 5. Co-word network of most frequently used words in scientific article titles

In this study, the co-occurrence of keywords used in the titles of scientific studies is illustrated in Figure 5, represented by three distinct colors. The color differentiation indicates the proximity and frequent co-usage of these terms within the same field. Lines connecting the spheres signify the co-occurrence of words. The size of the spheres in Figure 5 varies according to the number of connections each word has with others. The largest spheres are centrally located on the map and are colored blue, representing the words **Biophilic** and **Design**. Surrounding these central spheres are tightly connected networks of words such as **health, well-being, environments, approach, building, sustainable, nature, buildings, review** and **architecture**, all of which are also colored blue. Spheres colored red, representing words like **Study, Impact, Indoor, Environment, Virtual, Plants, Performance, Effects, Cognitive, Office**

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and **Pilot,** interact more frequently among themselves and also with the blue spheres. Spheres colored green, representing words like **Urban, Green, Space, Urbanism, Cities, City, Planning** and **Infrastructure** show interaction with the blue spheres. The interaction between the green and red spheres is observed to be minimal.

Terms at the edges of the network with fewer connections indicate potential gaps in biophilic design research or new areas of research that have not yet been fully explored. Terms such as cognitive or plants have fewer connections, indicating that these topics are not yet fully integrated or less studied in the biophilic design literature. This presents new and innovative areas of study for researchers and creates opportunities for a deeper examination of the concepts associated with these terms.

It is also suggested that these less connected terms could become a focal point in future research, contributing to a better understanding of various aspects of biophilic design. Research on these terms helps to explore broader areas of application and impact of biophilic design and opens new doors for interdisciplinary studies. In particular, topics such as cognitive aspects or the effects of plants on human psychology and health can provide a rich field to better understand the effects of biophilic design on human experience.

Thematic transformation in bibliometric analysis is an analysis used to understand how the most frequently used words in scientific article titles have evolved and changed over time. The thematic transformation of the most frequently used words in scientific article titles related to biophilic design is presented in Figure 6.

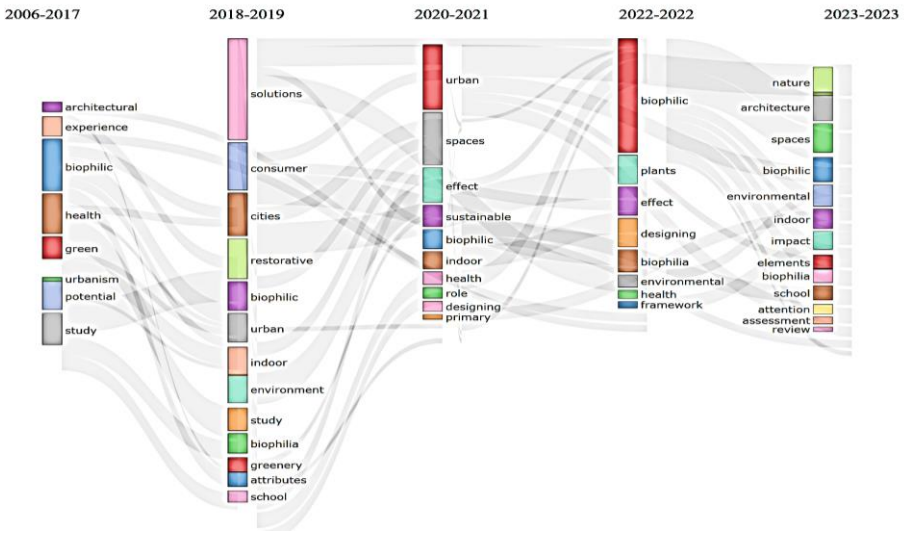

Figure 6. Thematic Transformation of the Most Frequently Used Words in Scientific Article Titles

In the realm of biophilic design, keywords used in the titles of scientific studies exhibit a thematic transformation over time, as illustrated in Figure 6. This image is a Sankey diagram reflecting the thematic transformation of the most frequently used terms in scientific article titles related to biophilic design. Each column represents a different time period and each color represents a different keyword. The position and width of the words in the column indicate their frequency of use during that period. The connections between the colors indicate the continuity

of the same words across different time periods or the emergence of new words. The word biophilic occupies an important place in all time periods, emphasizing its continuing importance.

On the other hand, new terms have emerged over time and some of them have lost their popularity. Urbanism and green are used more between 2006-2017, while terms such as nature and architecture are more common in the 2023-2023 period.

A thematic shift in the most frequently used keywords in the titles of scientific studies related to biophilic design is observed across **five distinct time periods:** 2006-2017, 2018-2019, 2020-2021, 2022, and 2023.

- In the 2006-2017 period, prominent keywords include architecture, experience, biophilic, health, green, urbanism, potential and study.
- In the 2018-2019 period, titles have increasingly featured words such as solutions, consumer, cities, restorative, biophilic, urban, indoor, environment, study, biophilia, greenery, attributes, and school.
- For the 2020-2021 period, the keywords that have gained prominence are urban, spaces, effect, sustainable, biophilic, indoor, health, role, design, and primary.
- In the year 2022, the standout keywords are biophilic, plants, effect, design, biophilia, environmental, health, and framework.
- Lastly, in the year 2023, the keywords that have gained prominence are nature, architecture, spaces, biophilic, environmental, indoor, impact, elements, biophilia, school, attention, assessment, and review.

These analyses show the emphases of biophilic design in different periods, its prominent subtopics and how it has evolved.

This research presents a bibliometric analysis of keywords in the titles of scientific studies in the field of biophilic design. The analysis reveals that the most frequently occurring words in the titles are biophilic and design. A noteworthy observation is the shifting emphasis of these keywords over the years. For instance, while architecture and experience were significant in the 2006-2017 period, the focus shifted to solutions and consumer in the 2018-2019 period. These evolutionary changes provide insights into how focal points in the field of biophilic design have developed over time. This information serves as a valuable guide for researchers in planning future studies.

The identification of the five periods is intended to more clearly analyze the thematic and theoretical transformations that have taken place in the biophilic design literature over time. This distinction highlights different stages of development in the discipline. The period 2006-2017 represents an initial period in which the foundations of biophilic design were laid and extensive studies were carried out. In this period, basic concepts such as architecture, green spaces and experience

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are at the forefront. In 2018-2019, the focus in the literature shifts to applied solutions, consumer behavior and restorative design. 2020-2021 is a period where issues such as health, indoor comfort and sustainability come to the forefront due to the impact of the COVID-19 pandemic. 2022 is a year in which environmental frameworks and the theoretical dimensions of biophilic plants are explored in more depth. 2023 focuses on the integration of nature into architecture, evaluation methods and the multidisciplinary effects of biophilic design.

This study aims to examine the impact of biophilic design on various disciplines through a bibliometric analysis. Our findings show that the words "biophilic" and "design" are used extensively in the literature, confirming that biophilic design is a fundamental approach to strengthen the relationship between human nature, as emphasized by Kellert and Calabrese (2015).

The results of the analysis show that biophilic design is not limited to the fields of architecture and design, but also intersects with other disciplines such as urban planning, environmental sciences, public health and workplaces. The frequent use of terms such as 'urban', 'green' and 'nature' in analysis is in line with the work of Beatley and Newman (2013) who emphasize the importance of integrating nature in urban spaces. This suggests that biophilic design not only has aesthetic value, but also has the potential to enhance urban sustainability and quality of life.

In recent years, biophilic design has played an important role in sustainable development and environmental sustainability (Totaforti, 2020). In particular, biophilic design has been shown to have positive effects on the health of employees in workplaces (Sanchez et al., 2018). Biophilic design has been observed to increase productivity, reduce stress and increase job satisfaction in workplaces (Gray & Birrell, 2014). Biophilic design also aims to maintain the human-nature connection by providing psychological benefits (Baldwin et al., 2011).

"The increasing use of the terms sustainability and health points to the positive effects of biophilic elements in improving indoor air quality and promoting psychological well-being in the studies by Wolverton et al. (1989). This supports that biophilic design can be an important tool for environmental and social sustainability.

The findings of the study on the role of technology and digital tools are in line with discussions by Pallasmaa (2014) on the potential of technology to enrich the human experience and connect with the natural world. Virtual and augmented reality applications can be used to rethink the ways in which biophilic design principles can be applied in interiors and urban environments.

This study also shows that biophilic design is a multidisciplinary field and bridges disciplines such as architecture, urbanism, psychology and environmental science. The theoretical foundations of biophilic design, beginning with Wilson's (1984) "Biophilia" hypothesis and continuing with Kellert's (2008) work, have evolved into practical applications and research initiatives, as bibliometric analysis findings show.

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This bibliometric analysis reveals current research trends and conceptual emphases in the field of biophilic design. The findings of the study offer valuable insights into how this field can be expanded and deepened in future research. In particular, studies on the application of biophilic design in various disciplines such as health, education, urban planning and workplaces highlight the positive impacts of this approach on human well-being and environmental sustainability. Bibliometric analysis shows that biophilic design, the integration of natural elements with man-made environments, has direct positive impacts on the physical and mental health of individuals.

Future research should examine in more detail the effects of biophilic design on human behavior, health outcomes and social interactions. This is particularly important for the integration of technological advances and innovative uses of materials into biophilic design principles. There is also a need to understand how biophilic design can better align with ecological sustainability and biodiversity conservation strategies. In this context, the focus should be on the contribution of biophilic design to the development and protection of urban green spaces, air quality improvement and water management systems in cities.

Examining biophilic design in terms of cultural and geographical diversity can develop a comprehensive understanding of how this approach can be customized and applied in different communities and environments. Comparative studies on the perception and evaluation of biophilic design in different cultural contexts would further strengthen the universality and flexibility of this design approach.

Finally, economic evaluations and cost-effectiveness analyses of biophilic design can demonstrate not only the ecological and social benefits of this approach, but also its value in terms of economic sustainability. This would be an important step towards the widespread adoption and implementation of biophilic design.

Bibliometric analysis highlights the vast potential and versatility of biophilic design and provides a basis for how work in this field can expand in the future. Biophilic design will continue to be a rich field for both academic research and practical applications as an approach that strengthens the relationship between humans and nature, enhances health and well-being, and promotes ecological balance.

CONCLUSION

Biophilic design is gaining increasing importance in the scientific world as an approach that enhances quality of life by strengthening the emotional bond between humans and nature. This study examined the words appearing in the titles of scientific articles on biophilic design using bibliometric methods and revealed the fundamental trends in the field.

A total of 346 articles published in 184 journals in the Web of Science database between 2006 and 2023 were analyzed. The findings show that biophilic and design are the most frequently used terms. The frequency

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of the words urban, green, nature, and "architecture" reveals that biophilic design has a strong relationship with urban planning, sustainability, and architecture.

The frequent use of terms such as health, well-being, and cognitive shows that biophilic design has significant psychological and health effects, not just aesthetic ones. The words sustainable and environment emphasize that this approach is integrated with environmental awareness and ecological balance.

The analysis results reveal that biophilic design goes beyond architecture and intersects with disciplines such as environmental sciences, psychology, public health, and urban planning. Furthermore, the increasing use of concepts such as virtual and infrastructure shows that biophilic design is becoming increasingly important in digital environments as well.

Biophilic design has become a multidimensional field that integrates human health, sustainability, and technological innovation. This approach continues to shape the future of sustainable and human-centered spaces by strengthening the connection between nature and humans.

REFERENCES

Agboola, O. P., Olayemi, A. A., & Ajiboye, A. (2024). Assessing the effectiveness of biophilic design approach towards sustainable architecture. Nature Design and Innovation, Special Issue, 45–58. https://jomardpublishing.com/UploadFiles/Files/journals/NDI/SI2024/Agboola_et_al.pdf

Akyıldız, N. A., & Olğun, T. N. (2021). Darende/Balaban Geleneksel Yerleşim Dokusunda Biyofilik Tasarım İzlerinin İrdelenmesi. *Kent Akademisi*, *14*(3), 560–577. https://doi.org/10.35674/kent.983117

Al Sayyed, R. (2025). The impact of biophilic elements in full-scale virtual interiors on stress reduction. Journal of Digital Architecture and Design, 9(1), 55–70. https://doi.org/10.1016/j.jdades.2025.01.006

Alipour, L., & Khoramian, M. (2023). Investigating the impact of biophilic design on employee performance and well-being by designing a research instrument. *Kybernetes*, *ahead-of-print*,4431-4447 https://doi.org/10.1108/K-08-2022-1134

Arif, M., Kulonda, D. J., & Jones, J. (2021). The impact of biophilic design interventions on workplace satisfaction and productivity. Journal of Environmental Psychology, 76, 101640. https://doi.org/10.1016/j.jenvp.2021.101640

Arslan Selçuk, S., & Öztürk Akbıyık, S. (2023). A Bibliometric Analysis on Climate Change and Built Environments. *Planarch - Design and Planning Research*, *7*(1), 96–107. https://doi.org/10.5152/Planarch.2023.221736

Baldwin, R. F., Powell, R. B., & Kellert, S. R. (2011). Habitat as Architecture: Integrating Conservation Planning and Human Health. *Ambio*, *40*(3), 322–327. https://doi.org/10.1007/s13280-010-0103-7

Beatley, T. (2016). *Handbook of Biophilic City Planning & Design*. Island Press. https://books.google.com.tr/books

Berto, R., & Barbiero, G. (2017). *The Biophilic Quality Index. A Tool to Improve a Building from "Green" to Restorative. | Visions for Sustainability*. Visions for Sustainability, 8, 38-45. https://ojs.unito.it/index.php/visions/article/view/2333

Beukeboom, C. J., Langeveld, D., & Tanja-Dijkstra, K. (2012). Stress-Reducing Effects of Real and Artificial Nature in a Hospital Waiting Room. *The Journal of Alternative and Complementary Medicine*, *18*(4), 329–333. https://doi.org/10.1089/ACM.2011.0488

Bowler, D., Knight, L., & Pullin A. (2010). The Importance of Nature for Health: Is There A Specific Benefit Of Contact With Green Space? *In collaboration for Environmental Evidence Library.* www.environmentalevidence.org/SR40.html.

Browning, W. D., & Ryan, C. O. (2020). *Nature Inside: A biophilic design guide - William D. Browning, Catherine O. Ryan*. Routledge 1. https://books.google.com.tr

Browning, W. D., Ryan, C. O., & Clancy, J. O. (2014). *14 Patterns of Biophilic Design*. Terrapin Bright Green. https://www.terrapinbrightgreen.com/reports/14-patterns

Bulut, C., & Yıldız, F. (2024). Bibliometric analysis of laser powder bed additive manufacturing of high-entropy alloys: where are we and how far have we come? Progress in Additive Manufacturing, 1-20. https://doi.org/10.1007/s40964-024-00840-5

Büyükkıdık, S. (2022). A Bibliometric Analysis: A Tutorial for the Bibliometrix Package in R Using IRT Literature. *Eğitimde ve Psikolojide Ölçme ve Değerlendirme Dergisi*, *13*(3), 164–193. https://doi.org/10.21031/epod.1069307

Çavdar, E. (2021). Yeşil Lojistik: WoS Verilerine Dayalı Bibliyometrik Bir Analiz (2000-2021). *Econder International Academic Journal*, *5*(2), 359–373. https://doi.org/10.35342/econder.1006218

Chang, C. C., Cheng, G. J. Y., Nghiem, T. P. Le, Song, X. P., Oh, R. R. Y., Richards, D. R., & Carrasco, L. R. (2020). Social media, nature, and life satisfaction: global evidence of the biophilia hypothesis. In *Scientific Reports 2020 10:1* (Vol. 10, Issue 1). Nature Publishing Group. https://doi.org/10.1038/s41598-020-60902-w

Celik E, Durmus A, Adizel O, Nergiz Uyar H (2021) A bibliometric analysis: what do we know about metals(loids) accumulation in wild birds? Environ Sci Pollut Res 28:10302–10334. https://doi.org/10.1007/s11356-021-12344-8

Çelik E, Sarıboğa L (2023) Assessment of the role of birds in seed distribution: a bibliometric analysis of studies on this subject. In: Murat oduncuoğlu, Kurt APDHİ (eds) Recent advances in natural and engineering Sciences. *Livre de lyon*, Lyon, pp 29–53. http://dx.doi.org/10.5281/zenodo.14547581

Chen, Y., Xiong, K., Ren, X., & Cheng, C. (2022). An overview of ecological vulnerability: a bibliometric analysis based on the Web of Science database. *Environmental Science and Pollution Research*, *29*(9), 12984–12996. https://doi.org/10.1007/s11356-021-17995-1

DeLauer, V., McGill-O'Rourke, A., Hayes, T., Haluch, A., Gordon, C., Crane, J., Kossakowski, D., Dillon, C., Thibeault, N., & Schofield, D. (2022). The impact of natural environments and biophilic design as supportive and nurturing spaces on a residential college campus. *Cogent Social Sciences*, *8*(1), 1–19. https://doi.org/10.1080/23311886.2021.2000570

Derviş, H. (2020). Bibliometric Analysis using Bibliometrix an R Package. *Journal of Scientometric Research*, *8*(3), 156–160. https://doi.org/10.5530/jscires.8.3.32

Di Giuseppe, M. (2024). Biophilic design in immersive virtual environments: Evaluating spatial and emotional experiences through VR technology. Frontiers of Architectural Research, 13(2), 210–225. https://doi.org/10.1016/j.foar.2024.02.005

Dijkstra, K., Pieterse, M. E., & Pruyn, A. (2008). Stress-reducing effects of indoor plants in the built healthcare environment: The mediating role of perceived attractiveness. *Preventive Medicine*, *47*(3), 279–283. https://doi.org/10.1016/J.ypmed.2008.01.013

DOI: 10.15320/ICONARP.2025.346

Ellegaard, O., & Wallin, J. A. (2015). The bibliometric analysis of scholarly production: How great is the impact? *Scientometrics*, *105*(3), 1809–1831. https://doi.org/10.1007/S11192-015-1645-z

Ertin, T. D. G. , & Karakaya, A. B. (2022). Biyomorfik Form Ve Örüntülerden Esinlenen Tasarimlar Üzerine Bir Stüdyo Deneyimi. *SED-Sanat Eğitimi Dergisi*, *10*(1), 33–45. https://doi.org/10.7816/sed-10-01-03

Farruk h, M., Meng, F., Raza, A., & Tahir, M. S. (2020). Twenty-seven years of Sustainable Development Journal: A bibliometric analysis. *Sustainable Development*, *28*(6), 1725–1737. https://doi.org/10.1002/SD.2120

Girginkaya Akdağ, S. (2021). Biyofilik Tasarım ve Teknoloji Arakesitinde: Yeni Alışveriş Mekan ve Deneyimleri. *Kent Akademisi*, *14*(4), 1043–1058. https://doi.org/10.35674/kent.982905

Gray, T., & Birrell, C. (2014). Are Biophilic-Designed Site Office Buildings Linked to Health Benefits and High Performing Occupants? *International Journal of Environmental Research and Public Health*, *11*(12), 12204–12222. https://doi.org/10.3390/ijerph111212204

Guleria, D., & Kaur, G. (2021). Bibliometric analysis of ecopreneurship using VOSviewer and RStudio Bibliometrix, 1989–2019. *Library Hi Tech*, *39*(4), 1001–1024. https://doi.org/10.1108/LHT-09-2020-0218

Gür, M., & Kaprol, T. (2022). The Participation of Biophilic Design in the Design of the Post-Pandemic Living Space. *IGI Global*, 75–106. https://doi.org/10.4018/978-1-7998-6725-8.CH004

Hady, S. I. M. A. (2021). Activating biophilic design patterns as a sustainable landscape approach. *Journal of Engineering and Applied Science*, *68*(1), 1–16. https://doi.org/10.1186/S44147-021-00031-X

Hähn, N., Essah, E., & Blanusa, T. (2021). Biophilic design and office planting: a case study of effects on perceived health, well-being and performance metrics in the workplace. *Intelligent Building International*, *13*(4), 241–260. https://doi.org/10.1080/17508975.2020.1732859

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

Hussein, H., Elkady, S., & Abd El-Razek, A. (2022). Enhancing learning environments through biophilic design strategies in educational buildings. Sustainability, 14(21), 13974. https://doi.org/10.3390/su142113974

Jabbarioun Moghaddami, H. (2019). *Re-thinking Biophilic Design Patterns In Preschool Environments For Children* [Master's thesis, Middle East Technical University]. *Open METU*. https://open.metu.edu.tr/handle/11511/45239

Karataş, T. (2020). Çevresel Sanat Uygulamalarının Sürdürülebilirliğe Katkısı ve Biyomimikri. Iğdır Üniversitesi Sosyal Bilimler Dergisi(24), 721-744. Retrieved from https://dergipark.org.tr/tr/pub/igdirsosbilder/issue/66831/1045320

Kellert, S. R. (2012). *Building for life: Designing and understanding the human-nature connection*. https://books.google.com/books

Kokol, P., Blažun Vošner, H., & Završnik, J. (2021). Application of bibliometrics in medicine: a historical bibliometrics analysis. *Health Information and Libraries Journal*, *38*(2), 125–138. https://doi.org/10.1111/HIR.12295

Köseoğlu, E., Katuk, D., Taşdemir, E., & Genç, H. (2023). A Bibliometric Analysis of Emotion at the Intersection of the Concepts of Biophilic and Design. *SAR Journal - Science and Research*, *6*(2), 61–72.

Kulak, M., & Gulmez-Samsa, C. (2023). Nanoparticles and medicinal plants: A visualized analysis of the core and theme content of the reports in the period

of 2018–2022. In V. Fotopoulos & G. Gohari (Eds.), *Engineered nanoparticles in agriculture: From laboratory to field* (pp. 59–92). De Gruyter. https://doi.org/10.1515/9781501523229-002

Liu, Z., Yang, Z., Osmani, M., Van Den Berg, P., Dane, G., & Birenboim, A. (2021). The relationship between sustainable built environment, art therapy and therapeutic design in promoting health and well-being. *International Journal of Environmental Research and Public Health, 18*(20), 10906.https://doi.org/10.3390/IJERPH182010906

McGee, B., Park, N. K., Portillo, M., Bosch, S., & Swisher, M. (2019). Diy Biophilia: Development of the Biophilic Interior Design Matrix as a Design Tool. *Journal of Interior Design*, *44*(4), 201–221. https://doi.org/10.1111/JOID.12159

Morawski, C., & Dunnington, C. L. (2021). Biophilia and visual art education: Two teachers narrate their own connections. *International Journal of Education and the Arts*, *22*(9), 1–26. https://doi.org/10.26209/IJEA22N9

Özğan, A. O., & Aluçlu, İ. (2023). Doğayla Uyumlu Mekânlar: Biyofilik Tasarımın Bibliyometrik Değerlendirmesi. *İdealkent*, *15*(41), 483–505. https://doi.org/10.31198/idealkent.1350785

Özğan, A.O. ve Aluçlu, İ. (2023). Biyofilik Tasarimin Akademik Değerlendirmesi. Türkiye Orman Bilimleri Dergisi, 7(2), 267-283. https://doi.org/10.32328/turkjforsci.1347473

Özğan, A. O. (2025). Integrating biophilic and patient-centered design: A healing architectural model for Turkish city hospitals [Doctoral dissertation, Dicle University, Institute of Science]. YÖK National Thesis Center. https://tez.yok.gov.tr/UlusalTezMerkezi

Pallasmaa, J. (2021). The embodied image: Imagination and imagery in architecture. Hoboken, NJ: Wiley.

Panagopoulos, T., Sbarcea, M., & Herman, K. (2020). A biophilic mind-set for a restorative built environment. *Landscape Architecture and Art, 17*, 68–77. https://doi.org/10.22616/j.landarchart.2020.17.08

Patra, S. K., Bhattacharya, P., & Verma, N. (2006). Bibliometric Study of Literature on Bibliometrics. *Desidoc Bulletin of Information Technology*, *26*(1), 27–32. https://doi.org/10.14429/dbit.26.1.3672

Peters, T., & D'Penna, K. (2020). Biophilic Design for Restorative University Learning Environments: A Critical Review of Literature and Design Recommendations. *Sustainability 2020, Vol. 12, Page 7064*, *12*(17), 7064. https://doi.org/10.3390/SU12177064

Peters, T., & Verderber, S. (2021). Biophilic Design Strategies in Long-Term Residential Care Environments for Persons with Dementia. *36*(3), 227–255. https://doi.org/10.1080/26892618.2021.1918815

Rodríguez-Soler, R., Uribe-Toril, J., & Valenciano, J. D. P. (2020). Worldwide trends in the scientific production on rural depopulation, a bibliometric analysis using bibliometrix R-tool. Land use policy, 97, 104787. https://doi.org/10.1016/j.landusepol.2020.104787

Relf, P. D. (2009). The therapeutic values of plants. Journal of Therapeutic Horticulture, 8(3), 235–237. https://doi.org/10.1080/13638490400011140

Rons, N. (2018). Bibliometric approximation of a scientific specialty by combining key sources, title words, authors and references. *Journal of Informetrics*, *12*(1), 113–132. https://doi.org/10.1016/j.joi.2017.12.003

Russo, A., & Andreucci, M. B. (2023). Raising Healthy Children: Promoting the Multiple Benefits of Green Open Spaces through Biophilic Design. *Sustainability 2023, Vol. 15, Page 1982*, *15*(3), 1982. https://doi.org/10.3390/SU15031982

DOI: 10.15320/ICONARP.2025.346

Sachs, N. A. (2022). E. O. Wilson: A Legacy of "Biophilia." *Health Environments Research & Design Journal*, *15*(4), 283–286. https://doi.org/10.1177/19375867221120409

Sanchez, J. A., Ikaga, T., & Sanchez, S. V. (2018). Quantitative improvement in workplace performance through biophilic design: A pilot experiment case study. *Energy and Buildings*, *177*, 316–328. https://doi.org/10.1016/j.enbuild.2018.07.065

Şenozan, M. I. (Muazzez I. Ş. (2018). *İnsan-mekan-doğa etkileşiminin sürdürülebilir bir öğretisi olarak biyofilik tasarım (Master's thesis).* Mimar Sinan Fine Arts University. Retrieved from http://acikerisim.msgsu.edu.tr/xmlui/handle/20.500.14124/1296

Sinemillioglu, M. O., Akin, C. T., & Karacay, N. (2010). Relationship Between Green Areas and Urban Conservation in Historical Areas and Its Reflections: Case of Diyarbakir City, Turkey. *European Planning Studies*, *18*(5), 775–789. https://doi.org/10.1080/09654311003612620

Soderlund, J., & Newman, P. (2016). 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

Söderlund, J., & Newman, P. (2017). Improving Mental Health in Prisons Through Biophilic Design. The *Prison Journal*, *97*(6), 750–772. https://doi.org/10.1177/0032885517734516

Stavrianos, A. (2016). Green inclusion: biophilia as a necessity. *British Journal of Special Education*, *43*(4), 416–429. https://doi.org/10.1111/1467-8578.12155

Tardast, Z., Meshkini, A., & Rajabi, A. (2021). Explain the Strategic Planning Model of Biophilic Tourism Case Study: Tehran Metropolis. *Urban Tourism*, *8*(2), 65–79. https://doi.org/10.22059/JUT.2021.299414.782

Tekin, M., Demirci, Z., & Aydın, S. (2025). Biophilic design in the built environment: Trends, gaps and future directions. Buildings, 15(14), 2516. https://doi.org/10.3390/buildings15142516

Totaforti, S. (2020). Emerging Biophilic Urbanism: The Value of the Human–Nature Relationship in the Urban Space. *Sustainability*, *12*(13), 5487–5503. https://doi.org/10.3390/su12135487

Varshabi, N., Selçuk, S. A., & Avinç, G. M. (2022). Biomimicry for Energy-Efficient Building Design: A Bibliometric Analysis. *Biomimetics 2022, Vol. 7, Page 21*, *7*(1), 21. https://doi.org/10.3390/biomimetics7010021

Vincent, E., Battisto, D., Grimes, L., & McCubbin, J. (2010). The Effects of Nature Images on Pain in a Simulated Hospital Patient Room. *Health Environments Research & Design Journal,* *3*(3), 42–55. https://doi.org/10.1177/193758671000300306

White, M. P., Alcock, I., Grellier, J., Wheeler, B. W., Hartig, T., Warber, S. L., Bone, A., Depledge, M. H., & Fleming, L. E. (2019). Spending at least 120 minutes a week in nature is associated with good health and wellbeing. *Scientific Reports 2019 9:1*, *9*(1), 1–11. https://doi.org/10.1038/s41598-019-44097-3

Wijesooriya, S. (2023). Biophilic design frameworks: A review of structure and applications. Frontiers of Architectural Research, 12, 100–115. https://doi.org/10.1016/j.foar.2023.04.002

Xian, N., & Wang, W. (2021). Research on Intelligent Facility Design of Medical Indoor Space Based on Barrier-free Design. *2021 2nd International Conference on Intelligent Design (ICID)*, 451–457. https://doi.org/10.1109/icid54526.2021.00095

Yang, S., Luo, J., Zou, W., Zhu, Q., Cen, J., & Gao, Q. (2024). Research trends in vascular chips from 2012 to 2022: a bibliometrix and visualized analysis. *Frontiers in Bioengineering and Biotechnology*, 12, 1409467. https://doi.org/10.3389/fbioe.2023.1409467

Zhong, Y. (2024). Implementing biophilic design in architecture through three-dimensional green façade applications. Building and Environment, 242, 111016. https://doi.org/10.1016/j.buildenv.2024.111016

Resume

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