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# Islamic Perspectives on Biophilic Landscape Design in the Built Environment: A Bibliometric Analysis

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**Abstract**

Biophilic design scholarship has expanded rapidly, yet Islamic ecological ethics remain marginal, weakening cultural fit in Muslim-majority contexts. The study's aim is to systematically map the field and assess where Islamic principles appear or fail to appear and translate those patterns into actionable design and decision indicators. A Scopus-only corpus was assembled and screened using PRISMA 2020, yielding 70 English-language publications. Science mapping in VOSviewer v1.6.20 produced citation, author and reference co-citation, and keyword co-occurrence networks. Thresholds balanced clarity and coverage. Right-censoring was addressed via publication year and citations-per-year, and self-citations were excluded. Results show three dominant clusters which is Well-being and Psychology, Urban Sustainability, and Evolutionary Frameworks that are underpinned by a Western canon. Output rises sharply in 2021, while influence remains concentrated in earlier landmark works. Crucially, Islamic terms and principles are absent from frequent keywords and peripheral in co-citation structures, signalling limited integration of faith-informed ethics. The contribution is twofold: (i) a transparent profile of the field and (ii) an analytic crosswalk linking clusters to Sakinah (tranquillity), Hima (conservation), Mizan (balance), and Khalifa (stewardship), from which practice indicators are derived. Embedding these ethics as design parameters can improve cultural resonance and guide biophilic practice in Muslim-majority contexts while enriching the canon.

## 1.0 INTRODUCTION

Urban densification has reduced routine contact with natural elements in everyday settings, shifting daily experience toward predominantly built environments (Rojas-Carvajal et al., 2022). A substantial body of evidence associates access to greenery and other natural features with psychological restoration and stress recovery, supporting the case for systematic reintegration of nature within the built environment (Franco et al., 2015; Senapati et al., 2015; Truong et al., 2016; Chawla, 2021).

Biophilic design addresses this challenge by translating the biophilia hypothesis which is an inherent human affinity for life and life-like processes into spatial strategies for buildings, landscapes, and public space (Wilson, 1986). As the field continues to grow, practice often focuses on visible greening interventions where performances rely on delivery conditions such as planting quality and maintenance capacity. Evidence on critical success factors for vegetation planting reinforces that greening outcomes are shaped by implementation reliability rather than intent alone (Sani et al., 2020). This practical constraint increases the value of context-responsive frameworks that can justify, guide, and sustain nature-based design in specific settings.

Conceptual framing in biophilic design research, however, remains largely anchored in secular and Western-derived explanations, especially evolutionary and environmental psychology accounts of nature preference and restoration. In parallel, Islamic environmental thought offers a normative account of human–nature relations grounded in stewardship (Khalifa), balance (Mizan), conservation-oriented protection (Hima), and tranquillity (Sakinah). These ideas have been developed through foundational scholarship on Islamic cosmology and ethics as well as dedicated work on Islam–ecology linkages such as Nasr (1968) Man and Nature; Foltz et al. (2003) Islam and Ecology; Izzi Deen (2003) Islamic Environmental Ethics; Khalid (2002) Islam and the Environment. Despite their relevance to design ethics and long-term care of landscapes, the extent to which such concepts are visible within the core knowledge structure of biophilic design research has not been established.

This gap is not primarily conceptual but empirical. Assertions that Islamic perspectives are marginal in biophilic design are often made without examining the field's organising structures which is its dominant themes, influential sources, and shared keyword vocabularies. Bibliometric analysis is well-suited to this task because it can map citation, co-citation, and keyword co-occurrence networks that reveal what the field privileges, how themes cluster, and which concepts remain peripheral or absent. Islamic ecological concepts are therefore treated as analytic probes rather than assumed absences, allowing visibility and positioning to be tested against the literature's actual structure. The study is guided by three research questions:

- RQ1: What thematic and intellectual structures characterise biophilic landscape design research in the built environment from 2015 to 2024?
- RQ2: Where and how prominently do Islamic ecological concepts operationalised through terms and constructs linked to Khalifa, Mizan, Hima, and Sakinah appear?
- RQ3: Which dominant thematic clusters provide the strongest basis for translating Islamic ecological ethics into context-relevant biophilic design indicators for the built environment?

A bibliometric mapping of a Scopus-indexed, English-language corpus (2015–2024) is conducted using citation, co-citation, and keyword co-occurrence analyses. An interpretive crosswalk then relates the mapped clusters to Khalifa, Mizan, Hima, and Sakinah to support a structured discussion of implications, while acknowledging the constraints of database coverage and language indexing.

## 2.0 METHODOLOGY

### 2.1 Databases and Time Span

This bibliometric analysis used Scopus only, covering publications through December 2024 (exported 20 January 2025). The funder of this research mandated a single index. This ensured consistency and avoided cross-database mismatches and deduplication artefacts. Scopus's curated, international coverage of journals, conferences, and books provides a robust base for mapping. Only English-language records were included to

ensure consistent screening and interpretation, avoid translation bias, and comply with the funder's requirements. This restriction introduces selection bias and narrows coverage (see Scope and Bias), but it yields a consistent, well-structured dataset suitable for the analyses reported.

### 2.2 Search Strategy

The selection process followed PRISMA 2020 guidelines for literature selection (Identification → Screening → Eligibility → Inclusion). Eligibility involved scope confirmation only with no qualitative data extraction of study findings. Reasons for exclusion were logged at each stage, and records were filtered against predefined inclusion criteria, then screened by title–abstract–keywords. Clearly off-topic items were removed. Remaining records underwent targeted record evaluation to confirm fit, yielding a coherent, reproducible dataset. Figure 1 illustrates the selection flow.

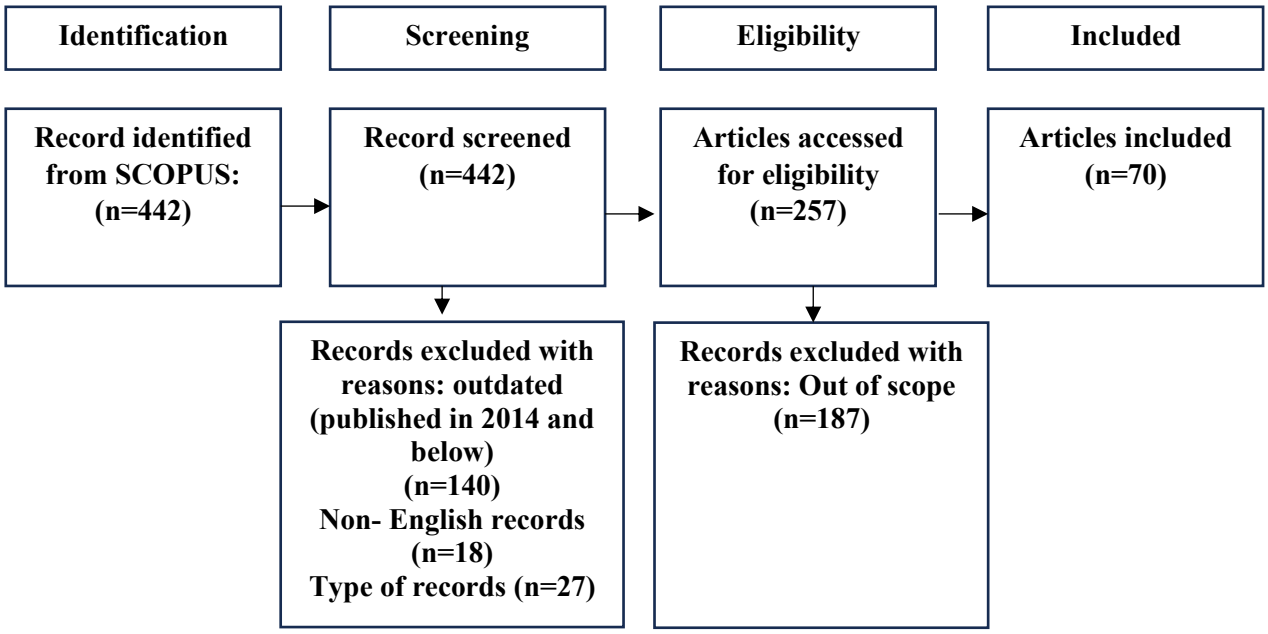


**Figure 1.** Record search strategy
(Source of figure: Authors)

The systematic search for "Islamic Perspectives on Biophilic Landscape Design in the Built Environment" was initiated on 20 January 2025 using an expanded keyword strategy to capture this niche topic. Following a three-stage PRISMA workflow (identification, screening, eligibility), the Scopus search returned 442 records. Pre-specified inclusion and exclusion criteria (detailed in Table 2) were then applied to ensure currency and topical alignment, narrowing the pool substantially. At the eligibility stage, remaining studies were assessed individually such as titles, abstracts, and when necessary methodological sections to confirm fitness for inclusion. In the end, 70 publications met all criteria and were retained for bibliometric analysis, yielding a focused corpus for mapping.

### 2.3 Identification

Keywords were iteratively refined to enable a comprehensive search strategy. Starting from core phrases, we expanded the query with conceptual synonyms and related terms spanning biophilic design and Islamic perspectives in the built environment. Candidate terms were drawn from online thesauri and recurring terminology in prior studies, resulting in a consolidated list. The finalised query was applied to Scopus Title–Abstract–Keyword fields, combining three concept groups with Boolean logic:

- Biophilic Design: the root biophilia* to capture *biophilia*, *biophilic*, and derivatives.
- Built Environment: terms delimiting the built/landscape context (e.g., "built environment," "landscape architecture," "landscape design").
- Islamic Context: Islam* (Islam, Islamic, etc.) and Muslim* to ensure inclusive coverage.

Within-group terms were joined with OR, and the three concept groups with AND, so each record addressed all dimensions (e.g., biophilia* AND (Islam* OR Muslim*) AND ("landscape design" OR "built environment")). The strategy was intentionally broad to balance specificity and inclusivity, capturing any link between biophilic design and Islamic perspectives across landscape and built-environment contexts. The final search was executed in Scopus on 20 January 2025, and all results were exported for screening and analysis. Table 1 lists the identification string.

**Table 1.** The search string used for identification

| Databases | Keywords used |
|---|---|
| Scopus | (TITLE-ABS-KEY ( biophilic OR biophilia OR "nature-integrated design" OR "nature-based design" OR "ecological design" OR green design OR "environmental design" ) AND ( design OR "landscape design" OR "landscape architecture" OR "built environment" ) AND ( islam OR islamic OR muslim OR religiosity OR religious OR spirituality OR spiritual OR religion OR faith ) |

The search retrieved 442 records. Despite this volume, only a small fraction of the hits substantively addressed the intersection of biophilic design and Islamic perspectives. This outcome underscored the need for careful screening to isolate the relevant literature.

### 2.4 Screening

Table 2 lists the screening criteria. We retained peer-reviewed journal articles, conference papers, and one book (2015–2024) and excluded pre-2015 items, non-English records, and non-scholarly formats. No open-access filter was applied. Screening was strictly topical, building a coherent bibliometric dataset centred on biophilic design in the built/landscape context. Applying these criteria removed 185 records, leaving 257 for scope confirmation. These 257 were then assessed for direct relevance to Islamic perspectives on biophilic landscape design via title and keywords review (abstract consulted where needed) to ensure genuine engagement with biophilic principles in an Islamic context.

**Table 2.** The inclusion and exclusion criteria.

| Criterion | Inclusion | Exclusion |
|---|---|---|
| Type | Research articles, conference papers, books | Short communications, mini- reviews, case reports, encyclopaedias |
| Time frame | Between 2015 and 2024 | 2014 and earlier |
| Language | English | Non-English |

### 2.5 Eligibility

In the eligibility phase, we confirmed that each screened record explicitly addressed biophilic landscape design in the built environment. We additionally checked for Islamic concept terms in titles, abstracts, or full texts as evidence of a substantive Islamic framework. The process comprised: (i) a second pass of titles/abstracts to verify genuine biophilic focus (not metaphorical usage), and (ii) targeted abstract review where the scope was ambiguous. Of the 257 records advanced from screening, 70 met the refined eligibility criteria and formed the final dataset for bibliometric analysis, ensuring a corpus tightly aligned with the study aim.

### 2.6 Tools and Parameters

Bibliometric mapping used VOSviewer v1.6.20. The 70 Scopus records (metadata, references, citation counts) were exported (20 Jan 2025) and imported unchanged. We generated keyword co-occurrence, author co-citation, reference co-citation, and document citation networks, using association-strength normalisation, full counting and VOSviewer's default clustering/layout. Nodes were not manually repositioned

(labels/colours only). In addition to visual maps, we provided separate tables to report occurrences/co-citations and total link strength. Figures and tables repeat all parameters and thresholds for transparency.

Parameter settings and inclusion thresholds were calibrated to surface the most informative relationships and keep the maps interpretable. We applied minimum threshold criteria for inclusion of items in each network. The specific VOSviewer threshold parameters, determined through trial to balance inclusiveness and clarity, were as follows:

- Citation analysis: No citation threshold, all 70 documents included. Edges count shared references (full counting), with association-strength normalisation and VOSviewer default clustering/layout. Coupling uses reference lists, therefore items with zero Scopus citations are retained. Self-citations are excluded from descriptive tallies but do not affect coupling links.
- Reference co-citation: A minimum of 3 co-citations for a cited reference. Among 4,370 distinct references cited in the dataset, 27 publications were co-cited (i.e. cited by the same papers) at least 3 times, and these formed the reference co-citation map.
- Author co-citation: Threshold ≥20 co-citations per author. Counts derived from the 70 documents' reference lists (full counting) and mapped in VOSviewer using association-strength normalisation with default clustering/layout; authors meeting the threshold constitute the author co-citation network.
- Keyword co-occurrence: A minimum of 3 occurrences of a keyword across the dataset. Out of a total of 511 unique keywords in the corpus (author keywords plus index terms), 46 met this frequency threshold and were included in the co-occurrence analysis (keywords with fewer than 3 appearances were excluded as singular or infrequent terms).

These thresholds prioritised core scholarly patterns and filtered out one-off noise. All parameters were set a priority and are restated with the relevant results; for transparency, figures also repeat threshold values and settings. Networks were generated with VOSviewer's standard clustering and layout so that node distances reflect relationship strength. No manual repositioning was applied. Only labels and colours were adjusted for legibility.

### 2.7 Right-Censoring Adjustment and Metric Definitions

All citation metrics are as of 20 January 2025. Right-censoring affects indicators which newer works have had less time to accrue citations. So, counts are interpreted in relation to publication year, with citations per year used where helpful as a rough normalisation. The analysis emphasises relational/network measures over raw totals to limit recency bias. Self-citations are excluded from all tallies. The key techniques and metrics used are outlined below:

- Citation analysis: Traces direct citation links among the 70 publications to show knowledge flows and influential contributions in biophilic design. On its own, it misses deeper relational structure (Ibrahim et al., 2024). When paired with co-citation, it gives a coherent picture of the field's architecture and evolution, clarifying how themes interlock.
- Co-citation analysis: Applied to authors and references. Items cited together are assumed conceptually related. Charts intellectual kinships, pivotal works, and thematic clusters tend to favour established literature, so niche/novel studies can be underrepresented (Ibrahim et al., 2024). Used alongside direct citation metrics to capture both landmark and emerging strands, which is useful for reading biophilic design through an Islamic lens.
- Co-occurrence (co-word) analysis: Mapping themes via keywords that appear together within documents, revealing dominant concepts, linkages, and topic momentum. While author keywords are primary, titles/abstracts can supplement when sparse (Donthu et al., 2021). Combined with co-citation mapping, yields a fine-grained view of conceptual structure and influence.

All metrics and network maps follow established science-mapping practice. We interpret them with explicit caveats. Citation-based indicators are susceptible to right-censoring and disciplinary citation norms.

Because architecture/planning typically has lower citation rates than the life sciences, raw counts are read in-field, not as cross-field absolutes.

### 2.8 Scope and Bias

Using a Scopus-only corpus, which was mandated by the funder can optimised consistency but excluded relevant work not indexed there. Although Scopus is broad, it is not exhaustive. The actual body of scholarship on Islamic perspectives in biophilic design may be larger. Co-citation mapping partially mitigates this by surfacing influential references cited within the corpus, even when those works are outside Scopus (e.g., regional journals or books). Language and cultural scope also constrain coverage. Limiting to English-language publications biases results toward Anglophone scholarship. Hence, important studies in Arabic or other languages may be absent. This language limitation is acknowledged, though it aligns with the practical scope of many international bibliometric studies and with the project's focus on globally accessible literature. Moreover, focusing on items explicitly labelled "Islamic" may miss relevant research on nature in Islamic architecture that uses different terminology. These choices align with common bibliometric practice and the project's remit but should frame the interpretation of findings.

## 3.0 RESULTS AND ANALYSIS

Findings are organised across four lenses: (i) descriptive statistics and publication trajectories, (ii) citation networks, (iii) co-citation patterns, and (iv) keyword co-occurrence. Analyses draw on a Scopus corpus of 70 English-language publications (2015–2024; retrieved 20 January 2025) using VOSviewer v1.6.20 (full counting; association-strength normalisation). Overall, the results map field development, surface principal contributors, and show where Islamic ecological ethics such as *Hima, Mizan, Sakinah, Khalifa* that remain peripheral yet offer interpretive leverage for biophilic landscape design.

### 3.1 Descriptive Analysis and Publication Trends

Table 3 summarises the Scopus corpus: 70 journal articles (2015–2024) by 186 authors across 133 institutions in 31 countries. Collectively, the papers have 1,253 citations as of 20 January 2025 with an average of 17.90 per article. Collaboration is highly international (98.9% multi-country authorship), with a mean of 2.66 authors per paper. Author-supplied keywords total 255 unique terms. Citation counts reflect Scopus reporting, excluding self-citations.

**Table 3.** Bibliometric summary of the Scopus dataset (70 articles, 2015–2024; data retrieved 20 Jan 2025)

| | |
|---|---|
| Articles | 70 |
| Timespan | 2015 - 2024 |
| Authors | 186 |
| Average citations per article | 17.90 |
| Single author documents | 13 |
| Co-author per document | 1.66 |
| International co-authorship % | 98.92 |
| Total journal | 61 |
| Authors per article | 2.66 |
| Author's keyword | 255 |
| Institutions | 133 |
| Countries | 31 |

Figure 2 charts annual publications alongside total citations. Output remained modest (2–6 papers per year) until a sharp rise in 2021 (15 papers), coinciding with the landmark article "Biophilia as Evolutionary Adaptation: An Onto- and Phylogenetic Framework for Biophilic Design." Counts then stabilise (10 in 2022, 9 in 2023, 11 in 2024), signalling sustained momentum and a platform for culturally attuned directions, including engagement with Islamic environmental ethics.

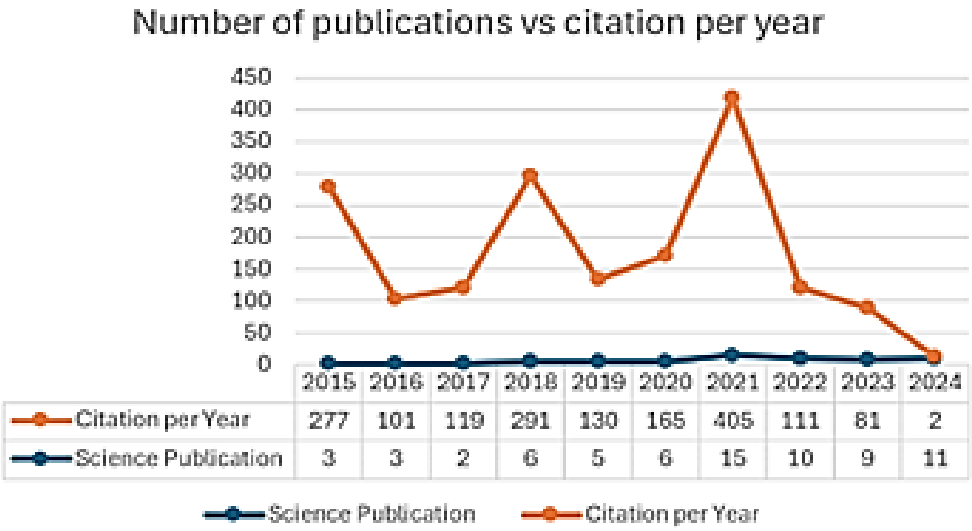


**Figure 2.** Number of publications vs. citations per year for biophilic landscape design research. Annual citation counts reflect how often the 70 articles were cited in that year. Data source: Scopus (retrieved 20 Jan 2025) (Source of figure: Authors)

Citations follow a different rhythm. Totals climbed to 291 in 2018 and peaked at 405 in 2021, before dropping to 111 (2022), 81 (2023), and 2 (2024). This pattern reflects concentration around a few highly influential studies and the right-censoring of recent items. The decoupling of citation intensity from publication volume suggests that field-shaping contributions have arrived in bursts rather than through steady incremental growth.

Within this trajectory, Islamic ecological ethics remain peripheral. *Khalifa* (stewardship) is rarely made explicit as a guiding duty, *Mizan* (balance) is seldom framed as an ethical mandate rather than a technical target, *Hima* (conservation) is not yet operationalised in design casework, and *Sakinah* (tranquillity) is scarcely connected to spiritual calm within restorative narratives. The result is a literature that advances biophilic theory and application but underutilises culturally grounded ethical frames that could deepen its relevance.

The path forward is to replace incidental references with a rigorously theorised integration of these principles. In practice, this means testing stewardship as an accountability lens (*Khalifa*), embedding equilibrium as a normative standard (*Mizan*), trialling community-managed green reserves as design policy (*Hima*), and linking restorative outcomes to culturally meaningful concepts of peace (Sakinah). Such work would complement the existing corpus and help translate biophilic design into frameworks that resonate more fully across Muslim-majority contexts.

### 3.2 Citation Analysis

To map the intellectual structure of the field, a citation network of the 70 documents was generated using VOSviewer. In this analysis, each article is linked to others by shared citations (bibliographic coupling). All articles were included (no minimum citation threshold), yielding a network in which 34 strongly connected papers formed three main clusters (Figure 3). The mapping was based on full counting of shared references and default normalisation and reflects citation data as of January 2025.

- Cluster 1: Well-being and Psychology. Centred on health and psychological outcomes of biophilic design, anchored by Gillis and Gatersleben (2015), the corpus's most-cited paper (216 Scopus citations). Related works include Xue et al. (2019) on health-centred green-building criteria and Berto et al. (2018) on restorative effects of nature connectedness. Together, these studies define the field's early emphasis on stress recovery and well-being.
- Cluster 2: Urban Sustainability. Focused on urban ecology and nature-based solutions, exemplified by Fink (2016) and Blau et al. (2018) linking biophilic strategies to sustainability and climate resilience. Hand et al. (2017) (100 citations) shows community gardens cultivating children's biophilia. This cluster bridges biophilia with urban planning, green infrastructure, and community engagement.
- Cluster 3: Evolutionary Frameworks. Led by Barbiero and Berto (2021) (63 citations), advancing an evolutionary/phylogenetic model of biophilia as adaptive; connected to Peters and D'Penna (2020) (59 citations) on restorative design in education, with culturally neutral framing. The thread runs from evolutionary psychology to design applications in buildings and landscapes.

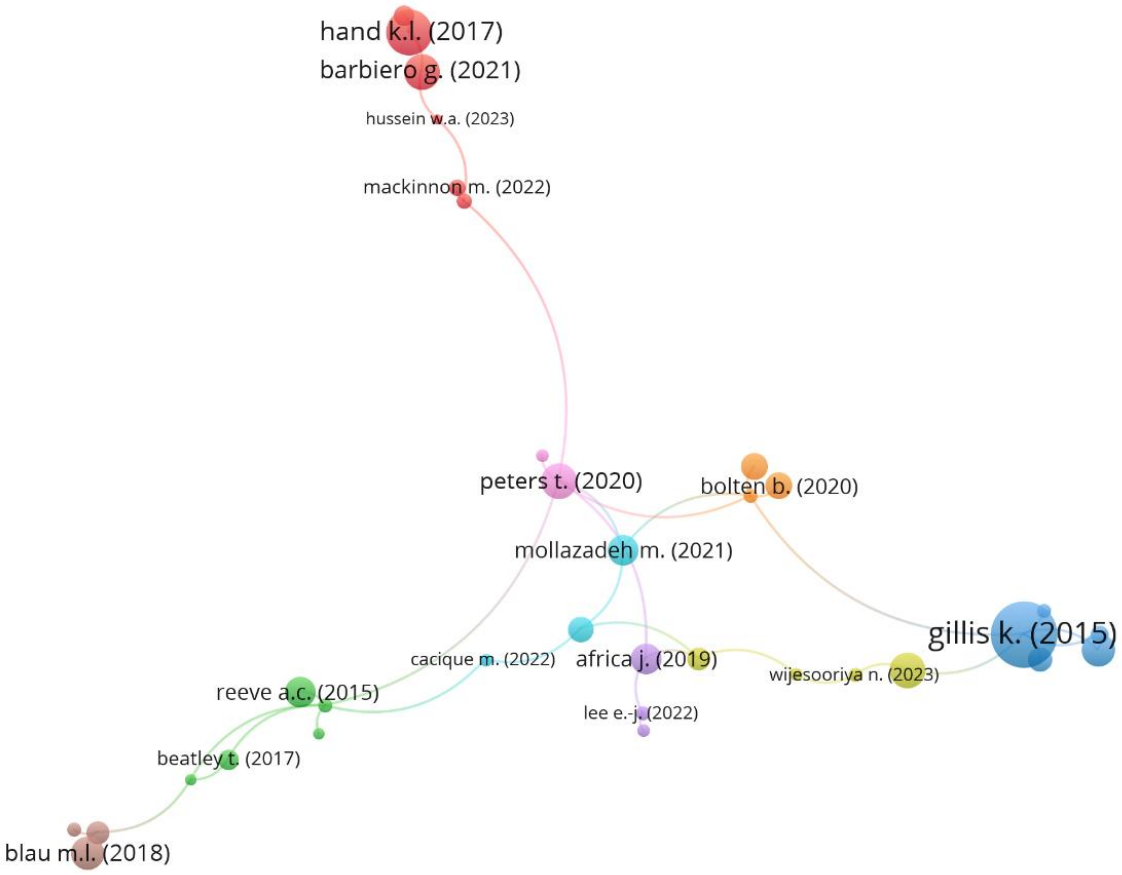


**Figure 3.** Citation network of biophilic landscape design publications (2015–2024), showing three main thematic clusters. All 70 articles are included; 34 articles form the largest connected component depicted. Cluster colouring is based on VOSviewer's modularity clustering. Data: Scopus (retrieved 20 Jan 2025) (Source of figure: Authors)

Across clusters, the network maps the field's core conversations, from health psychology through sustainable urbanism to evolutionary theory. Table 4 lists the ten most-cited articles (Scopus totals as of the retrieval date), aligning closely with these themes.

**Table 4.** Top ten cited publications in the dataset (70 articles, 2015–2024). Citation counts are from Scopus (retrieved 20 Jan 2025, and exclude self-citations)

| Rank | Title | Authors | Citation | Year |
|---|---|---|---|---|
| 1 | A review of psychological literature on the health and wellbeing benefits of biophilic design | Gillis, K., Gatersleben, B. | 216 | 2015 |
| 2 | The importance of urban gardens in supporting children's biophilia | Hand, K.L., Freeman, C., Seddon, P.J., (...), Stein, A., Van Heezik, Y. | 100 | 2017 |
| 3 | An individual's connection to nature can affect perceived restorativeness of natural environments. some observations about biophilia | Berto, R., Barbiero, G., Barbiero, P., Senes, G. | 97 | 2018 |
| 4 | Human-nature for climate action: Nature-based solutions for urban sustainability | Fink, H.S. | 75 | 2016 |
| 5 | Urban gardens as a space to engender biophilia: Evidence and ways forward | Lin, B.B., Egerer, M.H., Ossola, A. | 71 | 2018 |
| 6 | Biophilia as Evolutionary Adaptation: An Onto- and Phylogenetic Framework for Biophilic Design | Barbiero, G., Berto, R. | 63 | 2021 |
| 7 | Incorporating biophilia into green building rating tools for promoting health and wellbeing | Xue, F., Lau, S.S., Gou, Z., Song, Y., Jiang, B. | 62 | 2019 |
| 8 | Biophilic design for restorative university learning environments: A critical review of literature and design recommendations | Peters, T., D'Penna, K. | 59 | 2020 |
| 9 | Urban river recovery inspired by nature-based solutions and biophilic design in Albufeira, Portugal | Blau, M.L., Luz, F., Panagopoulos, T. | 51 | 2018 |
| 10 | Exploring restorative potential of biophilic servicescapes | Purani, K., Kumar, D.S. | 51 | 2018 |

The citation network shows a clear thematic shift over time. Early studies (2015–2019) in Cluster 1 emphasised psychological and ecological outcomes such as stress reduction and well-being, while post-2020 research increasingly engaged with evolutionary and design-framework perspectives (Cluster 3). Table 4 highlights a persistent gap. The most cited works advance universal design narratives but neglect culturally specific or faith-informed values. For instance, Lin et al. (2018) and Hand et al. (2017) highlight the benefits of urban greenery and children's nature experiences without invoking stewardship (*Khalifa*) or conservation (*Hima*). Likewise, Fink (2016) and Blau et al. (2018) promote urban sustainability but omit the ethical principle of balance (Mizan). Figure 3 reinforces this point that religious or Islamic terms appear, if at all, only at the margins. Only recently have a few works (e.g., Mackinnon et al., 2022; Lee & Park, 2022) begun to connect biophilia with Islamic perspectives, and these remain tentative, with limited citation traction.

Influence in the network is still concentrated in early foundational studies, particularly Gillis and Gatersleben (2015), which anchors the field in Western environmental psychology. This reflects a strong reliance on Euro-American paradigms, while explicitly non-Western or Islamic contributions, such as Africa et al. (2019) on biophilic design and climate in health contexts, remain marginal in citation impact. Nonetheless, the network suggests potential avenues for intellectual expansion. For example, Barbiero and Berto (2021) could be extended by linking evolutionary frameworks to Qur'anic views of human–nature relations. Similarly, Peters and D'Penna (2020) on restorative learning spaces could be aligned with Islamic design traditions, such as mosque courtyards or Quranic Garden motifs, while Xue et al. (2019)'s health metrics might be adapted to assess culturally inflected design features.

Overall, the citation analysis exposes a blind spot. The Islamic ecological tenets are rarely integrated into otherwise well-developed discussions of biophilic design. The main clusters which is well-being,

sustainability, and evolutionary theory lean heavily on Western case studies and theories. Foundational works highlight the benefits of nature contact yet overlook *Sakinah*, while urban resilience studies fail to invoke *Mizan* or *Khalifa*, and *Hima* is absent altogether. In sum, the field has yet to incorporate the moral and spiritual dimensions central to Islamic environmental thought.

### 3.3 Result of Co-citation Analysis

Co-citation analysis was employed to identify the seminal literature that underpins biophilic design research. Two levels of co-citation were examined using VOSviewer (v1.6.20): cited references (specific works co-cited by the 70 articles) and cited authors (influential authors frequently cited together). For the reference co-citation map (Figure 4), a minimum of 3 citations was set for a reference to be included, which ensured that only core, widely cited works appear. This yielded a network of the key references shaping the field. Similarly, the author co-citation map (Figure 5) included authors cited at least 20 times by the corpus, highlighting the prominent scholars and intellectual lineages in biophilic design. Both maps were generated with full counting and association strength normalisation.

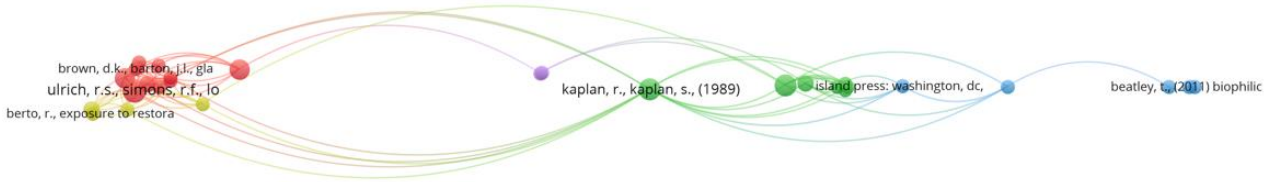


**Figure 4.** Co-citation map of influential references cited in the biophilic design literature. Key classic works cluster at the centre (red nodes) connecting stress-reduction, restorative environment, and biophilia theory. (VOSviewer parameters: full counting, minimum 3 citations per reference; data as of 20 Jan 2025) (Source of figure: Authors)

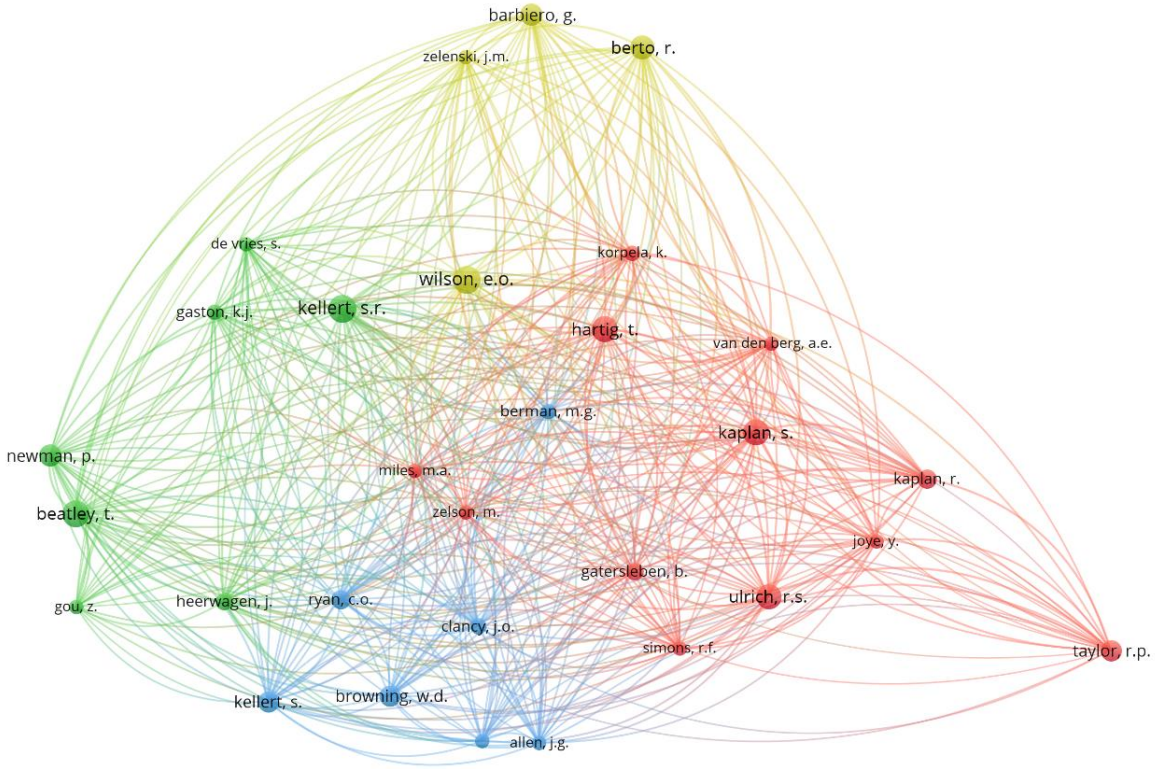


**Figure 5.** Co-citation map of frequently cited authors in biophilic design research. Node size corresponds to the number of citations by the corpus; node proximity and links indicate how often authors are cited together. Four clusters (colour-coded) represent different knowledge domains within the field. Data based on Scopus records (2015–2024) (Source of figure: Authors)

In reference co-citation network (Figure 4), the map foregrounds the field's core texts. Ulrich (1984) and Kaplan and Kaplan (1989) sit at the centre (co-cited together by ~25 of the 70 papers), cementing the stress-reduction and restorative-environment narrative. Close by is Wilson (1986) (~24), anchoring the evolutionary claim of an innate affinity for nature. Together these works bridge psychological restoration and evolutionary arguments that underpin biophilic design.

A tight knit subcluster links Kaplan and Kaplan (1989) with Ulrich (1984), supported by studies on sensory and cultural restoration for example, Alvarsson et al. (2010) on natural soundscapes and Brown et al. (2013) on visual stress recovery. Ouellette et al. (2005) extends this theme through a monastery-garden case. In parallel, Kellert and Wilson (1995) (*The Biophilia Hypothesis*) broadens the phylogenetic/theoretical base, while Beatley and Newman (2013) translates biophilia into urban planning, bridging theory and application.

Emerging references signal newer threads. Blau et al. (2018) on urban river restoration points to blue-green infrastructure. Peripheral nodes such as Bixler et al. (2002) (children's play in nature) and Hartig and Mang (1991) (restorative experiences) mark niche topics at the map's edges. Overall, the network confirms a cohesive, Western-led canon in environmental psychology and ecology. References from Islamic environmental thought seldom meet the inclusion threshold, indicating their limited presence in the field's shared foundation. Table 5 demonstrate the top 10 co-cited references in biophilic design research.

**Table 5.** Top 10 co-cited references in biophilic design research (2015–2024), ranked by number of corpus papers citing each. (Data source: 70 Scopus-indexed articles, retrieved 20 Jan 2025)

| Rank | Reference (Author, Year) | Times cited by corpus |
|---|---|---|
| 1 | Kaplan, R. & Kaplan, S. (1989). *The Experience of Nature: A Psychological Perspective.* | 25 |
| 2 | Ulrich, R.S. (1984). "View through a window may influence recovery from surgery." *Science.* | 25 |
| 3 | Wilson, E.O. (1986). *Biophilia.* Harvard Univ. Press. | 24 |
| 4 | Kellert, S.R. & Wilson, E.O. (1995). *The Biophilia Hypothesis.* | 22 |
| 5 | Gillis, K. & Gatersleben, B. (2015). "A review of... benefits of biophilic design." *Buildings.* | 15 |
| 6 | Beatley, T. & Newman, P. (2013). "Biophilic cities are sustainable, resilient cities." *Sustainability.* | 10 |
| 7 | Berto, R. *et al.* (2018). "Some observations about biophilia and restorativeness." *Behavioral Sciences.* | 9 |
| 8 | Hartig, T. & Mang, M. (1991). "Restorative effects of natural environment experiences." *Environment & Behavior.* | 7 |
| 9 | Lin, B.B. *et al.* (2018). "Urban gardens as a space to engender biophilia…" *Frontiers in Built Env.* | 7 |
| 10 | Hand, K.L. *et al.* (2017). "Urban gardens supporting children's biophilia." *PNAS.* | 6 |

Moving from individual works to authors, the co-citation analysis identified groups of scholars who constitute the intellectual pillars of biophilic design. The mapping considered authors cited frequently across the corpus (threshold: ≥20 citations) as illustrated in Figure 5. Table 6 shows the top 10 co-cited authors in biophilic design research. Four major thematic groupings emerged:

- Foundations of biophilia theory. Anchored by E.O. Wilson and S.R. Kellert (76 citations each; TLS ~1,939), with close ties to S. Kaplan (66; TLS ~1,878) and R. Kaplan (36; TLS ~1,154). Establishes biophilia's evolutionary roots and psychological evidence which is the field's conceptual core.

- Restorative environments and psychological benefits. Led by T. Hartig (64; TLS ~1,878) and R.S. Ulrich (59; TLS ~1,683), foregrounding empirical links between natural settings, stress reduction, and recovery, cements health outcomes as a primary driver.
- Biophilic urbanism and sustainability. Driven by T. Beatley (71; TLS ~1,241) and P. Newman (49; TLS ~683), connecting biophilia to sustainable cities, green infrastructure, and policy. G. Barbiero (49; TLS ~1,781) bridges theory and practice via design standards and guidelines.
- Emerging and niche contributors. Exemplified by R. Berto (58; TLS ~2,018), whose high linkage indicates cross-cutting influence on restorativeness and human-centred design across varied contexts (e.g., education, hospitality).

**Table 6.** Top 10 co-cited authors in biophilic design research, with number of citations in the corpus and total link strength (TLS) from author co-citation analysis (VOSviewer). (Data: 70 articles' references, 2015–2024, Scopus)

| Rank | Author | Citations in corpus | Total Link Strength (TLS) |
|---|---|---|---|
| 1 | Kellert, Stephen R. (USA) – environmental scholar | 76 | 1939 |
| 2 | Wilson, Edward O. (USA) – biologist/naturalist | 76 | 1803 |
| 3 | Beatley, Timothy (USA) – urban planner | 71 | 1241 |
| 4 | Kaplan, Stephen (USA) – environmental psychologist | 66 | 1878 |
| 5 | Hartig, Terry (Sweden) – environmental psychologist | 64 | 1878 |
| 6 | Ulrich, Roger S. (USA) – healthcare design researcher | 59 | 1683 |
| 7 | Berto, Rita (Italy) – psychology of design | 58 | 2018 |
| 8 | Barbiero, Giuseppe (Italy) – ecology/education | 49 | 1781 |
| 9 | Newman, Peter (Australia) – sustainability/transport | 49 | 683 |
| 10 | Kaplan, Rachel (USA) – environmental psychologist | 36 | 1154 |

Co-citation results at both reference and author levels expose a clear gap: Islamic ecological ethics and thinkers are virtually absent from the foundational canon of biophilic design. The seminal touchstones which is Ulrich's healing environments, the Kaplans' environmental psychology, Wilson's Biophilia, and Kellert's design interpretations rest on Western paradigms and, while broadly informative, do not account for culturally specific values central to Islam or other non-Western traditions.

Several missed convergences are evident. *Sakinah* could enrich restorative models by framing calm as spiritual harmony, not only physiological recovery. *Mizan* would recast sustainability and resilience as ethical duties, not just ecological targets. *Khalifa* aligns naturally with ethical governance in biophilic urbanism but is rarely invoked. *Hima* offers a ready framework for collective resource management, for example, community-managed gardens or protected green sanctuaries, yet it scarcely appears. Integrating these principles would broaden biophilic theory, embedding spiritual values and communal ethics to make the discourse more inclusive and resonant in Muslim-majority contexts.

### 3.4 Result of Co-occurrence of Keyword Analysis

Using VOSviewer, a keyword co-occurrence analysis mapped themes across the 70 articles. Figure 6 displays author-supplied keywords as nodes linked by their co-appearance within documents. A minimum occurrence of 3 yielded 46 keywords. With full counting and association-strength normalisation, node size reflects frequency and link thickness indicates co-occurrence strength; colour clusters denote thematic groupings.

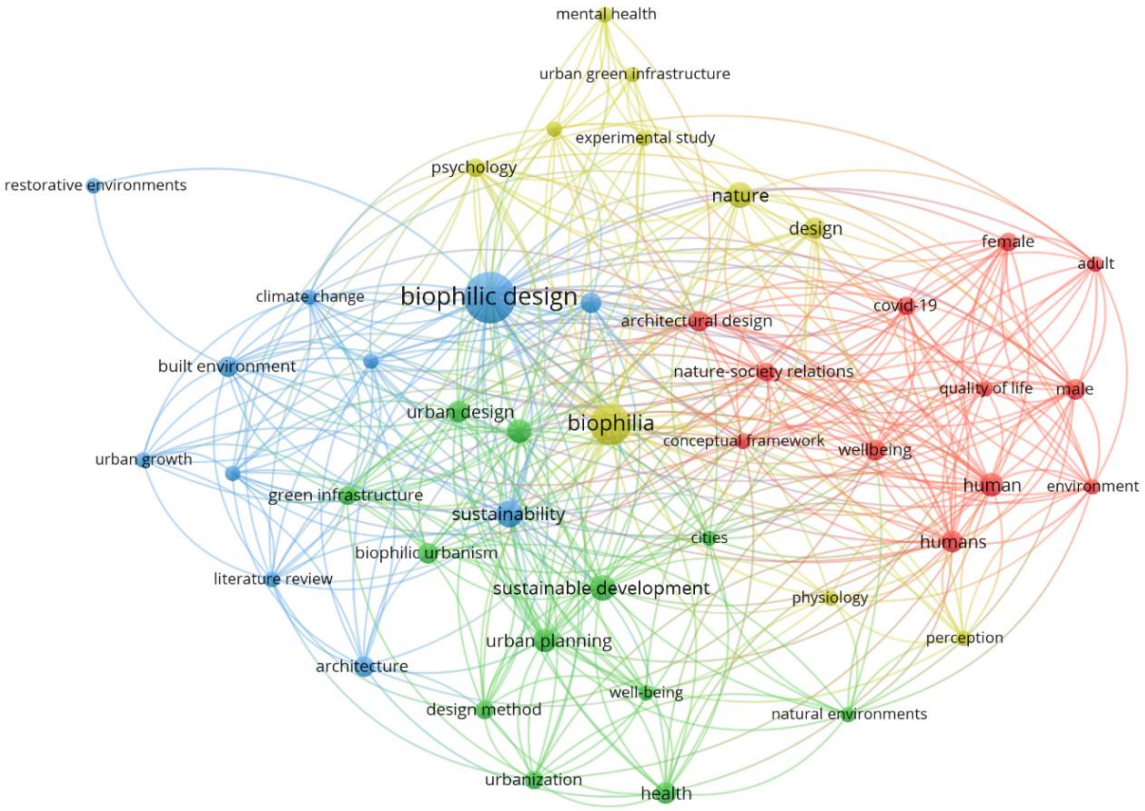


**Figure 6.** Co-occurrence network of frequent keywords in biophilic landscape design research (VOSviewer v1.6.20). A minimum of 3 occurrences was required for inclusion (46 keywords met this threshold). Nodes are sized by occurrence count and coloured by cluster, illustrating major research themes. Data: Scopus (2015–2024, keywords as provided by authors) (Source: Authors)

Terminology is led by "biophilic design" (34 occurrences) and "biophilia" (21), followed by "sustainability" (9), "sustainable development" (8), and "nature" (8). The distribution confirms sustained emphasis on biophilic design and its alignment with sustainability agendas, combining the human–nature connection with broader environmental goals. Table 7 shows the top 10 keywords in biophilic design literature.

**Table 7.** Top 10 keywords in biophilic design literature (2015–2024) by occurrence, with total link strength (TLS) from co-occurrence network. (Data derived from author keywords in 70 Scopus articles; minimum 3 occurrences)

| No. | Keyword | Occurrences |
|---|---|---|
| 1 | biophilic design | 34 |
| 2 | biophilia | 21 |
| 3 | sustainability | 9 |
| 4 | sustainable development | 8 |
| 5 | nature | 8 |
| 6 | green infrastructure | 7 |
| 7 | urban planning | 6 |
| 8 | restoration (or restorative) | 6 |
| 9 | mental health | 5 |
| 10 | biodiversity | 5 |

In the keyword network, four thematic clusters emerge (colour-coded in Figure 6), each representing a grouping of concepts often studied together:

- Red cluster (12 terms): Foundational concepts/frameworks: e.g., "conceptual framework," "environmental systems," "wellbeing," plus demographic tags ("male," "female"), indicating occasional gender-focused analyses and the field's basic conceptual/psychological context.
- Green cluster (12 terms): Urban applications/planning: "biophilic urbanism," "greenspace planning," "green infrastructure," "urban design," "sustainable development," centring on city- and neighbourhood-scale implementation.
- Blue cluster (11 terms): Ecological/technical dimensions: "biodiversity," "environmental protection," "built environment adaptation," "biophilic design implementation," highlighting conservation science and technical deployment.
- Yellow cluster (10 terms): Human–nature and health: "biophilia (theory)," "mental health," "nature-connectedness," "physiological impact," "psychological impact," focusing on experiential and health outcomes.

Taken together, the clusters trace an interdisciplinary landscape: theory and frameworks (Red), urban implementation (Green), ecological/technical concerns (Blue), and human experience and health (Yellow). The centrality of "biophilic design" alongside "sustainability" signals a field increasingly fusing ecological integrity with human-centred goals by framing biophilic design not merely as aesthetics or psychology, but as a strategy to advance sustainable development while improving well-being.

The keyword co-occurrence analysis highlights both strengths and absences. The field is organised around four clusters, foundations (Red), urban sustainability (Green), ecological/technical themes (Blue), and human health (Yellow) and dominated by terms such as biophilic design, sustainability, nature, urbanism, and mental health. This vocabulary underscores a strong, interdisciplinary discourse but one that remains secular and universalist, with no presence of Islamic concepts. None of the 70 articles use Islam, Islamic environment, or values such as *Hima, Mizan, Khalifa,* or *Sakinah* as keywords, confirming that culturally specific or spiritually embedded perspectives have not yet shaped the field.

At the same time, each cluster presents a natural entry point for Islamic ecological principles. *Khalifa* could enrich Green-cluster debates on sustainable cities by framing urban design as a divinely entrusted responsibility. *Hima* aligns with the blue cluster's focus on biodiversity and protection, offering a culturally rooted model of collective resource management. The Yellow cluster's emphasis on health and connectedness could be deepened by *Sakinah*, linking stress recovery to spiritual peace. Finally, *Mizan* could extend the Red cluster's systemic frameworks by coupling ecological equilibrium with moral balance. Integrating these principles would not diminish existing insights but add ethical depth and cultural resonance, broadening the theoretical framework of biophilic design for contexts where environmental and spiritual values are intertwined.

## 4.0 DISCUSSIONS

### 4.1 Publication Growth and Influence

The results suggest that publication output stayed modest from 2015 to 2020 (2–6 papers per year) and then rose sharply in 2021 (15 papers), remaining relatively high through 2024. Citations did not increase at the same pace as it climbed to 291 in 2018, peaked at 405 in 2021, and then fell in 2022–2024. This pattern reflects two realities: citations are concentrated around a small number of highly influential studies, and newer papers have had less time to be cited. Overall, the field appears to be shaped by a few key "anchors" works rather than a steady accumulation of equally influential publications.

The dataset shows wide international participation but a less diverse knowledge base. The corpus includes 70 articles written by 186 authors from 133 institutions across 31 countries, with strong multi-country collaboration (98.92%). Even so, the core theories and frequently cited foundations remain largely Western,

suggesting that global authorship has not yet translated into a more plural and culturally varied theoretical framework.

### 4.2 Core Literature and Western Influence

The bibliographic coupling network identifies three main thematic clusters (Figure 3): Well-being and Psychology, Urban Sustainability, and Evolutionary Frameworks. The most-cited works align closely with these clusters (Table 4). Gillis and Gatersleben (2015) anchors the well-being and psychology strand (216 citations), while highly cited studies on urban gardens, nature connectedness, sustainability, and evolutionary framing shape the other clusters. Overall, the field is organised around broadly universal framings such as health restoration, sustainability, and evolutionary explanations of environmental preference, rather than culturally grounded ethical frameworks.

Co-citation results help explain why this orientation persists. At the reference level, Ulrich (1984) and Kaplan and Kaplan (1989) sit at the centre of the network (each cited by 25 of the 70 papers), followed by Wilson (1986) (24) and Kellert and Wilson (1995) (22) (Figure 4; Table 5). Together, these foundational texts establish two dominant lines of thinking which is restorative environmental psychology and evolutionary biophilia. These frameworks continue to define what is treated as core knowledge in the field.

A similar pattern appears at the author level. The ten most co-cited authors are dominated by U.S.-based scholars and Western institutions, including Kellert, Wilson, Beatley, Kaplan, and Ulrich, with additional influence from Sweden, Italy, and Australia (Table 6; Figure 5). This dominance reflects both historical and institutional factors. Many key concepts and measurement traditions in restoration research, health-oriented design, and biophilia theory were developed within Western research networks and then reinforced through citation practices and academic training. Scopus coverage and English-language publishing norms also tend to privilege Anglophone and Euro-American journals and books, consistent with the study's scope limits. As a result, influence consolidates through repeated co-citation, and conceptual diversification becomes difficult unless new contributions enter the same citation networks with comparable visibility and empirical credibility.

### 4.3 Presence of Islamic Ecological Ethics in the Bibliometric Results

Keyword co-occurrence results (Figure 6) show four broad topic areas: foundational frameworks (Red), urban applications and planning (Green), ecological and technical implementation (Blue), and human–nature and health outcomes (Yellow). Unsurprisingly, "biophilic design" (34) and "biophilia" (21) dominate the vocabulary. Other recurring terms include "sustainability" (9), "sustainable development" (8), "nature" (8), and "green infrastructure" (7), along with keywords related to restoration and mental health (Table 7). Taken together, these clusters suggest that the literature is interdisciplinary, with a clear emphasis on linking well-being outcomes to sustainability and practical implementation.

A key finding is the lack of explicit Islamic framing within the high-frequency keyword vocabulary. None of the 70 papers use Islam-related concepts such as *Hima, Mizan, Khalifa*, or *Sakinah* as keywords. This suggests that Islamic ecological ethics have not shaped the field's mainstream thematic indexing within this corpus. Co-citation findings align with this pattern, as Islamic environmental thought seldom reaches inclusion thresholds in reference and author co-citation analyses, indicating limited integration into the shared intellectual foundation of the mapped literature.

This result should not be interpreted as evidence that relevant Islamic scholarship does not exist. Rather, it indicates that within the Scopus-indexed, English-language corpus analysed, Islamic ecological ethics are not currently visible in the field's organising structures, including dominant keywords, central references, and leading co-cited author clusters.

### 4.4 Evidence-based Entry Points for *Hima, Mizan, Sakinah,* and *Khalifa*

Mapped clusters do not reflect the lack of conceptual compatibility. They reflect the lack of integration into core networks. Each Islamic principle corresponds with a trajectory of research that is already in place, providing an intervention path that is tangible and integrated into the current structure of the field.

#### *4.4.1 Positioning Sakinah in restoration research*

The Well-being and Psychology cluster (Figure 3) is anchored in stress recovery and restorative outcomes, with highly influential synthesis and measurement-oriented work defining the cluster's centre of gravity. The keyword network corroborates this emphasis through "restoration," "mental health," and "nature-connectedness" (Figure 6; Table 7). *Sakinah* represents a defensible extension point precisely because it maps onto the same outcome domain (calm/restoration) while adding a culturally meaningful framing that can be operationalised and tested within existing restorative models.

#### *4.4.2 Using Hima to Strengthen Community Nature Management*

The Urban Sustainability cluster links biophilic strategies with green infrastructure, urban planning, and community engagement (Figure 3). The Green and Blue keyword clusters also emphasise "green infrastructure," "urban planning," "biodiversity," and "environmental protection" (Figure 6). Hima adds a governance and institutional approach through community-managed conservation. This aligns with the field's sustainability agenda, but it is not yet visible as an explicit organising concept in the dominant keyword vocabulary or co-citation foundations.

#### *4.4.3 Mizan and Sustainability Evaluation*

Sustainability is a central keyword and often appears alongside biophilic design (Table 7). Sustainability-focused authors and references also hold prominent positions in both citation and co-citation structures. *Mizan* fits naturally within this sustainability focus, but it shifts the emphasis from technical optimisation to proportionality as an ethical standard. This shift is only defensible when it is translated into measurable planning and design criteria. The most practical route is therefore methodological: defining balance as explicit evaluation constructs that can be used in sustainability-oriented biophilic assessment work already represented in the citation network (Table 4).

#### *4.4.4 Khalifa and Responsibility in Design Governance*

The author co-citation map shows a strong biophilic urbanism and sustainability cluster shaped by urban planning and policy-oriented scholarship (Figure 5; Table 6). *Khalifa* fits most naturally within this strand as a governance and accountability framing that sits alongside existing sustainability and management approaches, rather than as a rhetorical add-on. The absence of these terms from the field's keyword vocabulary suggests that stewardship has not yet become a shared indexing category within the biophilic design literature.

These entry points show how Islamic scholarship can enter the field's knowledge networks. Integration is most likely to gain traction when Islamic concepts are operationalised within high-centrality clusters, expressed in language used by dominant research streams such as health outcomes, sustainability performance, and governance models, and linked through citation practice to the field's canonical foundations (Figures 4–5; Tables 5–6).

### 4.5 Implications for Theory and Practice

The field's conceptual core remains anchored in restorative psychology and evolutionary biophilia, reinforced through dense co-citation around a small set of classic works (Figure 4; Table 5). The mapped absence of Islamic ethics in keywords and co-citation indicates that biophilic design theory currently functions as a largely secular, universalist framework within the indexed corpus (Figure 6). Theoretical diversification is therefore not a matter of adding "context" paragraphs; it requires concept operationalisation that can enter the same citation and keyword ecosystems that sustain the field's canon.

The keyword and citation clusters indicate where applied biophilic work is concentrated (urban planning/green infrastructure; biodiversity/implementation; well-being outcomes). These clusters provide bounded domains for translating Islamic principles into practice indicators: restorative performance (*Sakinah*), community governance of green assets (*Hima*), proportional sustainability evaluation (*Mizan*), and stewardship/accountability instruments in planning and development (*Khalifa*). The maps therefore support targeted, cluster-aligned translation rather than broad prescriptive guidance.

### 4.6 Future Research Directions Grounded in the Mapped Gaps

Three directions follow directly from the bibliometric evidence. First, Islamic concepts should be operationalised as testable constructs within the field's dominant outcome and governance domains, enabling entry into the high-centrality clusters identified in Figure 3 and Figure 6. Second, bibliometric visibility requires deliberate scholarly practice: explicit keywording, clear conceptual definitions, and citation linkages to canonical works that currently structure co-citation networks (Tables 5–6). Third, coverage limits should be addressed in subsequent mapping exercises through multilingual and regionally indexed sources, given the acknowledged constraints of a Scopus-only, English-language corpus.

## 5.0 CONCLUSIONS

This study offers a reproducible bibliometric map of biophilic landscape design research in the built environment (2015–2024). The field clusters around well-being/restoration, urban sustainability applications, and evolutionary/theoretical framings, supported by a concentrated co-citation core. Within the Scopus-indexed, English-language corpus analysed, Islamic ecological ethics do not register as organising concepts in the dominant keyword and co-citation structures, indicating an identifiable integration gap in the indexed knowledge base.

The study's distinct contribution is an analytic crosswalk that positions *Hima, Mizan, Sakinah,* and *Khalifa* as cluster-aligned entry points for theory building and for specifying design decision parameters that are legible to the field's existing research streams. Limits include database and language bias, indexing effects, and the tendency of bibliometrics to privilege highly cited and frequently indexed concepts. Future research should expand coverage using multilingual and regional sources, operationalise the four principles into testable constructs within restoration and sustainability domains, and evaluate their uptake through mixed-method case studies, including whether such constructs become visible in keyword vocabularies and citation networks over time.

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