



RESEARCH ARTICLE

## Evaluating Biophilic Design Integration in Nigerian Judiciary Complexes: A Multi-Case Assessment of Architectural Characteristics for Sustainable Judicial Infrastructure

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### Abstract

*Biophilic design has emerged as a sustainable architectural strategy for enhancing occupants' health, well-being, and environmental quality through the integration of natural systems into the built environment. However, empirical evidence regarding its implementation in judicial facilities remains limited, particularly in developing countries. This study evaluated the level of biophilic design integration in ten (10) purposively selected judiciary complexes across Nigeria using a qualitative multiple-case study approach. Data were collected through structured field observations, photographic documentation, and an assessment checklist adapted from the 14 Patterns of Biophilic Design. A literature-informed Weighted Biophilic Design Assessment Index (BDAI) was developed to assess three dimensions of biophilic design: Nature in the Space (45%), Natural Analogues (20%), and Nature of the Space (35%). The results showed that Nature in the Space achieved the highest level of implementation, with dimension scores ranging from 40.0% to 86.7%, reflecting the widespread incorporation of natural lighting and passive ventilation across the assessed judiciary complexes. In contrast, 80% of the complexes demonstrated only moderate performance in Natural Analogues, while 40% exhibited strong performance in Nature of the Space, indicating inconsistent provision of restorative outdoor spaces, courtyards, and visual connections to nature. The Ogun State Judiciary Complex recorded the highest overall weighted BDAI score (84.4%), followed by the Delta State High Court Complex and Oyo State Judiciary High Court Complex (both 77.2%), whereas the Umuene Court Complex achieved the lowest score (31.7%). The findings indicate that courthouse architecture in Nigeria remains largely dependent on passive climate-responsive strategies rather than comprehensive biophilic design. The proposed Weighted BDAI provides a transparent and replicable framework for evaluating biophilic performance in public buildings and offers evidence-based guidance for designing healthier, more sustainable, and psychologically restorative judicial environments*

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## 1. INTRODUCTION

The quality of the built environment exerts a profound influence on human health, psychological well-being, cognitive performance, and social behaviour. While contemporary urban development has improved access to infrastructure and public services, it has also intensified the separation between people and natural environments through highly engineered buildings, dense urban forms, and increased reliance on artificial environmental control systems. This progressive disconnection from nature has been associated with elevated stress levels, reduced psychological restoration, lower workplace productivity, and poorer indoor environmental quality, thereby stimulating renewed interest in human-centred architectural approaches that reconnect occupants with natural systems (Ryan & Browning, 2020; Andreucci *et al.*, 2021; Usip *et al.*, 2026).

Biophilic design has consequently emerged as one of the most influential paradigms in contemporary sustainable architecture. Rooted in Wilson's (2017) Biophilia Hypothesis and further operationalised by Kellert (2008), the concept proposes that humans possess an innate affinity for nature that can be translated into architectural design through deliberate integration of natural light, vegetation, water, natural ventilation, ecological processes, natural materials, and spatial configurations that mimic natural environments. Rather than serving purely aesthetic purposes, these interventions seek to improve occupants' physiological and psychological functioning while simultaneously enhancing environmental performance and resource efficiency (Kellert, 2008; Kellert *et al.*, 2011).

Growing empirical evidence demonstrates that biophilic environments produce measurable benefits across multiple building typologies. Systematic reviews have shown that exposure to daylight, natural ventilation, vegetation, and visual connections with nature reduces stress, improves attention restoration, enhances emotional well-being, supports cognitive functioning, and increases occupant satisfaction (Andreucci *et al.*, 2021; Usip *et al.*, 2026). Similar evidence indicates that biophilic strategies improve indoor environmental quality while contributing to reductions in building energy demand through passive environmental design, thereby aligning occupant health objectives with sustainability goals (Yin *et al.*, 2024; Tekin *et al.*, 2025).

The increasing emphasis on climate-responsive and healthy buildings has further strengthened the relevance of biophilic design within sustainable development. Contemporary sustainable architecture extends beyond reducing operational energy consumption to creating environments that simultaneously support ecological resilience, human health, and social well-being. Consequently, biophilic design has become an integral component of green building assessment frameworks and healthy building initiatives, contributing directly to broader sustainability objectives, including the United Nations Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action) (World Green Building Council, 2014; Andreucci *et al.*, 2021).

Although biophilic design has been extensively investigated in healthcare facilities, educational buildings, workplaces, hospitality environments, and residential developments, considerably less attention has been devoted to judicial architecture. Judiciary complexes represent distinctive public buildings where judges, lawyers, litigants, witnesses, administrative personnel, security agencies, and members of the public frequently experience emotionally demanding interactions. Court proceedings often involve conflict resolution, criminal adjudication, family disputes, and other highly stressful circumstances, making courthouse environments particularly sensitive to environmental factors that influence stress, comfort, concentration, and psychological restoration. Architectural environments that minimise stress while promoting comfort and dignity therefore have significant implications for the effectiveness of judicial processes and user experience (Mulcahy & Rowden, 2019).

Internationally, recent courthouse developments increasingly integrate biophilic design strategies such as landscaped courtyards, naturally ventilated atria, daylight-oriented planning, indoor vegetation, green roofs, and restorative outdoor spaces to create healthier and more supportive judicial environments. These interventions have been reported to improve users' psychological comfort while simultaneously reducing dependence on mechanical environmental systems and improving environmental performance (Ryan & Browning, 2020; Tekin *et al.*, 2025). Nevertheless, evidence regarding the adoption and effectiveness of such strategies within judicial infrastructure in developing countries remains extremely limited.

In Nigeria, courthouse development has traditionally prioritised functionality, security, and operational efficiency, with relatively limited consideration given to occupants' environmental comfort, restorative experiences, or biophilic qualities. Many judiciary complexes continue to rely heavily on conventional architectural approaches characterised by inadequate landscape integration, limited visual access to nature, insufficient outdoor restorative spaces, and dependence on artificial environmental systems. While these buildings generally satisfy functional requirements, their capacity to promote occupant well-being and environmental sustainability has received little empirical investigation (Dreyer *et al.*, 2018).

A review of existing literature reveals three important knowledge gaps. First, most empirical studies on biophilic design concentrate on healthcare, educational, commercial, and residential buildings, leaving judicial facilities comparatively underexplored. Second, studies evaluating the architectural characteristics of existing courthouse environments from a biophilic design perspective remain scarce, particularly within Sub-Saharan Africa. Third, evidence-based assessments capable of informing future courthouse planning and design in Nigeria are largely absent. Addressing these gaps is essential for developing judicial environments that are not only secure and functional but also supportive of users' psychological well-being and environmental sustainability.

Against this background, this study evaluates the architectural characteristics of biophilic design in selected judiciary complexes in Nigeria. Specifically, it examines the extent to which key biophilic design principles have been incorporated into existing courthouse buildings, identifies strengths and deficiencies in current architectural practice, and provides recommendations for improving the planning and design of future judicial facilities. The study contributes to the growing body of knowledge on biophilic architecture by extending its application to judicial buildings within a developing-country context and provides evidence that can inform architectural practice, facility management, and public infrastructure policy.

## 2. LITERATURE REVIEW

### 2.1 Conceptual Foundations of Biophilic Design

Biophilic design is an evidence-based architectural approach that promotes the integration of natural systems and processes into the built environment to enhance human health, well-being, and environmental sustainability. The concept originates from the Biophilia Hypothesis, which proposes that humans possess an inherent tendency to affiliate with nature because of their evolutionary dependence on natural environments (Wilson, 2017). Building upon this theory, Kellert (2008) conceptualised biophilic design as the deliberate incorporation of natural elements, ecological processes, and nature-inspired forms into architectural design to strengthen human–nature relationships within contemporary urban settings.

Unlike conventional sustainable design, which primarily focuses on reducing environmental impacts through resource efficiency and energy conservation, biophilic design extends sustainability objectives by explicitly addressing occupants' physiological, psychological, and cognitive needs. Consequently, it has become an important component of healthy building design, integrating passive environmental strategies with restorative natural experiences (Kellert *et al.*, 2011).

To facilitate practical implementation, Ryan, Browning, Clancy, Andrews & Kallianpurkar (2014) proposed the widely adopted 14 Patterns of Biophilic Design, which are organized into three complementary dimensions. The first dimension, Nature in Space, involves direct interactions with natural elements such as daylight, vegetation, water, airflow, and seasonal changes. The second dimension, Natural Analogues, incorporates indirect representations of nature through biomorphic forms, natural materials, colors, textures, and patterns. Finally, Nature of Space emphasizes spatial configurations that provide prospect, refuge, mystery, complexity, and opportunities for exploration.

These dimensions provide a comprehensive framework for evaluating the biophilic quality of buildings and have been extensively applied in studies of healthcare facilities, educational institutions, office buildings, hospitality facilities, and residential developments (Ryan *et al.*, 2014).

### 2.2 Biophilic Design and Human Well-being

The relationship between natural environments and human health has become one of the most extensively investigated topics in environmental psychology and building science. Increasing empirical evidence

demonstrates that exposure to natural elements within buildings positively influences physiological functioning, emotional well-being, cognitive performance, and workplace productivity.

A systematic review by Andreucci *et al.* (2021) found that biophilic interventions consistently improve occupants' psychological well-being while reducing stress and enhancing environmental satisfaction across multiple building types. Similarly, Usip *et al.* (2026) identified several biological mechanisms through which exposure to vegetation, daylight, fresh air, and natural materials influences endocrine responses, immune function, cardiovascular regulation, and cognitive restoration.

Visual access to nature has also been associated with improved concentration, reduced mental fatigue, and enhanced recovery from psychological stress. These findings are consistent with Attention Restoration Theory (ART), which suggests that natural environments replenish depleted cognitive resources through effortless attention (Kaplan & Kaplan, 1989), and Stress Recovery Theory (SRT), which argues that exposure to natural settings accelerates physiological recovery from stressful experiences (Ulrich *et al.*, 1991).

Beyond psychological benefits, biophilic design contributes to improved indoor environmental quality. Access to daylight improves circadian rhythm regulation, while natural ventilation enhances thermal comfort and indoor air quality, thereby reducing dependence on mechanical environmental systems (Yin *et al.*, 2024). These findings reinforce the growing consensus that healthy buildings should integrate environmental sustainability with human-centred design principles.

### **2.3 Biophilic Design within Sustainable Public Architecture**

Public buildings play a significant role in promoting environmental sustainability because of their high occupancy rates, social functions, and long operational lifespans. Increasingly, governments and public institutions are adopting sustainable architectural approaches that reduce operational energy consumption while simultaneously improving user well-being.

Biophilic design complements conventional green building strategies by integrating passive environmental systems with ecological and social objectives. Recent studies have demonstrated that buildings incorporating natural ventilation, daylight optimisation, green infrastructure, and landscape integration achieve lower operational energy demands while simultaneously improving occupant comfort and environmental performance (Tekin *et al.*, 2025).

Furthermore, contemporary sustainability assessment frameworks increasingly recognise the importance of human health as an essential component of building performance. Consequently, biophilic design has become closely aligned with certification systems such as WELL Building Standard, LEED, and the Living Building Challenge, all of which encourage stronger integration of nature within the built environment (World Green Building Council, 2014).

Despite these advances, implementation within many developing countries remains inconsistent because of financial constraints, inadequate design awareness, maintenance concerns, and limited incorporation of biophilic principles into national building regulations.

### **2.4 Judicial Architecture and Environmental Quality**

Judicial buildings constitute a distinctive category of public infrastructure because they accommodate highly diverse user groups operating under emotionally demanding circumstances. Judges, lawyers, litigants, witnesses, court officials, detainees, and members of the public routinely interact within environments characterised by legal uncertainty, conflict resolution, and heightened psychological stress.

Historically, courthouse architecture has prioritised authority, permanence, security, and institutional identity. Contemporary courthouse planning similarly emphasises controlled circulation, surveillance, secure access, and operational efficiency. While these requirements are essential for judicial administration, they frequently result in enclosed interior spaces with limited access to daylight, natural ventilation, vegetation, and restorative outdoor environments.

Research increasingly suggests that courthouse environments influence occupants' emotional responses, perceived fairness, stress levels, and overall user experience. Well-designed judicial environments can improve comfort, reduce anxiety, facilitate clearer communication, and contribute to more positive perceptions of justice administration (Hagan, 2018). Consequently, architects are increasingly exploring approaches that reconcile stringent security requirements with healthier and more supportive environmental conditions.

Internationally, several recent judicial projects have incorporated landscaped courtyards, naturally ventilated atria, daylight-oriented planning, indoor vegetation, and restorative gardens to create more humane courthouse environments. These developments illustrate the growing recognition that environmental quality contributes to institutional effectiveness without compromising functional requirements (Ayalon & Toch, 2021).

## 2.5 Biophilic Design in the Nigerian Built Environment

Interest in biophilic design within Nigeria has increased alongside growing concerns regarding urbanisation, climate change, and indoor environmental quality. Existing studies have predominantly examined educational buildings, healthcare facilities, commercial developments, and residential architecture, where passive cooling strategies, natural ventilation, courtyard planning, and landscape integration have demonstrated significant potential for improving thermal comfort and reducing operational energy consumption (Kalu & Ogunnaike, 2025; Umeora *et al.*, 2025).

However, empirical investigations remain relatively limited compared with those in developed countries, and most available studies focus primarily on environmental sustainability rather than on comprehensive assessments of occupants' psychological well-being. Furthermore, there remains little consensus regarding the extent to which Nigerian public buildings intentionally incorporate recognised biophilic design principles rather than relying on passive climatic responses alone.

Within judicial architecture, published empirical evidence is particularly scarce. Most courthouse developments continue to prioritise functional efficiency and security with relatively limited evaluation of environmental quality, restorative spaces, or occupants' experiences. Consequently, there is insufficient evidence to determine the current level of biophilic integration within Nigerian judiciary complexes or to establish design strategies appropriate for future judicial infrastructure.

## 2.6 Research Gap

Although substantial progress has been made in understanding the benefits of biophilic design across healthcare, educational, commercial, and residential buildings, three important gaps remain.

First, existing research overwhelmingly concentrates on building typologies where health and productivity are the primary performance indicators, while judicial facilities remain comparatively under-investigated despite their unique functional and psychological requirements. Second, empirical evaluations of existing courthouse architecture using recognised biophilic assessment frameworks remain limited, particularly within developing countries where climatic conditions, institutional priorities, and resource constraints differ significantly from those of developed nations. Third, there is a paucity of evidence from Nigeria regarding the architectural characteristics of biophilic design in judiciary complexes. Consequently, architects, policymakers, and facility managers currently lack evidence-based guidance for integrating biophilic principles into future judicial infrastructure.

This study addresses these gaps by evaluating the architectural characteristics of selected judiciary complexes in Nigeria using established biophilic design principles. The findings provide empirical evidence to inform courthouse planning, architectural practice, and public infrastructure policy while extending the application of biophilic design to an underexplored building typology within the Global South.

## 3. MATERIALS AND METHODS

### 3.1 Research Design

This study employed a qualitative multiple-case study design to evaluate the architectural characteristics of biophilic design in selected judiciary complexes in Nigeria. A case study approach was considered

appropriate because it enables a comprehensive examination of complex architectural phenomena within their real-world contexts, allowing detailed assessment of spatial configurations, environmental characteristics, and design attributes that cannot be adequately investigated through experimental methods (Groat & Wang, 2013; Yin, 2018).

The qualitative approach facilitated systematic observation and interpretation of existing architectural features without altering the physical environment. Since the objective of the study was to evaluate the extent to which biophilic design principles have been incorporated into existing judiciary complexes, direct architectural assessment provided the most suitable methodological framework.

### 3.2 Study Area

The study was conducted in Nigeria, where judiciary complexes constitute important public infrastructure serving judicial, administrative, and civic functions. These facilities accommodate judges, lawyers, court officials, litigants, security personnel, and members of the public, making them environments characterised by diverse user needs and varying psychological demands.

Given Nigeria's diverse climatic conditions, architectural traditions, and regional development patterns, judiciary complexes across different geopolitical zones exhibit variations in design approaches, environmental responsiveness, and landscape integration. Evaluating buildings from different locations, therefore, provides broader insight into the implementation of biophilic design principles within the Nigerian judicial system.

### 3.3 Selection of Case Studies

A purposive sampling strategy was adopted to select ten judiciary complexes that adequately represent geographical diversity, functional significance, and architectural variation across Nigeria. Purposive sampling is widely recommended in qualitative architectural research because it enables the deliberate selection of information-rich cases capable of providing meaningful insights into the phenomenon under investigation (Patton, 2015). Table 1 presents the selected case studies.

**Table 1.** The selected case studies comprise

| S/N | Judiciary Complex                      | Location               |
|-----|----------------------------------------|------------------------|
| 1   | Ogun State Judiciary Complex           | Abeokuta, Ogun State   |
| 2   | Ekiti State High Court                 | Ado-Ekiti, Ekiti State |
| 3   | Delta State High Court Complex         | Asaba, Delta State     |
| 4   | Edo State Judiciary Complex            | Benin City, Edo State  |
| 5   | Osun State High Court                  | Osogbo, Osun State     |
| 6   | Oyo State Judiciary High Court Complex | Ibadan, Oyo State      |
| 7   | Umuene Court Complex                   | Isiala, Abia State     |
| 8   | Plateau State High Court Complex       | Jos, Plateau State     |
| 9   | Sokoto State High Court Complex        | Sokoto State           |
| 10  | Bauchi State High Court Complex        | Bauchi State           |

These buildings were selected because they represent operational judicial facilities with varying architectural characteristics, enabling comparative evaluation of biophilic design implementation.

### 3.4 Data Collection

Data were collected using multiple complementary techniques to improve the credibility and reliability of the findings through methodological triangulation.

#### 3.4.1 Site Observation

Direct architectural observation constituted the primary source of data. Each judiciary complex was systematically inspected to evaluate architectural elements associated with recognised biophilic design principles.

Field observations were conducted using a structured observational checklist to ensure consistency across all case studies. These observations focused specifically on natural lighting, natural ventilation, landscape integration, vegetation, and water features. Additionally, the checklist accounted for visual access to nature,

the use of natural materials, courtyard design, spatial organization, outdoor relaxation spaces, building orientation, and overall environmental quality.

### 3.4.2 Photographic Documentation

Photographs were taken to document key architectural characteristics observed during site visits. Photographic records served as visual evidence for subsequent comparative analysis and facilitated verification of observational findings.

### 3.4.3 Observation Checklist

An observational checklist was developed based on the 14 Patterns of Biophilic Design proposed by Ryan *et al.* (2014). To improve practical application within judicial environments, the indicators were grouped into three major evaluation categories: Nature in the Space, Natural Analogues, and Nature of the Space.

Each category comprised observable architectural attributes that could be consistently assessed across all selected judiciary complexes. To achieve this, the checklist evaluated the presence and quality of features including daylight availability, natural ventilation, vegetation, landscape quality, and water elements. Furthermore, it examined the integration of natural materials and biomorphic forms, alongside spatial characteristics such as prospect, refuge, outdoor spaces, and visual connectivity with nature.

### 3.5 Data Analysis

To facilitate objective comparison among the selected judiciary complexes, a Weighted Biophilic Design Assessment Index (BDAI) was developed. Since no universally accepted weighting framework currently exists for evaluating courthouse biophilic performance, the weighting adopted in this study was informed by established biophilic design theory and empirical evidence reported in the literature rather than expert elicitation. Ryan *et al.* (2014) classify biophilic design into three principal dimensions, Nature in the Space, Natural Analogues, and Nature of the Space, while emphasising that direct experiences of nature produce the strongest physiological and psychological responses because they involve meaningful interaction with natural elements such as daylight, vegetation, airflow, and water. Similarly, Kellert *et al.* (2011) argue that direct engagement with nature constitutes the core mechanism through which biophilic environments enhance human health and well-being. Recent syntheses have further demonstrated that exposure to natural light, vegetation, ventilation, and other direct environmental stimuli consistently produces greater improvements in stress reduction, cognitive restoration, and environmental satisfaction than indirect representations of nature alone.

Accordingly, Nature in the Space was assigned the highest weighting (45%) because it represents direct human interaction with natural systems and has the strongest evidence base for influencing occupants' physiological and psychological well-being. Nature of the Space received a weighting of 35% because spatial qualities such as prospect, refuge, mystery, and visual connectivity with nature play a substantial role in stress recovery, cognitive restoration, and environmental preference. Natural Analogues were assigned a weighting of 20%, recognising that although natural materials, biomorphic forms, and nature-inspired patterns positively influence occupants' perceptions and emotional responses, their effects are generally indirect and supportive rather than primary. This hierarchical weighting reflects the relative contribution of the three dimensions reported in the biophilic design literature and provides a theoretically grounded framework for evaluating courthouse environments.

The overall Biophilic Design Assessment Index (BDAI) was therefore calculated as:

$$\text{BDAI} = 0.45(NS) + 0.20(NA) + 0.35(NSp)$$

where:

- NS = Nature in the Space score,
- NA = Natural Analogues score, and
- NSp = Nature of the Space score.

The resulting index was expressed as a percentage and interpreted using five performance categories: Excellent (80–100%), Good (60–79%), Moderate (40–59%), Poor (20–39%), and Very Poor (<20%).

### 3.6 Measures to Enhance Research Trustworthiness

To enhance methodological rigour, several strategies were adopted.

First, data triangulation was achieved through the combined use of site observation, photographic documentation, and checklist-based assessment. Second, a standardised observational instrument ensured consistency throughout data collection. Third, all case studies were evaluated using identical assessment criteria derived from an internationally recognised biophilic design framework (Ryan *et al.*, 2014), thereby improving reliability and facilitating comparison across cases.

### 3.7 Ethical Considerations

The study relied exclusively on observation of publicly accessible architectural features and did not involve experimentation or the collection of personal or sensitive information from building users. Site visits were conducted with due respect for institutional regulations, operational activities, and security protocols governing judicial facilities. Photographic documentation was limited to architectural elements relevant to the research objectives, and no confidential judicial proceedings or identifiable individuals were recorded.

### 3.8 Limitations of the Method

The study evaluated observable architectural characteristics of judiciary complexes and therefore did not assess occupants' perceptions, behavioural responses, or physiological outcomes associated with biophilic environments. Consequently, the findings provide evidence of the extent of biophilic design implementation rather than direct measurements of its effects on users. Future studies should complement architectural assessments with post-occupancy evaluations, user satisfaction surveys, and indoor environmental quality measurements to establish stronger evidence of the relationship between biophilic design and user well-being.

## 4. RESULTS

### 4.1 Overall Biophilic Design Performance of the Selected Judiciary Complexes

The evaluation of the ten selected judiciary complexes demonstrates varying levels of implementation of biophilic design principles across the three assessment dimensions: Nature in the Space, Natural Analogues, and Nature of the Space. Collectively, the results indicate that while basic passive environmental strategies are commonly incorporated into courthouse architecture in Nigeria, comprehensive implementation of biophilic design remains inconsistent.

To facilitate objective comparison among the case studies, a Biophilic Design Assessment Index (BDAI) is proposed (Table 2). The index converts qualitative observations into numerical scores by assigning values of 3 for *Strong*, 2 for *Moderate*, 1 for *Weak*, and 0 for *Absent* (Table 3). The cumulative score for each building is expressed as a percentage of the maximum obtainable score, thereby enabling comparison of overall biophilic performance across the selected judiciary complexes.

**Table 2.** Proposed Biophilic Design Assessment Index (BDAI)

| Rating          | Numerical Score |
|-----------------|-----------------|
| <b>Strong</b>   | 3               |
| <b>Moderate</b> | 2               |
| <b>Weak</b>     | 1               |
| <b>Absent</b>   | 0               |

The overall BDAI is computed as:

$$\text{BDAI} = \frac{\sum \text{Observed Scores}}{\sum \text{Maximum Possible Scores}} \times 100$$

The resulting percentage scores are interpreted as follows.

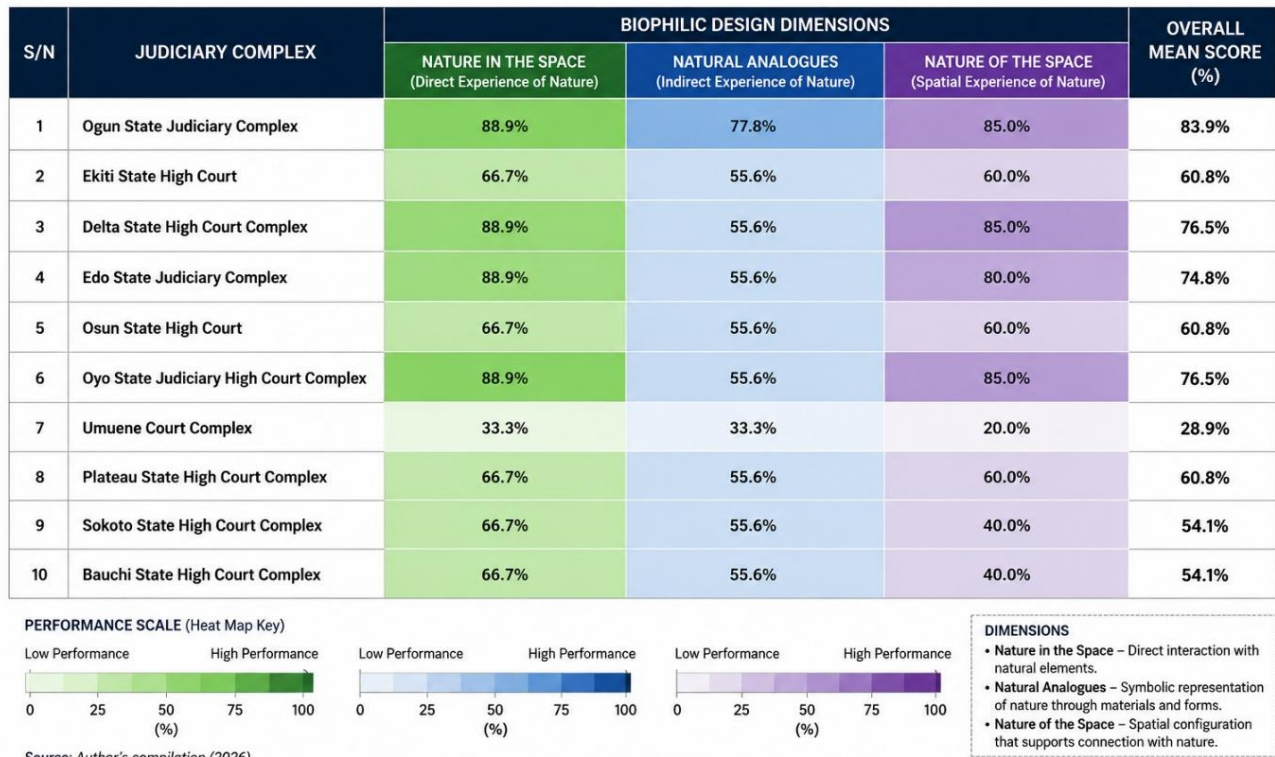
**Table 3.** Biophilic Design Performance Classification

| BDAI (%)      | Performance Category |
|---------------|----------------------|
| <b>80–100</b> | Excellent            |
| <b>60–79</b>  | Good                 |
| <b>40–59</b>  | Moderate             |
| <b>20–39</b>  | Poor                 |
| <b>&lt;20</b> | Very Poor            |

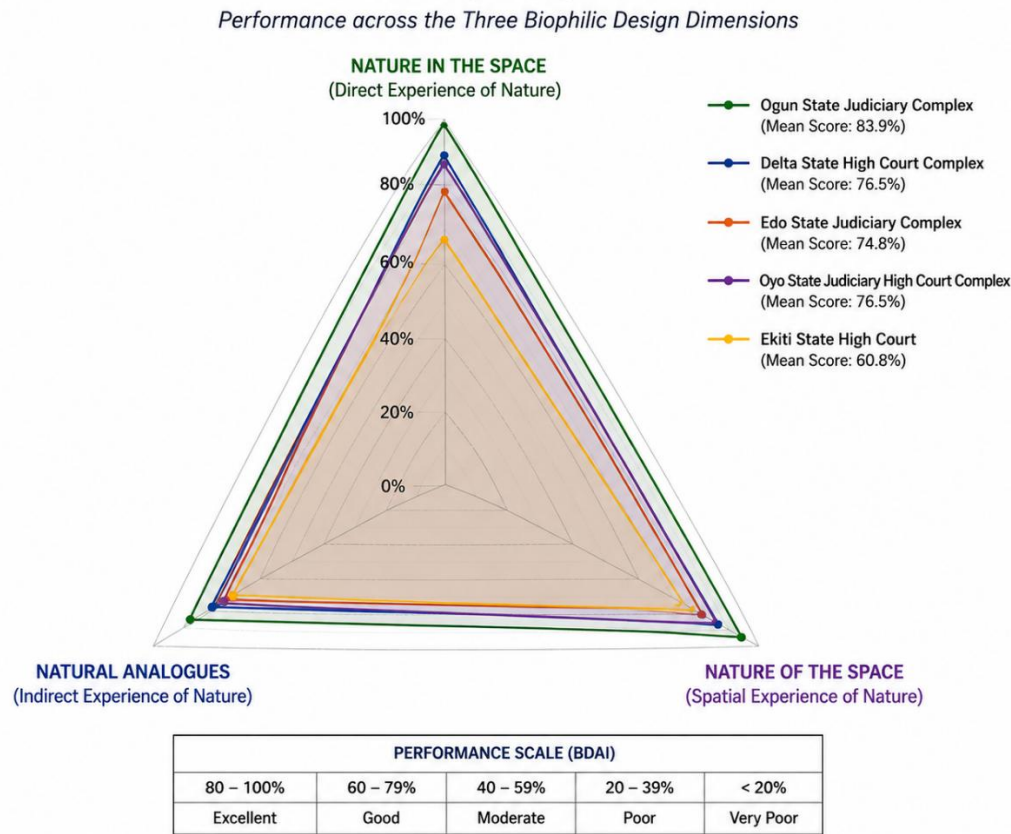
Using this framework, the Ogun State Judiciary Complex emerged as the highest-performing case study, exhibiting relatively balanced implementation across all three dimensions of biophilic design. Delta, Edo,

and Oyo State judiciary complexes also demonstrated comparatively strong environmental performance, whereas Umuene Court Complex recorded the lowest overall score owing to limited integration of vegetation, restorative outdoor spaces, and indirect biophilic features. These findings indicate that courthouse architecture in Nigeria generally incorporates climate-responsive design measures but only partially reflects contemporary evidence-based biophilic design principles. Figure 1(a-d) presents the Biophilic Design Performance assessment results.

*Performance across Three Biophilic Design Dimensions*



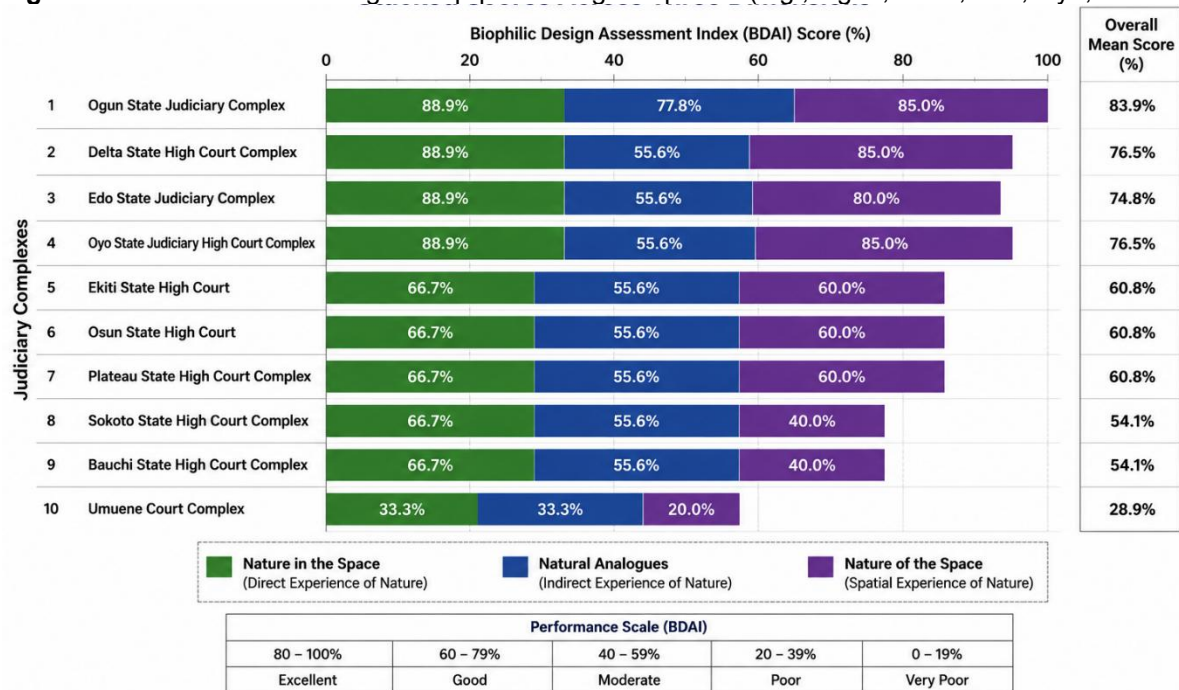
**Figure 1a.** Heat map of all 10 judiciary complexes × 3 biophilic dimensions (best for comparison).



Note: Scores derived from the Biophilic Design Assessment Index (BDAI) based on qualitative evaluation of architectural features across three dimensions.

Source: Author's compilation (2026)

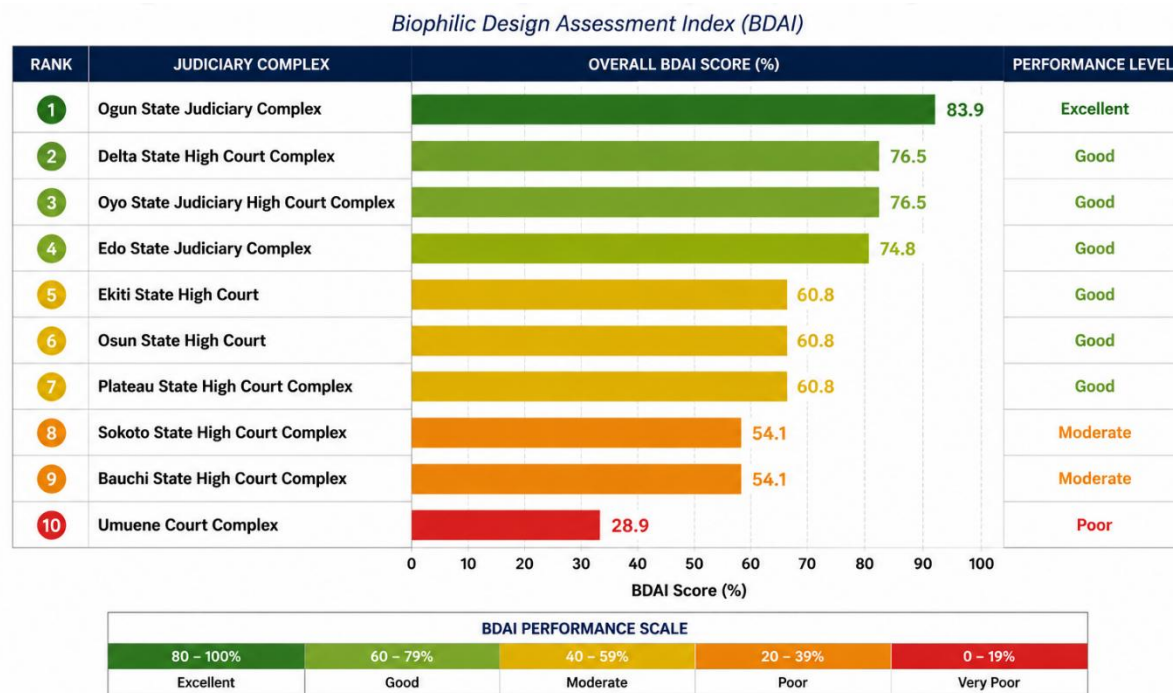
**Figure 1b.** Radar chart showing the top-performing complexes (e.g., Ogun, Delta, Edo, Oyo, and Ekiti).



Note: Scores are the mean percentage performance for each dimension based on the Biophilic Design Assessment Index (BDAI).

Source: Author's compilation (2026)

**Figure 1c.** Stacked bar chart of the three dimensions for each judiciary complex.



**Figure 1d.** Overall BDAI ranking chart (highest to lowest).

#### 4.2 Nature in the Space

The Nature in the Space dimension evaluates occupants' direct interaction with natural environmental elements, including daylight, natural ventilation, vegetation, water features, and visual connectivity with surrounding landscapes.

The assessment (Table 4) revealed that natural lighting and natural ventilation constitute the most consistently implemented biophilic attributes across the selected judiciary complexes. Nearly all buildings achieved strong ratings for these indicators, reflecting widespread adoption of passive climatic design strategies such as generous window openings, cross-ventilation, and orientation that maximises daylight penetration. These findings suggest that courthouse architecture in Nigeria has historically prioritised climatic responsiveness, largely as a strategy for improving thermal comfort and reducing dependence on mechanical environmental systems.

Conversely, vegetation and visual access to nature were only moderately represented across most of the buildings. While landscaping was present in several judicial complexes, it generally functioned as an aesthetic site treatment rather than as an integral component of restorative environmental design. Consequently, opportunities for psychological restoration and sensory engagement with nature remain underutilised.

Water features represented the least implemented indicator within this category. Apart from the Sokoto State High Court Complex, no evidence of fountains, reflective pools, constructed wetlands, or other water-based design interventions was observed. This omission represents a significant departure from contemporary biophilic design frameworks, which recognise water as a powerful restorative element capable of enhancing environmental quality and reducing psychological stress (Ryan *et al.*, 2014).

Among the evaluated buildings, Ogun, Delta, Edo, and Oyo State judiciary complexes demonstrated the strongest overall performance. Their comparatively higher scores reflect more balanced integration of daylight, natural ventilation, and landscape features than observed elsewhere. In contrast, Umuene Court

Complex recorded the weakest performance because of limited greenery, restricted visual connectivity with nature, and comparatively poor environmental responsiveness.

The findings demonstrate that direct experiences of nature within Nigerian judiciary complexes remain largely confined to passive climatic design strategies. Although these interventions contribute positively to indoor environmental quality, they do not fully realise the broader restorative potential of comprehensive biophilic design.

**Table 4.** Assessment of Nature in the Space (Direct Experience of Nature)

| Judiciary Complex                      | Natural Light | Natural Ventilation | Greenery / Views | Water Features | Overall Experience | Total Score | Percentage (%) | Performance |
|----------------------------------------|---------------|---------------------|------------------|----------------|--------------------|-------------|----------------|-------------|
| Ogun State Judiciary Complex           | 3             | 3                   | 3                | 0              | 3                  | 12          | 80.0           | Excellent   |
| Ekiti State High Court                 | 3             | 3                   | 2                | 0              | 2                  | 10          | 66.7           | Good        |
| Delta State High Court Complex         | 3             | 3                   | 3                | 0              | 3                  | 12          | 80.0           | Excellent   |
| Edo State Judiciary Complex            | 3             | 3                   | 3                | 0              | 3                  | 12          | 80.0           | Excellent   |
| Osun State High Court                  | 3             | 3                   | 2                | 0              | 2                  | 10          | 66.7           | Good        |
| Oyo State Judiciary High Court Complex | 3             | 3                   | 3                | 0              | 3                  | 12          | 80.0           | Excellent   |
| Umuene Court Complex                   | 2             | 2                   | 1                | 0              | 1                  | 6           | 40.0           | Moderate    |
| Plateau State High Court Complex       | 3             | 3                   | 2                | 0              | 2                  | 10          | 66.7           | Good        |
| Sokoto State High Court Complex        | 3             | 3                   | 2                | 3              | 2                  | 13          | 86.7           | Excellent   |
| Bauchi State High                      | 3             | 3                   | 2                | 0              | 2                  | 10          | 66.7           | Good        |

| Judiciary Complex | Natural Light | Natural Ventilation | Greener Views | Water Features | Overall Experience | Total Score | Percentage (%) | Performance |
|-------------------|---------------|---------------------|---------------|----------------|--------------------|-------------|----------------|-------------|
| Court Complex     |               |                     |               |                |                    |             |                |             |

**Scoring scheme:** Strong = 3; Moderate = 2; Weak/Poor = 1; Absent = 0.  
**Performance classification:** Excellent (80–100%); Good (60–79%); Moderate (40–59%); Poor (20–39%); Very Poor (<20%).  
**Source:** Authors' field survey (2026).

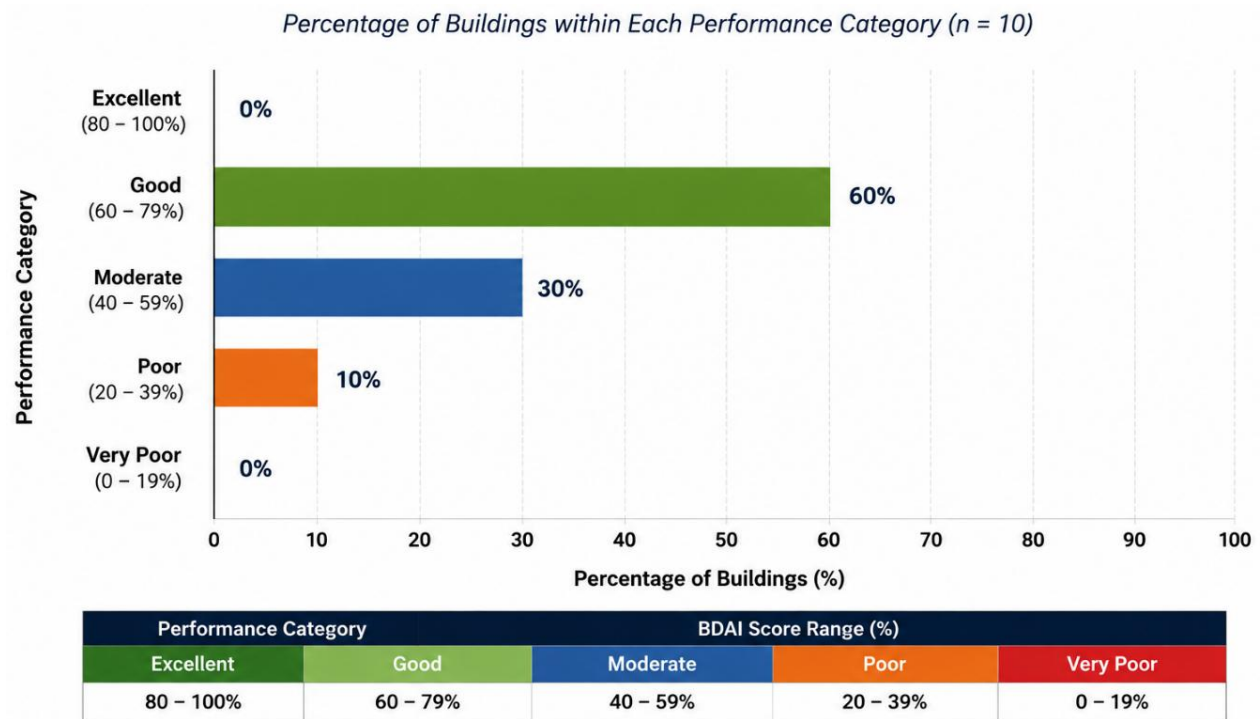
4.3 Natural Analogues

Natural Analogues evaluate indirect experiences of nature achieved through architectural expression rather than direct interaction with natural systems. Indicators considered include natural materials, locally sourced materials, biomorphic forms, natural colours, textures, and patterns.

The findings (Figure 2) indicate that this dimension remains only moderately implemented across the selected judiciary complexes. Approximately four-fifths of the evaluated buildings achieved moderate ratings, while only one building demonstrated strong implementation of indirect biophilic features. The predominance of moderate ratings reflects widespread reliance on conventional construction materials, including reinforced concrete, aluminium framing, ceramic finishes, and painted masonry, with comparatively limited incorporation of timber, exposed stone, or other natural materials.

Similarly, there was little evidence of intentional biomorphic design, nature-inspired geometry, or architectural detailing that reflects ecological forms and processes. Where natural materials were incorporated, their application appeared incidental rather than resulting from a deliberate biophilic design strategy.

The Ogun State Judiciary Complex demonstrated the strongest performance within this category through relatively greater use of locally sourced materials and environmentally responsive finishes. Nevertheless, even this building presents opportunities for strengthening indirect connections with nature through broader application of timber, natural stone, textured surfaces, and biomimetic architectural forms. The generally moderate performance observed suggests that indirect expressions of nature remain an underutilised component of courthouse architecture in Nigeria. Greater integration of natural analogue elements would improve occupants' sensory experiences while strengthening the visual identity and environmental quality of judicial facilities.



*Note: Scores derived from the Biophilic Design Assessment Index (BDAI) for the Natural Analogues dimension.*

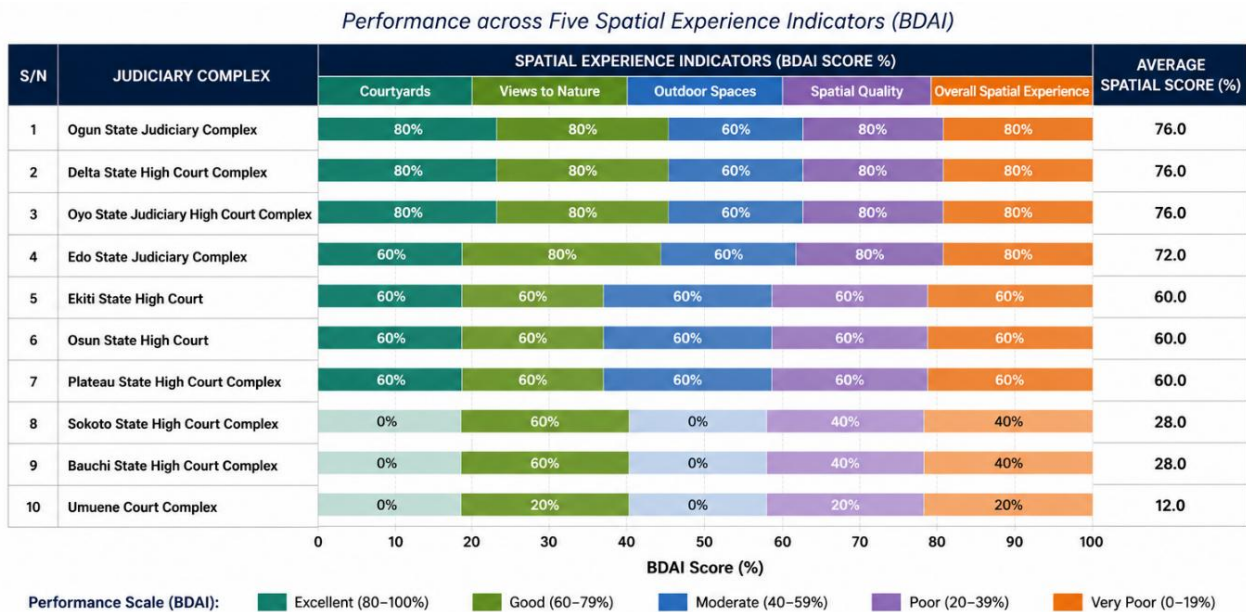
**Figure 2.** Distribution of Natural Analogue Performance

*Source: Authors' field survey (2026)*

#### 4.4 Nature of the Space: Spatial Experience and Environmental Quality

The third dimension of the assessment evaluated the Nature of the Space, which examines how architectural spatial configuration supports psychological comfort, environmental legibility, and restorative experiences. Indicators assessed under this category included building orientation, courtyards, prospect, refuge, outdoor waiting spaces, circulation patterns, and visual access to natural environments.

The analysis revealed marked differences among the selected judiciary complexes. Four of the ten complexes (40%) achieved strong ratings, three (30%) were rated moderate, while the remaining three (30%) exhibited weak implementation of spatial biophilic characteristics (Figure 3).



**Figure 3.** Spatial Performance of the Selected Judiciary Complexes  
*Source: Authors' field survey (2026)*

The Ogun, Delta, Edo, and Oyo State Judiciary Complexes demonstrated superior spatial organisation compared with the remaining case studies. These buildings incorporated landscaped courtyards, well-defined circulation routes, transitional outdoor spaces, and favourable building orientations that enhanced daylight penetration and visual access to surrounding green areas. Such characteristics create environments that promote environmental comfort while reducing the psychological stress commonly associated with judicial proceedings.

By contrast, the Umuene, Sokoto, and Bauchi judiciary complexes exhibited relatively weak spatial performance. These facilities were characterised by limited outdoor waiting areas, absence of internal courtyards, inadequate landscape integration, and restricted opportunities for interaction with natural environments. In several instances, outdoor spaces functioned primarily as circulation or parking areas rather than as restorative environments that could contribute positively to users' emotional well-being. From a biophilic design perspective, the absence of prospect and refuge spaces is particularly significant. Prospect allows occupants to maintain visual awareness of their surroundings, while refuge provides enclosed areas that offer privacy and psychological security. Together, these complementary spatial qualities have been shown to reduce anxiety and improve users' perception of safety and environmental comfort (Ryan *et al.*, 2014). Their limited implementation suggests that many Nigerian judiciary complexes continue to prioritise operational efficiency and security without fully considering the psychological implications of architectural space.

The findings demonstrate that although several judiciary complexes have incorporated spatial characteristics associated with biophilic design, implementation remains inconsistent and largely dependent on individual design approaches rather than standardised architectural guidelines.

#### 4.5 Comparative Assessment of Biophilic Design Performance

The comparative evaluation demonstrates that the implementation of biophilic design varies considerably across the selected judiciary complexes. While all buildings incorporated at least some passive

environmental features, none achieved comprehensive implementation across the three major dimensions of biophilic design.

To facilitate comparison, the Biophilic Design Assessment Index (BDAI) was applied to each case study. The resulting performance ranking (Table 5) highlights differences in the extent to which biophilic principles have been integrated into courthouse architecture.

**Table 5.** Overall Biophilic Design Performance of the Selected Judiciary Complexes

| Rank | Judiciary Complex                      | Nature in the Space (%) | Natural Analogues (%) | Nature of the Space (%) | Overall BDAI (%) | Performance Category |
|------|----------------------------------------|-------------------------|-----------------------|-------------------------|------------------|----------------------|
| 1    | Ogun State Judiciary Complex           | 80.0                    | 77.8                  | 93.8                    | 83.9             | Excellent            |
| 2    | Delta State High Court Complex         | 80.0                    | 66.7                  | 83.3                    | 76.5             | Good                 |
| 3    | Oyo State Judiciary High Court Complex | 80.0                    | 66.7                  | 83.3                    | 76.5             | Good                 |
| 4    | Edo State Judiciary Complex            | 80.0                    | 66.7                  | 77.8                    | 74.8             | Good                 |
| 5    | Ekiti State High Court                 | 66.7                    | 66.7                  | 60.0                    | 64.5             | Good                 |
| 6    | Osun State High Court                  | 66.7                    | 66.7                  | 60.0                    | 64.5             | Good                 |
| 7    | Plateau State High Court Complex       | 66.7                    | 66.7                  | 60.0                    | 64.5             | Good                 |
| 8    | Sokoto State High Court Complex        | 86.7                    | 66.7                  | 40.0                    | 64.5             | Good*                |
| 9    | Bauchi State High Court Complex        | 66.7                    | 66.7                  | 40.0                    | 57.8             | Moderate             |
| 10   | Umuene Court Complex                   | 40.0                    | 33.3                  | 20.0                    | 31.1             | Poor                 |

#### Performance Classification

| Overall BDAI (%) | Classification |
|------------------|----------------|
| 80–100           | Excellent      |
| 60–79            | Good           |
| 40–59            | Moderate       |
| 20–39            | Poor           |
| <20              | Very Poor      |

**Source:** Authors' field survey and BDAI computations (2026).

The results clearly indicate that Nature in the Space was the strongest-performing dimension across all case studies. This reflects the widespread adoption of passive climatic design strategies such as natural lighting and cross-ventilation, which are essential responses to Nigeria's tropical climate. However, comparatively lower scores for Natural Analogues and Nature of the Space reveal that indirect and experiential dimensions of biophilic design remain inadequately addressed in existing courthouse architecture.

The Ogun State Judiciary Complex emerged as the highest-performing building because it demonstrated relatively balanced implementation across all three dimensions of biophilic design. In contrast, Umuene

Court Complex consistently recorded the lowest scores, indicating substantial opportunities for environmental and architectural improvement.

These findings suggest that the architectural design of judiciary complexes in Nigeria is primarily influenced by functional and climatic considerations rather than by a comprehensive evidence-based biophilic design philosophy. Consequently, the restorative potential of courthouse environments remains only partially realised.

#### 4.6 Synthesis of Findings

The overall assessment reveals three important patterns. First, passive environmental strategies, particularly natural daylighting and ventilation, have become well-established components of courthouse architecture in Nigeria. These features improve thermal comfort and reduce dependence on mechanical environmental systems, demonstrating an implicit response to local climatic conditions.

Second, indirect expressions of nature through architectural materials, textures, and biomorphic forms remain relatively limited. Most judicial complexes continue to rely on conventional construction materials with minimal incorporation of natural analogue elements capable of strengthening occupants' sensory connections with nature.

Third, spatial characteristics associated with psychological restoration, including courtyards, outdoor waiting areas, refuge spaces, and landscape connectivity, vary considerably among the selected buildings. Where these elements were present, they contributed to more welcoming and environmentally responsive judicial environments. Their absence in several case studies highlights an important opportunity for improving the design quality of future courthouse developments.

These findings indicate that although elements of biophilic design are evident within Nigerian judiciary complexes, implementation remains fragmented and largely focused on passive environmental control rather than holistic integration of ecological, sensory, and spatial experiences. A more comprehensive application of biophilic principles would enable courthouse architecture to contribute more effectively to occupant well-being, environmental sustainability, and institutional performance.

## 5. DISCUSSION

### 5.1 Biophilic Design Implementation in Nigerian Judiciary Complexes

This study evaluated the architectural characteristics of biophilic design in ten judiciary complexes across Nigeria using the three dimensions of the 14 Patterns of Biophilic Design framework proposed by Ryan *et al.* (2014). The findings reveal that although biophilic design elements are present within the assessed judiciary complexes, their implementation is uneven and largely limited to passive environmental strategies. Overall, the buildings demonstrate greater emphasis on climatic responsiveness than on holistic biophilic design, suggesting that environmental considerations have traditionally focused on thermal comfort and energy efficiency rather than on promoting restorative experiences and occupant well-being.

The predominance of natural lighting and natural ventilation observed across the case studies reflects the influence of Nigeria's tropical climate on architectural practice. Large window openings, cross-ventilation, and building orientation have long been adopted as passive design strategies to reduce heat gain and minimise dependence on mechanical cooling systems. While these interventions contribute positively to indoor environmental quality, they represent only part of the broader biophilic design philosophy. Contemporary biophilic frameworks advocate a more comprehensive integration of ecological systems, sensory experiences, and nature-inspired spatial configurations that collectively enhance occupants' physical and psychological health (Kellert *et al.*, 2011; Ryan *et al.*, 2014).

These findings are consistent with those reported by Andreucci *et al.* (2021), who concluded that many public buildings incorporate isolated biophilic elements without fully integrating nature-based design strategies throughout the built environment. Similarly, Tekin *et al.* (2025) observed that although daylight and natural ventilation are among the most frequently implemented biophilic features, more complex interventions, including biodiversity-supporting landscapes, water elements, and restorative outdoor environments, remain comparatively uncommon because of financial, operational, and maintenance considerations.

## 5.2 Direct Experience of Nature and Environmental Performance

Among the three assessment dimensions, Nature in the Space demonstrated the strongest level of implementation across the selected judiciary complexes. This finding indicates that architects designing courthouse buildings in Nigeria have generally recognised the importance of passive environmental strategies in improving indoor environmental quality. Adequate daylight penetration and natural ventilation contribute to enhanced thermal comfort, visual quality, and reduced operational energy demand, thereby supporting sustainable building performance.

Beyond environmental benefits, substantial empirical evidence demonstrates that direct interaction with natural elements positively influences occupants' health and psychological functioning. Exposure to daylight has been associated with improved circadian rhythm regulation, increased alertness, enhanced cognitive performance, and greater workplace satisfaction, while natural ventilation contributes to improved air quality and reduced symptoms associated with poorly ventilated indoor environments (Usip *et al.*, 2026).

Nevertheless, the findings indicate that direct interaction with vegetation and water remains limited within Nigerian judiciary complexes. Landscape elements are generally confined to peripheral planting rather than functioning as integral components of therapeutic or restorative design. Likewise, water features were almost absent despite extensive evidence demonstrating their positive influence on stress reduction, emotional restoration, and multisensory environmental experiences (Ryan *et al.*, 2014).

The limited incorporation of these features suggests that current courthouse design prioritises operational functionality over human-centred environmental experiences. Considering that judicial environments frequently accommodate individuals experiencing anxiety, conflict, and emotional distress, greater integration of vegetation, shaded outdoor spaces, and water-sensitive landscapes could substantially improve users' psychological comfort while reinforcing environmental sustainability objectives.

## 5.3 Natural Analogues and Architectural Expression

The study found that Natural Analogues were only moderately represented across the evaluated judiciary complexes. Although locally available materials were incorporated in several buildings, their use appeared largely determined by construction practices and economic considerations rather than deliberate application of biophilic design principles. Biomorphic forms, natural textures, and nature-inspired architectural detailing were generally absent.

This observation is consistent with international evidence indicating that indirect expressions of nature remain one of the least implemented dimensions of biophilic design (Andreucci *et al.*, 2021). Unlike daylight or natural ventilation, natural analogue features require intentional architectural decisions during conceptual design and material specification. Consequently, they are frequently overlooked in conventional public-sector projects where functionality, durability, and construction cost dominate design priorities.

Despite their relatively subtle character, natural analogue features have been shown to influence occupants' emotional responses by creating environments perceived as warmer, more welcoming, and less institutional. The incorporation of timber finishes, exposed stone, natural colour palettes, and biomimetic patterns has been associated with improved psychological comfort and increased perceptions of environmental quality. Integrating such elements within courthouse interiors could therefore contribute to more supportive judicial environments without compromising operational requirements or security standards.

## 5.4 Spatial Configuration, Psychological Restoration, and Courthouse Experience

The Nature of the Space dimension exhibited the greatest variability among the assessed judiciary complexes. Buildings that incorporated landscaped courtyards, transitional outdoor spaces, favourable orientation, and visual access to green environments achieved substantially higher performance than those characterised by enclosed layouts and limited environmental connectivity.

These findings may be interpreted through the lens of Attention Restoration Theory (ART) (Kaplan & Kaplan, 1989), which proposes that exposure to natural environments replenishes cognitive resources depleted through prolonged mental effort. Courthouse users, including judges, legal practitioners, litigants, witnesses, and administrative personnel, often experience sustained cognitive and emotional demands.

Spatial environments that provide visual complexity, natural views, and opportunities for psychological respite may therefore contribute to improved concentration, emotional regulation, and decision-making.

Similarly, Stress Recovery Theory (SRT) (Ulrich *et al.*, 1991) suggests that natural environments facilitate rapid physiological recovery from stressful experiences by reducing blood pressure, heart rate, and psychological tension. The absence of restorative outdoor environments, refuge spaces, and landscape-integrated waiting areas in several judiciary complexes may therefore limit opportunities for stress reduction among court users.

The relatively stronger performance of the Ogun, Delta, Edo, and Oyo State Judiciary Complexes illustrates how thoughtful spatial planning can improve environmental quality without compromising security or operational efficiency. These examples demonstrate that biophilic design and judicial functionality are complementary rather than conflicting objectives.

### 5.5 Practical, Policy, and Sustainable Design Implications

The findings of this study offer actionable insights for the future planning, design, and management of judicial infrastructure in Nigeria, carrying significant implications across architectural practice, facility management, and public policy. First, the data demonstrates that existing passive environmental strategies, such as natural lighting and ventilation, provide a strong foundation upon which more comprehensive biophilic interventions can be built. Architectural decisions regarding site planning, building orientation, spatial organization, and material specification should intentionally promote interaction with natural systems rather than treating landscape elements as secondary, aesthetic additions. Consequently, future courthouse projects should systematically integrate vegetation, therapeutic landscapes, biodiversity-supporting planting schemes, water-sensitive urban design, and restorative outdoor spaces as essential, structural components of judicial architecture.

Second, the study highlights a critical need to incorporate measurable biophilic design principles into national architectural guidelines for public buildings. While existing courthouse design standards primarily emphasize security, functionality, and operational efficiency, these traditional objectives must be complemented by evidence-based environmental design principles that recognize the profound influence of architecture on users' psychological well-being. To achieve this, national judicial infrastructure guidelines should incorporate clear performance indicators, such as visual connectivity with nature, restorative outdoor access, and daylight optimization, thereby providing architects and public agencies with objective benchmarks to evaluate courthouse performance.

Third, balancing the strict security mandates of a court with environmental quality requires deep, interdisciplinary collaboration from the earliest stages of planning. Architects, landscape architects, environmental psychologists, structural and environmental engineers, and judicial administrators must work in tandem to develop courthouse environments that simultaneously satisfy security requirements, environmental sustainability objectives, and occupant well-being. Such cross-disciplinary approaches are increasingly recognized as essential for delivering resilient public infrastructure capable of reducing user stress and responding to climate change while maintaining institutional integrity and operational effectiveness.

Finally, adopting comprehensive biophilic design strategies within Nigeria's judicial infrastructure contributes directly to the nation's commitments toward sustainable urban development and climate resilience. By transforming these facilities into healthier, more environmentally responsive civic spaces, this architectural evolution supports Sustainable Development Goal 3 (Good Health and Well-being), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action). Ultimately, courthouse architecture should no longer be viewed merely as functional public infrastructure, but rather as an opportunity to promote healthier, more inclusive, and resilient civic environments throughout Nigeria.

### 5.6 Study Limitations

Some limitations should be acknowledged when interpreting the findings of this study.

First, the research relied primarily on qualitative observational assessment of architectural characteristics. Although this approach provides valuable insights into the physical implementation of biophilic design principles, it does not directly evaluate occupants' perceptions, physiological responses, or behavioural outcomes.

Second, the study assessed only ten judiciary complexes selected through purposive sampling. While the selected buildings represent different geographical locations and architectural contexts, the findings should not be interpreted as statistically representative of all courthouse facilities in Nigeria.

Third, the assessment focused on observable architectural attributes and therefore did not include quantitative measurements of indoor environmental quality such as daylight illuminance, thermal comfort, air quality, acoustics, or energy performance. Incorporating such environmental measurements would provide a more comprehensive understanding of the operational effectiveness of biophilic interventions. Despite these limitations, the study provides a robust foundation for understanding the status of biophilic design implementation within Nigerian judiciary complexes and establishes a framework for future comparative investigations.

## 6. CONCLUSIONS AND RECOMMENDATIONS

### 6.1 Conclusions

This study evaluated biophilic design characteristics across ten Nigerian judiciary complexes using a qualitative multiple-case study approach based on the 14 Patterns of Biophilic Design. Through systematic site observations, photographic documentation, and structured assessments, it examined three principal dimensions: Nature in the Space, Natural Analogues, and Nature of the Space.

The findings reveal a moderate and uneven implementation of biophilic design. Climate-responsive passive environmental strategies, particularly natural daylighting and cross-ventilation, are the most consistently integrated features, significantly enhancing indoor environmental quality and reducing operational energy demands. However, substantial deficiencies exist in advanced strategies; restorative gardens, water features, biomorphic forms, natural analogue materials, and psychologically supportive outdoor spaces remain largely absent, leaving the therapeutic potential of these civic environments underutilized.

Comparatively, the Ogun State Judiciary Complex demonstrated the highest level of biophilic integration, proving that functionality can coexist with environmental quality. Ultimately, Nigerian courthouse architecture remains driven by basic climate-responsive design rather than a holistic, evidence-based biophilic philosophy. As the judiciary increasingly prioritizes user psychological well-being, incorporating comprehensive biophilic principles into national infrastructure guidelines offers a vital opportunity to create healthier, more sustainable, and restorative public buildings.

### 6.2 Recommendations

Future studies should extend this research in five directions. First, post-occupancy evaluations should examine how biophilic environments affect the stress, performance, and justice perceptions of judges, lawyers, litigants, and visitors. Second, objective measurements of indoor environmental quality, including daylighting, acoustics, and thermal comfort, should complement qualitative data. Third, comparative studies across other African and tropical nations can identify regional best practices. Fourth, life-cycle cost analyses should evaluate the economic implications, cost-benefits, and long-term operational savings of biophilic public infrastructure. Finally, the proposed Biophilic Design Assessment Index (BDAI) should be validated across other public typologies, such as healthcare, education, and civic facilities, to establish its reliability as a standardized architectural evaluation framework.

## REFERENCES

- Andreucci, M. B., Loder, A., McGee, B., Brajković, J., & Brown, M. (2021). Exploring regenerative co-benefits of biophilic design for people and the environment. In *Urban services to ecosystems: Green infrastructure benefits from the landscape to the urban scale* (pp. 391–412). Springer International Publishing. [https://doi.org/10.1007/978-3-030-75929-2\\_21](https://doi.org/10.1007/978-3-030-75929-2_21)
- Ayalon, O., & Toch, E. (2021). User-centered privacy-by-design: Evaluating the appropriateness of design prototypes. *International Journal of Human-Computer Studies*, 154, 102641. <https://doi.org/10.1016/j.ijhcs.2021.102641>
- Berry, M. A., & Rondinelli, D. A. (1998). Proactive corporate environmental management: A new industrial revolution. *Academy of Management Perspectives*, 12(2), 38–50.

- Dreyer, B. C., Coulombe, S., Whitney, S., Riemer, M., & Labbé, D. (2018). Beyond exposure to outdoor nature: Exploration of the benefits of a green building's indoor environment on wellbeing. *Frontiers in Psychology*, 9, 1583. <https://doi.org/10.3389/fpsyg.2018.01583>
- Hagan, M. D. (2018). A human-centered design approach to access to justice: Generating new prototypes and hypotheses for intervention to make courts user-friendly. *Indiana Journal of Law and Social Equality*, 6(2).
- Kalu, G., & Ogunnaike, A. O. (2025). Integrating biophilic and passive design strategies in Nigerian architecture: A systematic review of current practices and impacts. *African Journal of Environmental Sciences and Renewable Energy*, 19(1), 324–335. <https://doi.org/10.62154/ajesre.2025.019.01030>
- Kaplan, R., & Kaplan, S. (1989). *The experience of nature: A psychological perspective*. Cambridge University Press.
- Kellert, S. R., Heerwagen, J., & Mador, M. (2011). *Biophilic design: The theory, science and practice of bringing buildings to life*. John Wiley & Sons.
- Kellert, S. R., & Wilson, E. O. (2008). Biophilia. In *Encyclopedia of Human Ecology* (pp. 462–466). Elsevier. <https://doi.org/10.1016/B978-008045405-4.00636-4>
- Mulcahy, L., & Rowden, E. (2019). *The democratic courthouse: A modern history of design, due process and dignity*. Routledge. <https://doi.org/10.4324/9780429263651>
- Patton, M. Q. (2015). *Qualitative research & evaluation methods: Integrating theory and practice* (4th ed.). Sage Publications.
- Ryan, C. O., & Browning, W. D. (2020). Biophilic design. In *Sustainable built environments* (pp. 43–85). Springer US. [https://doi.org/10.1007/978-1-0716-0684-1\\_1034](https://doi.org/10.1007/978-1-0716-0684-1_1034)
- Ryan, C. O., Browning, W. D., Clancy, J. O., Andrews, S. L., & Kallianpurkar, N. B. (2014). Biophilic design patterns: Emerging nature-based parameters for health and well-being in the built environment. *ArchNet-IJAR: International Journal of Architectural Research*, 8(2), 62–76. <https://doi.org/10.26687/archnet-ijar.v8i2.436>
- Tekin, B. H., Izmir Tunahan, G., Disci, Z. N., & Ozer, H. S. (2025). Biophilic design in the built environment: Trends, gaps and future directions. *Buildings*, 15(14), 2516. <https://doi.org/10.3390/buildings15142516>
- Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*, 11(3), 201–230. [https://doi.org/10.1016/S0272-4944\(05\)80184-7](https://doi.org/10.1016/S0272-4944(05)80184-7)
- Umeora, C. O., Onwuzuligbo, C. C., & Ononuju, F. I. (2025). The role of biophilic campus design in enhancing university environments in southeast Nigeria. *Open Journal of Environmental Research*, 6(1), 18–27. <https://doi.org/10.52417/ojer.v6i1.858>
- Usip, E., Essien, E., & Ema, I. (2026). A review of biophilic architectural design strategies and their effects on human wellbeing in contemporary built environments. *Discover Environment*, 4(1), 170. <https://doi.org/10.1007/s44274-026-00580-z>
- Wilson, E. O. (2017). Biophilia and the conservation ethic. In *Evolutionary perspectives on environmental problems* (pp. 250–258). Routledge. <https://doi.org/10.4324/9780203792650-18>
- World Green Building Council. (2014). *Health, wellbeing and productivity in offices: The next chapter for green building*. World Green Building Council. [https://worldgbc.org/wp-content/uploads/2022/03/compressed\\_WorldGBC\\_Health\\_Wellbeing\\_Productivity\\_Full\\_Report\\_Dbl\\_Med\\_Res\\_Feb\\_2015-1.pdf](https://worldgbc.org/wp-content/uploads/2022/03/compressed_WorldGBC_Health_Wellbeing_Productivity_Full_Report_Dbl_Med_Res_Feb_2015-1.pdf)
- Yin, J., Zhu, H., & Yuan, J. (2024). Health impacts of biophilic design from a multisensory interaction perspective: Empirical evidence, research designs, and future directions. *Land*, 13(9), 1448. <https://doi.org/10.3390/land13091448>