BIOPHILIC NET-POSITIVE ARCHITECTURE ESPOUSES PASSIVE DESIGN STRATEGIES FOR A HEALTHY SUSTAINABLE BUILT ENVIRONMENT: OVERVIEW

Hisham Sharif Bala [1], Baizhan Li [2], Danjuma Abdu Yusuf [3], Chenqiu Du [4].

School of Civil Engineering, Chongqing University, Chongqing, 400044, China.; hishamsharif@ymail.com[1],
National Center for International Research on Green Building and Built Environment, Chongqing University, Chongqing, 400044, China.; baizhanli@cqu.edu.cn,[2],
School of Architecture and Urban Planning, Chongqing University, Chongqing, 400044, China.;yusufdanjuma@gmail.com[3], [4]
Department of Architecture, Kano University of Science & Technology, Wudil, 713101, Nigeria.[4]

ABSTRACT

The mass paradigm in green architecture has reduced the environmental effect of the built environment, but the achievement in human nature connectedness (HNC) is still lost in the mystery of sustainability. Biophilic architecture has allowed buildings that link people and nature, hospitals where patients are recovering faster, schools where test scores for children are higher, offices where staff are more efficient, and communities where residents are sociable and involved. The study identifies the gap as the biggest challenge facing the earth and can be addressed by espousing a Restorative Environmental approach. This concept of biophilic nature arose from the realization that the conscience develops in a "sensorial rich earth, where landscapes, daylight, water, flora, and fauna are examples of them. This paper explores attributes of Biophilic design elements that espouse passive design as a theoretical framework for conceptualizing 'landscape' in the natural world. As the study adopts qualitative approaches, it uses a variety of strategies for finding, evaluating, and choosing three databases Google Scholar, Web of Science, and Scopus as all-inclusive criteria for identifying relevant publications. It further creates a framework for biophilic net-positive architecture that espouses passive design approaches. The review unveils how far human beings are from nature besides how much the earth is subjected to global warming and contributes to stressful lifestyles. It further reveals that open urban spaces should be seen as healing places where more inhabitants could gain from biophilic essentials; Biophilic environments in urban places can proffer the public with recuperative knowledge by liberating mental fatigue and lessening their intensity of stress. The study gives new insights and suggests improving future studies in the application of Biophilic architecture. This review provides useful information that will be used in the Project implementation of investigation activity as it further recommends the three-step mantra which will vividly help achieve the broad concept; firstly, to design with Passive approaches; secondly, to harmonize with vigorous mechanical systems if necessary and; thirdly, to make up with renewable systems, if necessary.

Keywords: *Biophilic; Passive Design; Sustainable Development Goals (SDGs); Net-positive Architecture; Human Nature Connectedness (HNC); Built Landscape; Nature-based solution.*

1.0 Introduction

Unplanned cities, climate change, and globalization result in more congestion as well as overcrowding which have all been issues in recent decades [1] [2]. Also, the large amount and speedy building construction barely have been noticed inglobal transformation and caused extensive difficulty in environmental possessions [3] Quarantines, sanitary restrictions, and isolation have all had an impact on the communal vibrant of our cities. While terms like healthy, sustainable, and resilient cities are still exploited [4], it is vital to consider the influence of the built landscapes on individual health and comfort. The use of a biophilic blueprint can transform the ecological circumstances of a structure or landscape inthe near-instant, but it ought to promote a green sustainable, and conservatory resilient neighborhood in the long run. [5] assert that a successful design ought to yield an extensive range of physical, emotional, and behavioral advantages. Physical results include improved physical health, reduced blood pressure, higher well-beingand contentment, fewer disease indications, and overall health improvement. Mental advantages include enhanced contentment and motivation, less stress and anxiety, andimproved problem-solving and creativity. The built environment is a major emphasis area in initiatives to minimize greenhouse gas emissions. The present notion (Biophilia) has spawned a new paradigm in environmental research, arguing that interaction withnature is essential for human mental and physical well-being [6] [7]. Biophilia, such as green space, is also important in social and familial connections in modern culture, and it benefits office employees and university students in densely populated places. This research aims to present Biophilic design ideas in hot and dry climates based on Iran conditions. The climate is a major environmental component that influences city development and architecture. A biophilic approach to comfort, aesthetics, and well-being adds "value" by supporting mutual health and environmental advantages for people, other animals, and living systems. While the benefits of net-positive design in terms of climate change, energy, and performance are well established, they are underappreciated. As a result, there is a growing disconnect between humans and nature in the constructed environment, as evidenced by insufficient interaction with sunlight, materials, ventilation, plants, vistas, customary shapes and forms, and overall valuable touch with the natural world.

1.1 Background information on Biophilia and Natural Systems

The philosophy of Biophilic Design inspires the use of natural schemes and procedures in designing built landscapes. It is based on the theory of Biophilia, which implies that human beings have an innate connection with nature and therefore access to nature is important for human well-being in modern peoples [8], However, human relationships with nature are often lacking due to social inclinations such as building design, urbanization, technology, and lifestyle. [8] proclaim that the link to human nature has shown how much excellent nature is for our comfort Furthermore, investigation after study records the mental and physical advantages of communicating through nature. Inhabitants who are closer to nature are more contented, have more meaning in their lives, and feel more vital. Even in minute quantity, nature is an influential elixir: when their hospital space has flora [9], post-surgery patients require and report less fatigue [6], they put in the article how much nature can influence us. Just looking at natural pictures accelerates mental regeneration and enhances executive functioning. When they describe the cause, one of these is the tendency ofurbanization: which depletes ecological environments and cuts the public away from scenic points usually used to justify the declining human relation to nature, but the results are not compatible with that account. [10] said in their article that, because we are part of it, it is nice to us. Humans and nature had a highly intertwined relationship from the outset. There is plenty of evidence [11] [4] [12] [13] [14] [6] that access to nature is good for the health, well-being, and enjoyment of people's green spaces also encouraging pro-social behaviors. The healing power of biophilic design has taken into consideration the scientific benefits of natural views [4]. A study [15] proclaims that patients recuperating from gallbladder operation improved faster and received less pain medication if they had a view of outdoor green areas via their window opening than if they were looking out on urban infrastructure. These advantages have clear economic benefits. Ulrich explained numeral conduct in which Biophilic design can improve ache to nature's healing power: mechanisms, including distraction and reductionof stress. The theory of distraction seizes that pain takes in concentration; the more ache consciousness the greater the intensity of familiarity. If patients are distracted or absorbed in a pleasant view of nature, less attention is given to pain, and the intensity is therefore reduced. For another device, "The well-documented finding that observing nature effectively reduces stress suggests a second mechanism. In many ways Biophilic exposition of nature directly orindirectly one way is light. Sunshine exposure, however, is one more mechanism of pain- diminution might derive into showing, Ulrich says. Biophilic design limelight on features of the natural earth that have contributed to human health, happiness, and productivity. According to [16], incorporating biophilia into hospitals has reduced post-operative healing by 8.5%. This is because basic attachments to nature, or interpretations of it, aid patients in their healing process. Nature, according to [1], has a beneficial influence on health, wellness, and general happiness, as the author mentions in the article. Architects in contemporary architecture have a variety of ways of living in harmony with nature. Falling Water by Frank Lloyd Wright and Ludwig Mies van der Rohe's Farnsworth House develop a relationship with the natural

environment. Some Avant-garde architects who the negative effects of construction on the environment in the 1960s include Superstudio, Archizoom, Ugo La Pietra, Rosselli, Ugo La Pietra, Mario Bellini, and Alberto Rosselli.

1.2 Existing studies

The study conducts a literature review on the furtherance of biophilic net-positive architecture and passive design techniques for healthy, sustainable built environments. It delves into natural connection, passive approaches, urban design, and biophilic designideas. The authors recommend more studies into combining natural and buildingfunctionality to create a healthier environment.

Table - 1: Summary of the Literature Review

Author	Year	Objective	Literature Survey	Contribution	Limitation
(Africa et al., 2019)	2019	The objective of this paper is to provide an illustrative compilation of how biophilic design practices can directly support resilience in human health and the built environment	The given information does not provide a detailed literature survey. However, the paper does reference several studies and sources to support its arguments and recommendations.	The paper highlights biophilic design practices' impact on human health and the built environment, linking them to climate change shifts and promoting ethical conduct.	The paper failed to explore synergies between biophilic design practices and nature-based techniques for sustainable, resilient built environments.
(Zhong et al., 2022)	2022	Reviewing biophilic design literature, examining origins, definition, sustainable architecture contributions, strategies, comparing frameworks, and identifying knowledge gaps for future research.	The literature review examines biophilic design as a theoretical framework for interpreting nature in architecture, comparing frameworks, and analyzing sustainability benefits.	The study reveals that biophilic design incorporates various natural aspects, including vegetation, sensory, metaphorical, morphological, material, and spiritual, to enhance the overall design experience.	The framework presented for biophilic design is a preliminary interpretation and may require further refinement.
(Cacique & Ou, 2022)	2022	The paper explores the integration of Health, Sustainability, and Resilience concepts in biophilic design, aiming to create healthy, sustainable, and resilient environments for improved health and well-being.	The paper discusses Health, Sustainability, and Resilience concepts and biophilic design, citing studies and reports, and examining Terrapin Bright Green's 14 biophilic design patterns.	The paper suggests integrating biophilic design with Health, Sustainability, and Resilience concepts to create healthy, sustainable, and resilient environments. It identifies 19 overlapping concepts and 16 closely related ones.	The paper lacks empirical evidence to support the claim that biophilic design can address Health, Sustainability, and Resilience concepts, and does not investigate their interactions.
(Andreucci et al., 2021)	2021	The paper compares adaptive and utilitarian paradigms to biophilic design principles, evaluating real-world case studies in London and Chicago, and highlighting their effectiveness in achieving positive human and ecological outcomes.	The paper explores nature and biophilic design using Kellert and Terrapin Bright Green's 14 Patterns, emphasizing evidence-based design and policy to link daily life with biodiversity and improve urban built environments.	The paper indicates key policy and design lessons learned around regenerative design and biophilia as well as new directions for action, particularly about climate change, sense of place, and well-being.	The paper is a literature survey and does not provide new empirical data or research findings. The paper focuses on case studies from London and Chicago, which may limit the generalizability of the findings to other urban contexts.
(Hidal & Desi, 2014)	2014	This paper aims to explore the concept of biophilic design as an urban design approach aimed at understanding the connections between natural and built environments about psychological restoration.	The paper reviews the literature on creating restorative environments in urban spaces, incorporating environmental psychology, public health, and urban design insights.	Discussing the components of the natural and built environment that provide psychological restoration. Suggesting that the use of natural features within urban spaces can provide positive outcomes for people's well-being.	The paper discusses biophilic design's potential for creating restorative urban environments. It provides a literature review and suggests elements for design, but lacks empirical evidence or case studies to support its claims.

(Aye et al., 2019)	2019	This paper explores the relationship between biophilia and engineering in creating sustainable, healthy, and structurally sound built environments. It provides an overview of biophilic design benefits and examples of implementing biophilic concepts in high-rise buildings.	The paper discusses biophilic design benefits and high-rise building implementation, emphasizing the need for collaboration between engineers and designers to find the optimum solution sensitivity to other needs and uses. It does not include a literature survey.	The paper explores the integration of biophilia and engineering in sustainable, healthy, and structurally sound built environments, emphasizing the benefits of biophilic design in high-rise buildings and the significance of collaboration between engineers and designers.	The paper's examples may not be universally applicable due to climate, culture, and regulations. It focuses on biophilia and engineering in high-rise buildings and may not provide comprehensive information on biophilic design in other environments.
(Panagopoulos et al., 2020)	2020	The paper explores biophilic design theory and practice, focusing on the restorative function of built environments. It identifies challenges and opportunities for transitioning from low-impact to net-positive/restorative environments through biophilic design.	The paper employs a literature review on built environment sustainability thinking developed during the project RESTORE (Rethinking Sustainability Towards a Regenerative Sustainability).	Identifying challenges and opportunities for transitioning from low-impact to net-positive/restorative-built environments through biophilic design. Examining urban planning principles that transfer human-nature biological bonds into restorative approaches.	The paper does not provide a detailed explanation of biophilic design, its patterns, and current debates; instead, it explains the origins and rise of biophilic design in a broad sense

1.3 Problem Statement

One of the biggest challenges we face in the coming year is to change our emphasis on architecture. Restorative Environmental Design or Biophilic Design aims to knit the building within the natural environment's existing fabric. Such structures can be energy efficient at the same degree as conventional LEED buildings, but will not turn their backs on the natural world. To start solving this mystery, it is necessary to understand how comfort is approached in today's architecture and, more importantly, how effective it has been in achieving its aim. In the contemporary built landscapes, the biophilic plan aims to provide a pleasant habitation for people as human beings that improves their health, fitness, and welfare. By creating an innovative framework for the fulfilling practices of nature within the built landscape, it seeks to solve the shortcomings of modern landscape practice and construction. Finally, the study finds this gap to fill; How and why do the level of attributes of Biophilic design elements espouse passive design?

1.4 Aim and Objectives

This paper intends to explore biophilic design as a theoretical framework for conceptualizing 'Biophilic theory' in Building environments. It further studies how far human beings are from nature besides how much the earth is subjected to global warming and contributes to stressful lifestyles. It also recalls the old way nature is connected to humans and emphasizes the necessity of nature. The primary objectives of the study are: i) to confer the conduct in which it contributes to attaining sustainability; ii) to examine how the concept of Biophilic theory from related theories in environmental behavior to passive techniques and how it has been distinct by key theorist; iii) to also look at the advantages and weakness of incorporating natural rudiments into buildings and public spaces. The results will give new insights, recommendations, and suggestions for improving and expanding the application of Biophilic architecture in the Build environment.

1.5 Materials and Method

This review uses a variety of strategies for finding, evaluating, and choosing three databases Google Scholar, Web of Science, and Scopus. The following are the broad, all-inclusive criteria for identifying relevant publications: presented the concept of biophilic design and its design principles; explored within the context of architecture, particularly urban architecture. To find articles from the oldest gathered literature, the snowball approach was utilized as a supplemental search. The assessment included significant reports, book chapters, and journal articles. Search criteria were set for each section of the study to choose relevant material. Additional articles like grey literature were included to find the major frameworks for defining biophilic design. Figure 1, portrays the framework for biophilic net-positive architecture that espouses passive design strategies. However, for built environment practitioners, the framework is meant to make the idea more tangible as it comprises of three fundamental design approaches. It should be noted that this framework only serves as a preliminary reading and that additional changes are required to put the idea of biophilic architecture into practice.

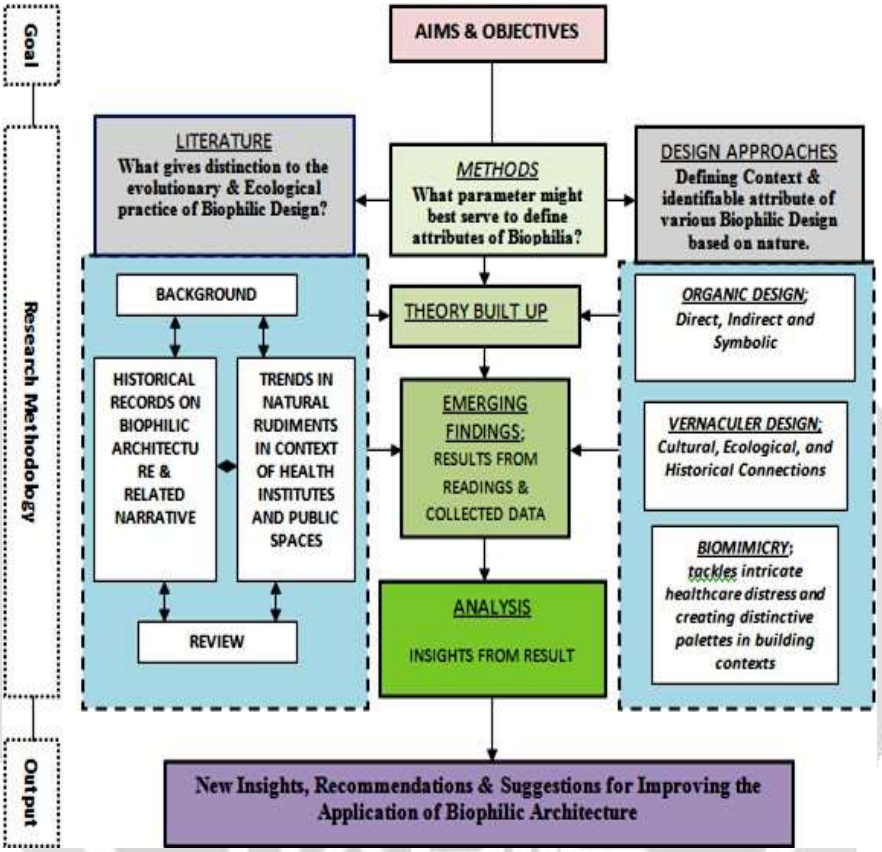

Fig - 1: Appraisal of Positive Framework Component Biophilic Net-Architecture

2.0 Theoretical findings

2.1 Relationship between net-positive and biophilic design

Reconnecting with nature has grown increasingly important in recent years as a response to rising city and ecological challenges. Many nature-based urban environmental solutions are viable options for addressing both the immediate issues of the recent pandemic and the continuing danger posed by climate change. There is a similarity between net-positive design and biophilic, both of which react to environmental and ecological forces. Biophilic goals promote ecological and human well-being, as well as place-based sensory and distinctive practices of nature and its forces. Net-positive designs are energy-efficient building that uses average on-site renewable exported energy. [17] [18], passionately urged the design community and related sectors to take on the Architecture 2030 Challenge in 2021. By the year 2030, the goal was to make "new buildings, developments, and significant building restorations" "carbon neutral" about GHG emissions [3]. The design industry has been working toward net-positive energy for the past 20 years, not only striving to reach zero. A multinational design project called Zero by 2040 has just extended the 2030 deadline by ten years. Many biophilic patterns' effectiveness is anticipated to fluctuate with diurnal and seasonal cycles. For example, the health advantages of a view of nature may be reduced or eliminated for night shift workers when the view is obscured by darkness. Secondary or seasonal techniques, such as indoor therapies, can assist in preserving balance by offering the intended response all year.

2.2 Elements that espouse both biophilic net positive and passive design

In the short term, biophilic design can change a building's or built landscape circumstances, but in the long term, it ought to promote a healthy ecological and sustainable setting. The thriving use of this style of proposal may provide us with a wide range of substantial, psychological, and behavioral benefits. Biophilic design has piqued the curiosity of the building industry all around the world in recent years [19]. It entails theuse of a variety of design methods, referred to as skills and uniqueness. The decision on which design proposal to espouse is

highly dependent on the project's conditions and constraints, which may include specific building and landscape uses. A recent study supportsthe constructive impacts of biophilic design on human health, but little guideline for execution exists. The theory and enlightening programs suitable to promote the practice thatbrings together biophilia and sustainable design have only just begun to inflate. Biophilic designs require frequent and even engagement with nature, center on human resilience to the natural world, and encourage an arousing connection to places and settings.

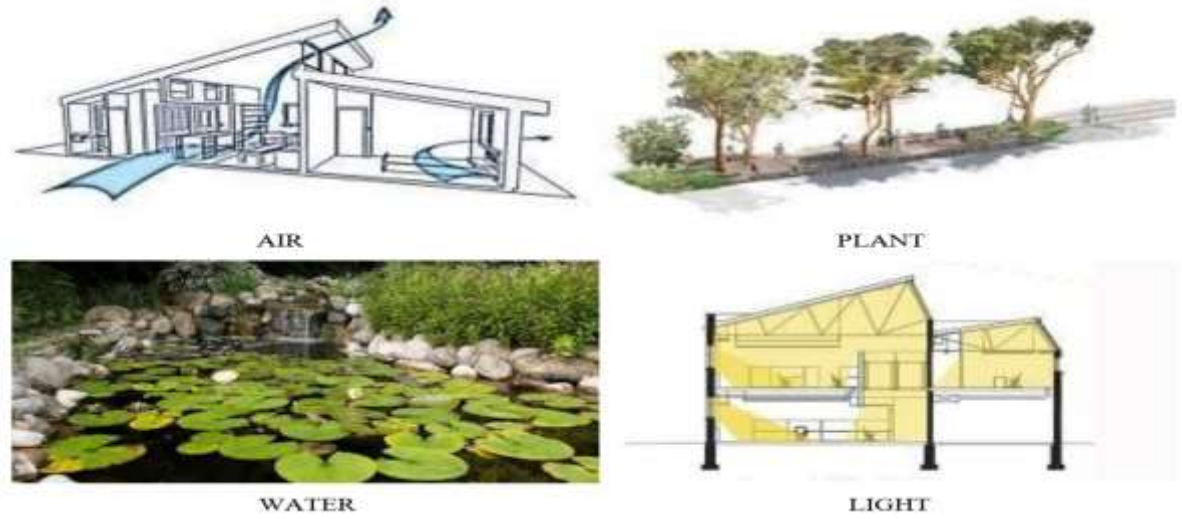

Fig – 1: Basic-Elements-of-Biophilic-Design-adapted-from-Duzenli-et-al-2015-Source-(Asim et al., 2020)

2.2.1 Air:

Natural ventilation is essential for self-productivity as well as comfort. Disparities in barometric pressure, airflow, humidity, and temperature, will enhance the natural ventilation occurrence in the built environment [21]. These circumstances can be accomplished through simple techniques such as moveable windows or more complicated technology and engineering solutions such as outside access. Air enhances natural aeration through vents, operable windows, and slim structures to mention a few [22] [23]. While, reproducing natural air and ventilation through airshafts, active window openings, porches, HVAC systems, vents, clerestories, and so on, the outcome improves sensory inconsistency and lessens monotony and negativity by replicating the delicate changes of natural air and ventilation that widen the satisfactory range of thermal comfort to reduce energy demand. Through the use of natural components and techniques, natural ventilation may embrace both biophilic net positive design and passive design principles to produce thermal comfort and energy efficiency. Biophilic Net Positive Design: By enabling fresh air and natural light to enter the area, natural ventilation fosters a connection with nature and biophilic components. The indoor atmosphere is made healthier and nicer, which boosts productivity and occupant well-being. Natural ventilation makes use of passive cooling strategies in passive design to lessen dependency on mechanical systems. To cool and ventilate the area,it makes use of natural air movements including wind, stack effect, and cross ventilation. As a result, there are fewer carbon emissions and operational expenses due to decreased energy use and reliance on air conditioning. Combining these ideas, natural ventilation improves interior air quality while also lessening the building's environmental effect. It is the best option for biophilic net positive and passive design strategies since it improves sustainability, energy efficiency, and the well-being of occupants.

2.2.2 Plants:

One of the most thriving ways to integrate nature's straight experience into the built landscape is the use of vegetation, particularly blooming flora. Plants may reduce stress, enhance physical health, increase satisfaction, and boost efficiency and production [24]. However, the use of solitary or isolated plants seldom has a significant positiveimpact. Plants in buildings and engineered landscapes ought to be plentiful and naturally integrated [25], with a preference for native species over foreign and invasivespecies [26]. Indoor plants could contribute to the building system, to the people who are using the building, and to the architecture as well [27]. Some are easy to describe in terms of the biological processes inside the plant, for instance. Sun protection - Plants can block excessive penetration of sunlight. Water and CO2 take action in the presence of sunshine to generate carbohydrates and discharge oxygen as a leftover piece. Cooling a building - greenery's transpiration and shade may lower indoor air temperatures and burdenon air-conditioning equipment [28]. On the other hand, there are several advantages that scientists have discovered to be measurable but for which no clear explanation exists, such as: i) Stress reduction - studies have shown that when people are around plants, they are less stressed; ii) Increased job productivity; quicker recovery after surgery; iii) Increased concentration in college lectures; and iv) Reduction in complaints about sick building syndrome symptom green façade.

2.2.3 Water

Since water is one of the basic needs, people have a positive reaction to water bodies. The presence of water can be beneficial. Humans appreciate seeing water, but much more so earshot as well as experiencing it. Perhaps our urge to be close to water is a comfort that we have sufficient water to imbibe because one cannot survive without it. The streams and lakes might represent remnants of our ancient ecosystem. The thrill of coming around the salty sea, at hand, cannot be clarified just by compulsion, as humans from all over the earth visit the seaside and take walks down the waterfront. Holidays near the shore and the evident joy of traveling in water-going ships, from sailing boats to coast liners, stimulate a massive worldwide tourism business [29]. Although not directly biophilia in the sense of attraction to live organisms, the impact is classified as such due to its analogous intensity. The presence of water boosts an individual's hearing, sight, and touching senses. According to Barton & Pretty, 2006 [30], responding to water bodies is extremely beneficial in enhancing self-esteem and mood. Water is central to any discussion of nature's healing properties. Water makes up approximately 71% of the planet's surface. Water is necessary for life to exist. Human bodies are composed of 75% water. The man's continued existence is reliant on having access to water. Water has been associated with hygiene and good spotlessness from the time of Hypocrites, who relate medicine and science by relating good hygiene to illness prevention [31]. Most faiths regard water as a purifier. Water, hand washing, hygiene, and cleansing before a clinical operation are still important in the avoidance of infection and disease today.

2.2.4 Light

The perception of natural light is vital to human health as well as comfort, allowing for night, day, and season orientation in reaction to the location and rotations of the sun [32]. Daylight alertness may also encourage the discovery and engagement in movement as a means of providing comfort. Beyond basic exposure, natural light may enlist esthetically pleasant shapes as well as patterns via the inventive interplay of diffuse and changeable light, light and shadow, and the combination of spatial light. Natural light may be brought down into the interior spaces through clerestories and glass walls, reflecting shade, colors and materials, and other design approaches [27]. Light in motion may be seen by comparing brighter and darker regions and daylight fluctuations over time. According to [31], a lack of sunshine promotes anger, weariness, disease, sleeplessness, melancholy, drunkenness, and suicide. More children are conceived in Finland during the summer months when the sun shines about twenty hours every day than in the winter season. Many metabolic processes are catalyzed by the sun, and when we don't get enough of it, certain metabolic paths go inactive, decreasing our capacity to burn fat and remove toxins [33]. Most hospital settings rely totally on artificial light, shutting us apart from the sun and seasons, as well as natural cycles. People working in inter-cores are never exposed to natural light or the elements. Cafeterias with windows should be included in designs to provide the best possible views. Respite places must be offered to assist personnel who must operate in regions with little natural light. We endeavor with natural light, ideally from several angles, to ensure that shades do not damage our stereoscopic hallucination, which is necessary to construct 3D pictures and intensive sensitivity. Sunlight is required not just for sensing and assessing our environment, but as well for the manufacture of vitamin D, which is important for our metabolism. Human skin and eyes are two organs that require sunshine, more so the circadian rhythms (innate perception of time, or "internal clocks") are governed by eye and skin sunlight, which regulates our sleep cycle via melatonin release. When our circadian cycles (like in jet lag) are interrupted, our bodies become weary and unable to perform efficiently. We need the sunshine to re-establish them.

2.3 Mechanisms of Biophilic Net-Positive Design Espouse Passive Design Strategies for Healing.

The six components of biophilic design entail human-nature partnerships, place-based linkages, light and space, patterns and processes, natural shapes and forms, and Environmental characteristics; whereas, air, natural materials, water, Color, and plants are only a few examples of natural characteristics that extract environmental elements. Through the use of flooring, it is simple to incorporate colors found in nature into the constructed world. The first element of biophilic design is natural elements, which include features that symbolize assets found in nature such as light and form. The second element is natural forms and shapes, the third is natural processes and patterns, and the fourth is natural space and light. These elements are designed to please human desire while dealing with nature. Place-based connections, the fifth component of biophilic design, are characteristics that unite culture and environment in such a manner that people form emotional bonds and interactions with places. Humans' relationships with locations show another evolutionary adaptation, the drive to take ownership over and control certain areas [13]. A person's sense of belonging in a place is still crucial for their health, which is why biophilic design uses techniques to arouse feelings of familiarity and foster a sense of community. For more efficient planning of the built environment, a more procedural structure is required to develop a framework for Biophilic design. The successful implementation of such a framework will eventually depend on adopting a new perception toward nature as much as executing a novel design method. conventional systems such as heating, cooling, ventilation, and lighting. By utilizing natural energy sources and sinks, passive techniques provide thermal and visual comfort. Examples include solar radiation, outside air, moist surfaces, flora, and so on. In a hot and dry region, an architect's goal would be to design a structure so that solar benefits are maximized in winter and reduced in summer.

Passive Design is a building approach that uses relatively little energy to generate a comfortable interior atmosphere by avoiding the quest for the active cooling or heating act. Passive design can help to lessen temperature changes, enhance indoor air quality, and make a home more comfortable to live in. This is accomplished by utilizing free, renewable energy sources such as the sun and wind to supply domestic heating, cooling, ventilation, and lighting. As a response, to accomplish this passive design, provide hand and encourage biophilic design into consideration, for example.

- Healthier Indoor Environment
  Efficient buildings also provide a better interior environment for the people who live and work in them, for example, by employing appealing architectural designs to lighten up work areas with sunshine rather than electricity, without producing excessive glare. High-performance buildings also provide comfortable temperatures and a quiet work environment [23].
- Increased Employee Productivity
  Improved building occupant comfort translates to higher workforce productivity. Recent studies [31] [10] [27] [20] have demonstrated that buildings with elements like natural light, better climate management, and more clever use of space boost employee productivity. There are several benefits to having urban green space (trees, grass, and greeneries).

3.0 Attribute of Biophilic net positive alongside Passive design

After comprehensive theoretical findings, this section summarizes the attributes of biophilic net positive design alongside passive design as follows:

3.1 Natural Ventilation

Having known that Passive cooling is a system in which a building structure (or a portion of it) is built to allow for enhanced ventilation and coolness retention inside the building components. it is believed to be an "option" to mechanical cooling, which necessitates a composite refrigeration system. By incorporating passive cooling systems into modern buildings, mechanical cooling can be eliminated or at least reduced in size and expense. Passive cooling is based on the relationship between a building and its environment. An inert solar energy technology that alleviates the natural circulation of cooler air from external covers parts of a building and its landscape. Hence, natural ventilation is used in biophilic design (movement of air, changes in air temperature, airborne scents) [20]. The passage of fresh air through a room alters everything. The home's orientation allows for cross-ventilation in all key sections via windows, doors, and movable skylights that allow fresh air to flow. The thermal comfort condition of an interior space is determined by how well the room is ventilated. Knowledge of microclimatic variables is vital in architectural design for natural ventilation: airstream and local breezes, sunshine, shadows, humidity, and plants may all contribute extensively to the thermal comfort of the inhabitants.

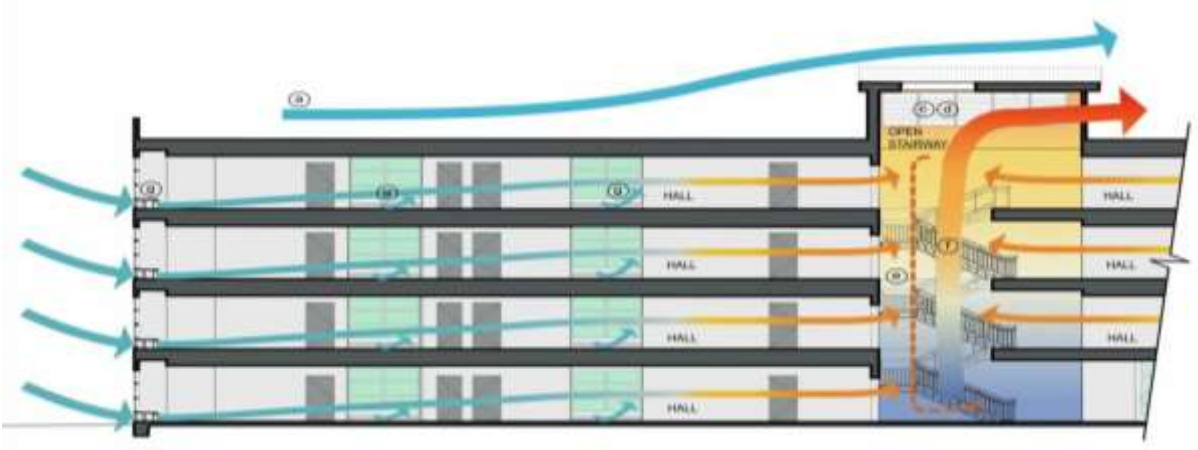

Fig – 3: Comfortable Airflow in a Building by using Natural Ventilation (Reference: econaur.com)

Natural ventilation offers high air-change levels at low cost, with new systems able to achieve higher levels than minimum ventilation needs, despite variations in air-change rate. In comparison to mechanical ventilation systems, natural ventilation has various advantages, including economic effectiveness, energy economy, and more sunshine. As they don't require electrical energy for fans, which can use up to 25% of the energy used by mechanically ventilated buildings, they also contribute to a sustainable built environment.

3.2 Landscaping

A passive cooling system can be improved with landscaping through the employment of plants to shade a home which is a particularly effective cooling strategy. A well-placed plant may provide effective, cool shade while also

adding to the aesthetic appeal of a structure; plants are also excellent for cooling since they absorb heat. The water vapor cools the air that passes through it, providing a supply of cool air for the structure. Along with the urban form, strategy planting of vines, shrubs, and trees, around a building and at roof covers such as pergolas, roof gardens, and beam overhangs aid in improving the microclimate. The utilization of natural landscaping in a structure is enabled by biophilic design. Unrelated to biophilia, studies in landscape planning [15] [34] have repeatedly demonstrated that people prefer semi-open settings with huge trees and water to thick forests or desert [16]. Plants have long been used to improve the look of indoor places. Plant research also indicates that a reduced respiratory system is likely connected to increased air quality. Flowers, like green plants, are related to favorable results, particularly an increase in positive emotional functioning.

3.2.1 Green facade

The front of a building is frequently the most essential part from a design viewpoint in architecture since it sets the character for the remainder of the construction. Because of our dependence on technology, we have reduced the demand for heating and cooling, as well as ventilation and interior lighting. The longitudinal greening elevation is an external wall that is planted with foliage primarily used for visual and conservatory principles. According to [35], green walls can trim down the temperature in a building by two degrees [36]. One of the primary functions of the facade is to provide the highest thermal insulation possible. Inadequate thermal insulation can result in significant heat losses and gains, increasing the cost by around 20% via so-called thermal bridges. The facade is chosen based on the materials available, the kind of building, and the aesthetic needs. Green facades have several advantages, such as biophilic net positive design and passive design principles. The positive biophilic net design integrates humans with nature, boosting well-being and biodiversity. Green facades, vertical gardens, or living walls integrate plants onto the façade of a building, offering visual and sensory impressions of nature while improving air quality, lowering noise pollution, and fostering biodiversity. By utilizing natural features and tactics for thermal comfort and energy efficiency, passive design concepts attempt to lessen dependency on mechanical systems. Green facades contribute to passive architecture by providing shade, minimizing solar heat intake, and lowering cooling demand. They also help to control indoor temperature by absorbing and releasing moisture via transpiration, resulting in a cooling effect. Green facades also help to passive cooling measures by collecting solar radiation, preventing it from being absorbed by the building's walls, and lowering heat accumulation. Green facades, in general, encourage both biophilic and passive design principles, assuring appropriate internal temperatures without relying largely on mechanical cooling systems.

Fig – 4: Nanjing Vertical Forest https://wfmmedia.com/wp-content/uploads/2022/03/Green-Buildings.jpg

The Nanjing Vertical Forest is a distinctive project by Stefano Boeri Architetti in Southern Jiangsu. Two buildings make up the concept, which has balconies and planters inspired by Milan's Vertical Forest. The towers, which have a total area of 4,500 square metres, include 600 huge trees, 200 medium-sized trees, and more than 2,500 plants. The initiative intends to increase yearly oxygen production to 16.5 tonnes, decrease CO2 emissions, and restore local biodiversity.

3.2.1.1 Benefit of green façade

Green facades are passive energy-saving measures that also improve aesthetics. They are crucial for restoring equilibrium in the urban environment and offering fresh insights into solutions to urban heat island problems since they are becoming more widely acknowledged as a potential solution to these problems. By swapping out green spaces for hard surfaces, which absorb sunlight and turn it into heat, green facades in dense urban structures lessen the urban heat island effect. By storing rainfall and lowering pollutants, good design encourages cooling, rainwater retention, air filtration, pollution removal, and cost savings. Green facades have the added benefit of improving the climate by managing air humidity and bringing down temperatures.

3.2.2 Living wall

Living walls or vertical gardens, commonly referred to as living walls, can include features of passive as well as biophilic net-positive architecture. They entail the utilization of vegetation, such as plants or moss, growing vertically on the exterior of a building or a free-standing object. The goal of biophilic net positive design is to develop places that improve human well-being by bringing people closer to nature. living walls, which incorporate live plants into the built environment, offer a visual link to nature and can enhance the quality of the air by collecting pollutants and releasing oxygen. Living walls can aid in temperature control and lessen the demand for mechanical cooling systems in passive design projects. As a natural insulating layer, the plants on the wall slow down the flow of heat through the building envelope. This can lessen the need for air conditioning and save energy use by keeping interior rooms cooler during hot weather. One of the most essential properties of living wall systems is temperature decrease. The plant's cooling function is efficient in lowering the temperature; and aids lower cooling energy consumption as the average temperature drop on the wall facade ranges from 8°C to 10°C [2] [32] [37]. When the space between the plant board and the building surface is 15 centimeters wide, the maximum temperature fall is 3.3°C. Specifically, all vertical green systems were discovered to lower relative temperature, wall planes, as well growth medium throughout the day. Living walls can also help with stormwater control and rainwater collection. Rainfall may be absorbed and retained by the plants, which lessens runoff and the strain on drainage infrastructure. This can enhance the overall ecological performance of the building or urban region and lessen the consequences of the urban heat island effect. Overall, using living walls in urban planning may enhance air quality, thermal comfort, energy efficiency, and visual appeal. Green facades may aid in creating resilient and sustainable cities by using both passive design and biophilic net-positive design concepts.

Fig – 5: From Planterra: A living wall affords a point of respite within this hospital
https://www.terramai.com/blog/wp-content/uploads/2018/05/henry-ford-hospital-living-wall.jpg

By bringing life to clinical settings, biophilic design in hospitals improves the physical, physiological, mental, and emotional advantages. In the atrium of Henry Ford Hospital in Michigan, which holds private events and acts as a community gathering place, a living wall was installed. Poinsettias for the holiday season are displayed on the wall.

3.2.2.1 Benefit of green wall

The living wall is the ideal biophilic design element, literally bringing life to a room and improving occupant well-being both physically and emotionally with advantages including natural air filtering, lowering noise, and assisting in maintaining humidity and temperature. In other hand Interior living walls contribute to better indoor air quality by collecting airborne contaminants including dust and other undesired gases, naturally humidifying dry air, and releasing oxygen in exchange for carbon dioxide. living walls are elaborate, long-lasting constructions comprised of modular panels and irrigation systems that may be divided into support systems and growing mediums.

3.2.3 Green roof

An elegant and organized green roof may serve as a high-class insulation device, lowering heat flux from the roof coverage during the hot season [28]. A set of Japanese scholars measured the roof grass garden situated on unwoven fabric on a tangible three-story pre-cast reinforced concrete structure. The assessments revealed that a roof grass garden lowered the quantity of heat entering the space throughout the summer. During the measurement, the temperature of the roof slab facade was reduced from 60 to 300 C, and a 50% reduction in heat flow was computed using a simple computation [24]. [38] discovered that establishing a green roof on an administrative building in Athens contributes significantly to energy savings during the summer months. From the standpoint of biophilic net positive design, green roofs contain organic components and techniques that encourage a connection with nature. By bringing nature closer to urban settings through the presence of plants on rooftops, individuals have

more opportunities to interact with green areas and enjoy the advantages of being in a natural setting. This relationship with nature enhances people's general well-being and happiness. Green roofs serve as natural insulation layers from the standpoint of passive design, minimizing heat transmission between the structure and the surrounding area. As a result, less mechanical heating or cooling is required, helping to regulate building temperatures and preserve energy. By lowering solar heat uptake on the roof surface, which aids in maintaining suitable inside temperatures, green roofs also support passive cooling measures. Green roofs improve rainwater harvesting and stormwater management by absorbing and retaining rainwater, reducing runoff, and improving harvested rainwater quality. They align with biophilic net positive design principles, contribute to energy conservation, and promote a connection with nature in urban environments.

Fig – 6: Center for Sustainable Landscapes https://images.squarespace cdn.com/content/v1/58e3eecf2994ca997dd56381/1605798775118-X7CLZ43OHV3T4N6H40SJ/CFSL-2.jpg?format=750w

The Phipps Conservatory aims to promote sustainability and human and environmental well-being through action and research. The project aims to transform people's relationship with built and natural environments. It is the first building to meet five green certifications and is home to over 100 native plant species, including 50 on the green roof. This enhances biodiversity and aids in stormwater management, reducing annualized runoff by 85%.

3.2.3.1 Benefit of green roof

Green roofs are excellent for fostering community growth and offering a variety of activities or a welcome respite from the stifling urban environment because of their cooling, soft texture, and air-cleaning qualities. Green roof flora serves as insulation, reducing heat transmission by 72% and lowering air conditioning expenditures by up to 35% [38]. Winter clothing serves as a cap to keep warm air inside the structure. According to research by Green Roofs for Healthy Cities, the plant and support layers on green roofs efficiently absorb 25%–40% of summertime rainfall and 70%–90% of wintertime precipitation, therefore minimizing storm water flow. Plants absorb 50% of sunlight, resulting in a cooler, more pleasant climate. This reduces the need for air conditioning, resulting in energy savings. This also positively impacts the surrounding environment and city temperatures, resulting in a 3°C temperature reduction in the city.

3.3 Natural Light.

The sun is the source of natural light, providing warmth and light as well as information about the time of day. Patients in bright rooms recover faster from sickness, have lower pain levels, use fewer powerful analgesics, and stay in the hospital for fewer days than patients in more poorly lit rooms placed in places where surrounding structures obstruct sunpenetration [39] [40]. Even small visits outside on a bright day can provide the advantages of sunshine, as can the design of rooms that incorporate daylight and sun into the inside without sacrificing the thermal comfort of the interiors. Thus, in biophilia design, in addition to providing an aesthetically pleasing environment, indoor daylight may improve mood, improve cognitive performance, reduce stress, and minimize the usage of severe pain medication in hospital settings. Many studies have been conducted to demonstrate the importance of natural light to human health. As a result, biophilic design embraces passive design to the utilization of natural lighting in a structure.

Fig – 7: Maximising your view with Exact glazing Upton Grey, Hampshire
https://cdncoejl.nitrocdn.com/nAULCPQhfyWwWdcnfnsxMknMGxFEHjYy/assets/images/optimized/rev-765386f/cmsAdmin/uploads/exact_cs_tunwoth_internal03.jpg

The charming property is located in the Hampshire countryside in the village of Upton Grey. Our customers opted to build a back addition after many years of living in their house without being able to take advantage of the breathtaking views. Now, they can enjoy the ever-changing rural views from a pleasant and comfortable area all year long. A Pure Glass Roof Lantern, a modern, simple design that complements the extension's contemporary aesthetic and provides an unobstructed view of the sky, was part of the project.

3.3.1 Benefit of Building Natural Light

Place windows, skylights, and light shelves in strategic locations to make the most of sunshine. This lowers energy expenses and improves the ambience by making it cozier and more welcoming. Systems for "biophilic" indoor lighting have several advantages. Blue light, which is included in the majority of white LED lights, can interfere with our circadian rhythms by preventing the production of melatonin, a hormone that induces sleep [31]. Man-made light sources can also give people headaches and eye discomfort. Biophilic lighting systems mimic human circadian cycles by using more natural light during the day and less blue light at night, promoting restful sleep at night and high levels of productivity during the day.

3.4 Natural Analogue and Building Form

The work of Natural Analogues investigates how items, materials, colors, forms, and patterns found in nature may be used to evoke the biological, non-living, and indirect aspects of nature. In the constructed world, these components are integrated into fabrics, ornamentation, furniture, and décor. The best Natural Analogue experiences allow for an indirect connection with nature by presenting information richness in an organized and occasionally dynamic manner. Building form and massing can significantly lower building energy intensity, but they are frequently influenced by a complicated set of aspects (building typology and usage, planning requirements, assessment, and performance [41] [42]. Structures with a lesser outer facade or area will attain greater energy efficiency performance with the same square footage. A compact building form decreases the energy intensity of the structure and the requirement for active mechanical systems. The massing of a planned construction must account for orientation and other-site precise characteristics as one of the initial design considerations. The innate human inclination for natural shapes has been related to biomorphic design, which when correctly articulated can improve human physical and mental well-being [39]. Nature-inspired architectural design may frequently result in very attractive and profoundly experienced settings, taking strength from an inherent human emotional and intellectual predisposition for the natural world. Light's sculptural features can therefore be coupled with a very organic environment. The idea is that by creating and building from nature, replicating its beauty and harmony, the constructed environment would be more favorable and sympathetic to the human body, mind, and soul.

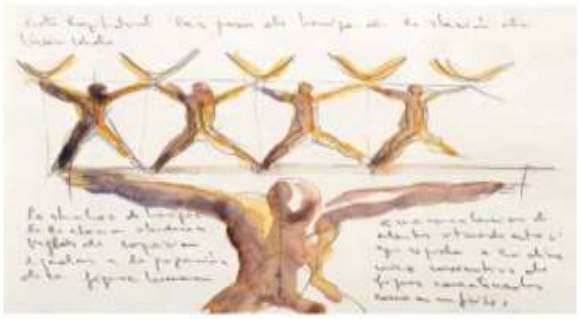

Figure – 8: Lyons Airport Railroad Station by the architect Santiago Calatrava. Concept design (left) and final output (right) (Source: McQuaid, 1993).

The international airport serving Lyon, France, and an essential hub for transportation in the Rhone-Alpes area is Lyon-Saint Exupery Airport, formerly known as Lyon Satolas Airport. Santiago Calatrava created the Gare de Saint-Exupery TGV train station, which is situated 20 km east of Lyon's downtown. The 5,600 square metre station has a 1,300-tonne roof, ticket counters, retail stores, dining options, and elevated access to and from the airport. It was created as a symbolic entrance to Lyon. With two huge cantilevered balconies that extend into the internal area, Calatrava's structure is as expressive inside the building as it is outside. Nature's patterns and arrangements, reflected in minimal processing, create a sense of place and ecology. These materials and elements also provide rich sensory information, adhering to a spatial hierarchy similar to those found in nature.

3.4.1 Benefit of Natural Analogue and Building Form

Artificial plants, moss walls, and architectural designs are examples of artificial features that evoke natural aspects. These components can boost productivity, well-being, and stress reduction in workplaces while also increasing overall visual appeal. Natural forms incorporate the geometry of the natural world into our built environment. Important passive design techniques for lowering energy use and enhancing thermal comfort in buildings are form and orientation [43] [20]. They are essential for reaching net zero energy objectives since they have a significant impact on solar exposure, daylighting, and wind direction. Depending on the location and temperature, different building designs are used, but it is crucial to maximize solar radiation in the winter and reduce it in the summer.

4.0 Discussions

4.1 How do biophilic net-positive architecture espouse passive design strategies to contribute to a healthy sustainable built environment?

Biophilic net-positive architecture is an emerging field that combines biophilic design principles with passive design strategies to create healthy and sustainable built environments.

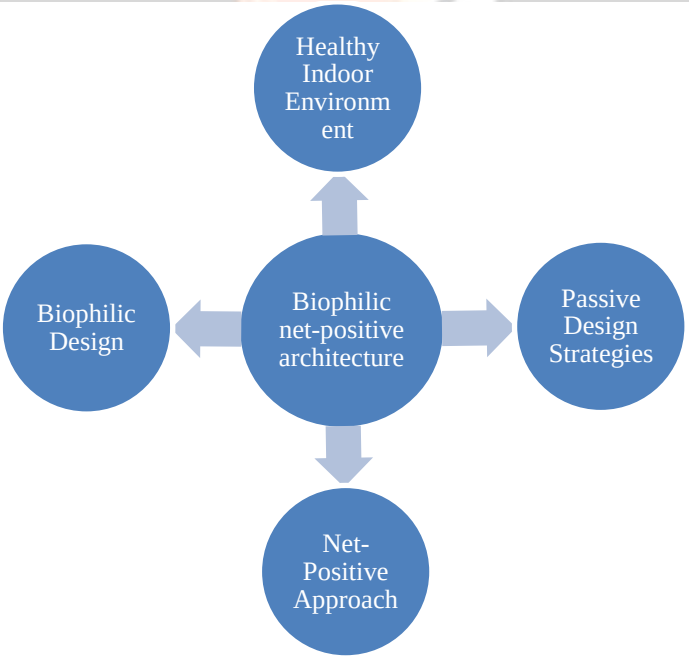

Figure - 9: shows the integration of biophilic net positive Architecture

1. Biophilic Design: The concept behind biophilic design is that people are inherently connected to nature. It aims to blend organic components like plants, natural light, and vistas of the outdoors into the constructed environment. According to this notion, being among nature may boost well-being, lessen stress, and increase creativity and productivity.
2. Passive Design Strategies: To reduce energy consumption and improve occupant comfort, passive design techniques optimize a site's natural resources and climate. Passive heating and cooling methods, natural ventilation, sun shading, and thermal insulation are some of these tactics. According to the philosophy underpinning passive design, buildings may use less energy and provide healthier indoor environments by reducing their reliance on mechanical systems.
3. Healthy indoor Environment: Creating a healthy interior environment is a priority for both passive and biophilic design methods. Natural light and vegetation are examples of biophilic design components that may enhance air quality, control humidity, and lessen the presence of dangerous compounds. By

maximizing natural ventilation and minimizing dependency on air conditioning, passive design solutions can improve indoor air quality and lower the risk of health problems linked to inadequate ventilation.

4. Net-Positive Approach: Net-positive architecture strives to design structures that produce more energy or resources than they use, going beyond just avoiding negative effects. This strategy supports a regenerative relationship with the environment and is consistent with sustainability ideals. A healthier and more sustainable constructed environment may be created by using renewable energy sources, efficient construction materials, and resource conservation techniques.

These theories collectively support the idea that biophilic net-positive architecture, through the integration of biophilic design and passive design strategies, can create healthier, more sustainable, and inspiring built environments that benefit both occupants and the surrounding ecosystem. By combining the principles of biophilic design and net-positive energy, biophilic net-positive architecture aims to create sustainable and healthy built environments. By incorporating natural elements, optimizing energy efficiency, and generating more energy than is consumed, these theories collectively support the idea that biophilic net-positive architecture can contribute to a healthier, more sustainable, and inspiring built environment.

4.2 Theoretical framework

4.2.1 Fundamental design approach

To encourage the incorporation of the "natural world" into architecture and the sustainability goals for a healthy sustainable build environment, this paper proposes an optimized biophilic design framework. figure 2 represents the fundamental design approach to achieve the framework while considering the three fundamental design approaches;

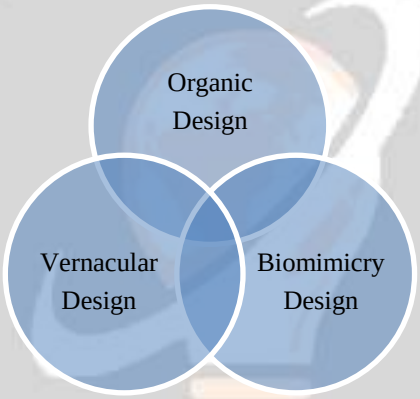

Figure - 10: Fundamental design approach to achieve optimized biophilic net positive design framework

- Organic design uses natural shapes and forms that directly, indirectly, or symbolically arouse people's intrinsic affection for the natural world [39]. The direct nature experience is contact with elements like wading along the seaside or sitting in the sunshine. Indirect encounters involve constant human contact to maintain the dimension of nature, such as watering a lawn or caring for a pet. Consequently, the application of a pattern using organic forms could be an obvious expression of a symbolic connection to nature. Organic design principles enhance Biophilic design by promoting harmony with the natural world through natural materials, curvilinear forms, and biomorphic patterns. This creates spaces that evoke a sense of nature, enhancing the biophilic experience and promoting well-being.
- As for vernacular design, structures or settings in which cultural, ecological, and historical connections produce a place of meaning [39]. Hence, the sense of ownership that comes with maintaining a space, whether at home or business, is included in biophilic design. Integrating vernacular design principles into Biophilic design allows Designers to create buildings responsive to local climate, culture, and resources. This involves using locally available materials, natural ventilation, and passive cooling and heating strategies, ensuring harmonization with the environment and minimizing environmental impact.
- Biomimicry is more than just a belief, as it integrates natural items to assist in tackling complicated healthcare concerns and creating distinctive color palettes in healthcare and building contexts [44]. This is beneficial to humans and can be done by replicating nature through numerous biometry features like "Lotus Effect", hardware, or seats with nanotechnology to reduce microbes to mention among others. Designers can optimize functionality and sustainability by observing and emulating nature's strategies. Biomimicry enhances energy efficiency by analyzing temperature regulation, airflow optimization, and sunlight capture. By incorporating these principles, buildings become more energy-efficient, resilient, and in tune with their natural surroundings.

The Biophilic design framework can be optimized by incorporating vernacular design, biomimicry, and organic design, drawing inspiration from nature, local culture, and sustainable practices. From this point on, the emphasis is

on developing persistent, resilient, and aesthetically appealing buildings that maximize human well-being while reducing their impact on the environment.

4.2.2 Optimize Biophilic Net Positive Design Framework

Biophilic Design:

Biophilic design is based on the idea that humans have an innate connection with nature and thrive in environments that incorporate natural elements.

Step 1: Incorporating Natural Elements:

Biophilic net-positive architecture starts by incorporating natural elements such as plants, water features, natural lighting, and natural materials in the design. This step helps create a visually appealing and stimulating environment that promotes well-being and reduces stress.

Implementation of Step 1:

- Integrate water features: Incorporate elements like ponds, waterfalls, or fountains to create a calming and visually appealing environment.
- Living walls and roofs: Install vertical gardens or green roofs to enhance air quality, provide insulation, and promote biodiversity.
- Natural materials: Use sustainable and locally sourced materials like wood, stone, and bamboo to create a connection with nature.
- Maximize nature views: Orient the building to maximize views of nearby green spaces, parks, or landscapes.

Step 2: Optimizing Energy Efficiency:

The biophilic design also focuses on optimizing energy efficiency in buildings. This involves using passive design strategies such as proper insulation, natural ventilation, and daylighting to minimize the need for artificial lighting, heating, and cooling. By reducing energy consumption, buildings can minimize their environmental impact and contribute to a sustainable future.

Implementation of Step 2:

- Orientation and layout: Design the building to take advantage of natural light and heat, reducing the need for artificial lighting and heating/cooling.
- Insulation and airtightness: Ensure proper insulation and airtightness to minimize heat loss or gain, reducing the need for excessive heating or cooling.
- Natural ventilation: Incorporate windows, vents, or skylights to facilitate natural airflow and reduce reliance on mechanical ventilation.
- Daylighting: Maximize the use of natural daylight by strategically placing windows, light shelves, or skylights.

Step 3: Creating a Healthy Indoor Environment:

Biophilic net-positive architecture prioritizes the creation of a healthy indoor environment. This includes improving air quality through natural ventilation systems, using non-toxic building materials, and incorporating biophilic elements that connect occupants with nature. Enhancing indoor air quality and reducing exposure to pollutants can have a positive impact on occupant health and well-being.

Implementation of Step 3:

- Biophilic design principles: Integrate elements like indoor plants, natural materials, and natural patterns to enhance well-being and reduce stress.
- Indoor air quality: Install air filtration systems and use low-emission materials to maintain clean and healthy indoor air quality.
- Acoustic design: Incorporate sound-absorbing materials and proper insulation to minimize noise pollution and create a peaceful environment.

Step 4: Energy Generation:

The net-positive architecture incorporates renewable energy systems such as solar panels, wind turbines, and geothermal systems to generate clean energy on-site. These systems can produce more energy than the building requires, allowing the excess energy to be fed back into the grid. By generating clean energy, buildings can reduce their dependence on fossil fuels, lower greenhouse gas emissions, and contribute to a more sustainable energy future.

Implementation of Step 4:

- Renewable energy systems: Install solar panels, wind turbines, or geothermal systems to generate clean and renewable energy on-site.
- Net-positive energy design: Aim to generate more energy than the building consumes, contributing excess energy back to the grid.

Step 5: Energy Conservation:
Net-positive architecture also emphasizes energy conservation measures.

This involves using energy-efficient appliances and lighting, implementing smart energy management systems, and promoting energy-conscious behavior among occupants. By reducing energy consumption, buildings can further optimize their net-positive energy performance and minimize their environmental footprint.

Implementation of Step 5:

- Energy-efficient appliances and lighting: Install energy-efficient appliances and LED lighting to reduce energy consumption.
- Smart controls and automation: Utilize smart technologies to monitor energy usage, optimize building systems, and reduce wastage.

4.4 summary

Biophilic net-positive architecture is an approach to building that incorporates nature and sustainability. It focuses on building environments that improve people's well-being and connection to nature. Passive design methods are an essential component of this strategy, to reduce energy use while increasing natural ventilation, daylighting, and thermal comfort. Architects may create healthy and sustainable built environments by using these principles. To achieve well-being and sustainability through the principles of biophilic net-positive architecture and passive design strategies for a healthy sustainable built environment, consider the following steps

- Integrate Biophilic Design: Incorporate natural elements such as plants, water features, and enough natural light into the architectural design. To create a connection with nature, use natural materials such as wood, stone, and organic fabrics.
- Maximize Natural Ventilation: Design buildings with operable windows, atriums, and courtyards to use natural airflow. This eliminates the need for mechanical ventilation systems while also promoting a healthier interior environment.
- Daylighting: Make the best use of natural light by including wide windows, skylights, and light shelves. This not only saves energy but also improves occupant well-being and productivity.
- Promote biodiversity by introducing native plants, green roofs, and vertical gardens into landscapes that sustain local ecosystems and species. This increases biodiversity and makes the ecosystem healthier.

5.0 Conclusion and Recommendation

It is vital to suggest design positivity for the post-pandemic municipality and metropolitan scenery that considers the built landscapes' influence on human well-being and fitness. During the pandemic, people were compelled to adjust their daily practices and way of living. Many types of research have been published in recent decades especially more so during the current pandemic (refer to cited literature). Architects, urban planners, as well landscape architects are increasingly developing more adaptable concepts with a more universal approach that improves human fitness and comfort. Concurrently, outstanding issues such as urbanization, population expansion, and climate change must be addressed. It is critical to include the notion of biophilic design in health facilities not just in new proposals but also in the built landscape. Public spaces like roof gardens, atria, green terrains, and gardens encourage and promote communal unity. Relating to natural surroundings promotes high-quality social, cognitive, physical, and emotional development in both adults and children. Interventions that support biodiversity (from microorganisms and pollinators to bigger fauna) add directly and ultimately to human fitness. In regards to energy balance, biophilic participation may necessitate purposeful and cautious continuous amendment of the cost and value. Henceforth Biophilic interventions may "tune" urban microclimates by providing shade and windbreaks, as well as assistance for regulated stormwater infiltration. Individual and communal stresses can be buffered by contact with bio-psychosocial natural components such as vistas, materials, noises, and architecture during distinctive moments when leisure and recreation outdoors are less secure. Circadian effective lighting techniques promote general health and aid in the regulation of sleep-wake cycles, which are expected to be increasingly disturbed by rising nighttime temperatures.

Furthermore, daylight, when considered in floor plan design along with the appropriate facade, may resolve daylight demands for visual calm while lowering building electrical and cooling costs. An in-depth passive solar and conservation can keep you comfortable in temps as low as 45 degrees Fahrenheit. Through shade and evapotranspiration, outdoor living walls may cool facades along with indoor areas. The influence of natural ventilation on the indoor micro-biota and inhabitants' health is still under investigation, with no precise recommendations in place. Hence, following the three-step mantra will vividly help achieve the above concept:

1. To design with Passive approaches first
2. To harmonize with vigorous mechanical systems if necessary.
3. To make up with renewable systems, if necessary.

This review provides useful information that will be used in the Project implementation of investigation activity. Understanding the bond that humans have Developing a biophilia philosophy of the natural world provides insight into how humans feel about natural environments. This should be considered while designing a biophilic room at the hospital and deciding which features to add.

5.1 Future research

The biophilic design paradigm encompasses a wide range of 'natural' design experiences, including material, morphological, sensory, physical, and spiritual occurrences. As incorporating nature into buildings (green architecture) becomes a marketing technique, essential issues must be addressed and scrutinized. Some factors (for example, air, daylight, plants, and landscape) provide an opportunity for developing design methods with many advantages, particularly for improving health and well-being, productivity, and productivity.

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	Authors	AFLLIATION	Remark
	Hisham Sharif Bala hishamsharif@ymail.com https://orcid.org/0009-0001-9604-9591	*School of Civil Engineering, Chongqing University, Chongqing, 400044, China.*	
	Baizhan Li baizhanli@cqu.edu.cn	*National Center for International Research on Green Building and Built Environment, Chongqing University, Chongqing, 400044, China.* *School of Civil Engineering, Chongqing University, Chongqing, 400044, China.*	Corresponding author
	Danjuma Abdu Yusuf yusufdanjuma@gmail.com https://orcid.org/0000-0002-5054-3164	*School of Architecture and Urban Planning, Chongqing University, Chongqing, 400044, China.* *Department of Architecture, Kano University of Science & Technology, Wudil, 713101, Kano, Nigeria.*	
	Chenqiu Du duchenqiu@cqu.edu.cn	*School of Civil Engineering, Chongqing University, Chongqing, 400044, China.*	