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## Swedish harmony in the built landscape: integrating natural environment and architecture

Swedish architecture has undergone a significant transformation from its functionalist origins towards a more holistic integration of high-performance technologies and natural elements, heavily influenced by the cultural philosophy of *friluftsliv*—a lifestyle encouraging regular contact with nature for mental well-being. This paper examines how *friluftsliv* aligns with the principles of biophilic design, a concept increasingly recognised for its benefits to human health and environmental performance. By analysing three projects in the Stockholm area—Hammarby Sjöstad, Stockholm Wood City, and Artipelag—this study highlights how contemporary Stockholm architecture incorporates biophilic strategies at both the building and urban levels. These cases reveal a synergy between sustainable engineering, timber construction, and design that fosters a connection between humans and the natural world. While projects demonstrate

measurable outcomes in terms of livability and sustainability, challenges remain in balancing ecological ambitions with social equity. The findings highlight the originality of linking biophilic design with *friluftsliv*, providing a culturally grounded framework for future research. Ultimately, Sweden's model presents a holistic vision that supports both environmental health and human well-being through architecture.

**Keywords:**  
Swedish architecture; biophilic design; *friluftsliv*; environmental sustainability; green infrastructure

## INTRODUCTION

Historically, Swedish architecture was heavily influenced by functionalist ideals, particularly during the early and mid-20th century, when modernism emphasised rational planning, minimal ornamentation, and the efficient use of materials (Colquhoun, 2002; Weston, 2003). However, by the late 20th century, a paradigm shift began to emerge. Swedish architects increasingly sought to reconcile modernist principles with ecological responsibility, local material traditions, and a deeper sensory connection to place (Beery, 2013). This evolution led to design approaches integrating high-performance building technologies with natural materials and organic forms.

This transition was likely supported by a long-standing cultural predisposition in Sweden towards nature and landscape. The concept of *friluftsliv*, which translates loosely to "outdoor life" or "life in the fresh air," reflects this deep-rooted connection. More than just a love for outdoor recreation, *friluftsliv* represents a cultural ethos grounded in the belief that regular immersion in nature is vital to human health, happiness, and social cohesion (Gelter, 2000; Sandell & Sörlin, 2008). It promotes time spent outdoors in all seasons and weather, reinforcing a way of life where natural environments are not separate from but integral to daily routines. Scientific research supports the health benefits of this philosophy. A study published in *Scientific Reports* found that spending at least 120 minutes per week in nature is associated with significantly lower stress levels and enhanced well-being (White et al., 2019). Additional studies confirm the positive psychological, physiological, and cognitive impacts of nature exposure, including reduced anxiety, improved mood, and increased attention restoration (Hartig et al., 2014).

Contemporary Swedish architecture increasingly reflects the values of *friluftsliv* in both form and philosophy. There is a noticeable synergy between how Swedes engage with natural landscapes and how they build within them, even in dense urban environments. Buildings are designed not only to perform efficiently but also to frame views, allow

natural light, provide access to outdoor spaces, and incorporate local materials, such as timber and stone (Stenberg et al., 2018).

In parallel, the international architectural discourse has adopted the concept of biophilic design, which promotes the integration of nature into the built environment to enhance human health and promote environmental stewardship. Empirical studies have shown that biophilic elements—such as natural ventilation, daylighting, vegetation, and water features—improve building performance and reduce energy use but also enhance occupants' well-being, satisfaction, and productivity (Browning et al., 2014; Söderlund et al., 2015; Zhong et al., 2022). As Moriah Rhodes stated, it was confirmed that "Nature nurtures" (Rhodes, 2017).

The core aspect of this paper focuses on identifying biophilic design characteristics and connecting them with successful projects. Its originality lies in associating these features with the Swedish concept of *friluftsliv*, which represents a natural desire to find spaces within the built environment that integrate nature with architecture.

## BIOPHILIC DESIGN

The concept of biophilic design first emerged in the book "Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life", which followed the previous ideas developed in "The Biophilia Hypothesis" by Kellert and Wilson (1993). Kellert et al. (2008) advocated for a sustainable design that can enhance the role of the natural environment in cities, as it can be considered a game changer in the lives of urban inhabitants (Söderlund, 2019a). They defined biophilic design as "the expression of the inherent human need to affiliate with nature in the design of the built environment" (Kellert et al., 2008). This concept has evolved over the years due to significant interest and dissemination through conferences, blogs, and websites (Söderlund, 2019a).

The connection between the natural environment and architecture is strengthened by the capability of architectural design to resemble nature through

the use of materials, forms, and patterns that evoke natural elements (Söderlund, 2019b). This has an impact on the emotional sphere of inhabitants, meaning that design should strive to influence people positively, enabling them to lead happier, more relaxed, and successful lives (Alexander, 1977). The involvement of people, their feelings, emotions, and well-being, made this a social movement, evolving from a previous phase where advancements in industry and technology sterilised buildings and design. When people are forced to live without a direct connection to the natural environment, they risk becoming mere 'components in a mechanical world'—inert passengers in a fundamentally sterile and non-interactive environment (Salingaros & Masden, 2008).

Previous research initiatives have helped define key biophilic design principles, providing a solid foundation for incorporating nature into the built environment. Kellert et al. (2008) recognised the need for a design toolkit to guide designers through the various aspects of biophilic design (Kellert & Calabrese, 2015). The current framework, established by Browning et al. (2014) and Ryan et al. (2014), outlines three categories and fourteen patterns of biophilic design, including the most significant relationships between nature and health in the built environment (Ryan et al., 2014). Downton et al. (2017) introduced a new pattern, "Indirect Nature," which encompasses indirect experiences of nature, such as artistic representations and illusions of nature (Downton et al., 2017b, 2017a). Table 1 shows the 14 patterns previously cited. Each pattern is assigned to a group, and it is described as follows (Browning et al., 2014).

The "Nature in the Space Patterns" address the direct, physical and ephemeral presence of nature in a space or place and include:

1. Visual Connection with Nature: An observation of natural elements, living organisms, and ecological processes.
2. Non-Visual Connection with Nature: Sensory stimuli such as sounds, touch, smells, or tastes that evoke a conscious and positive link to nature, living systems, or natural processes.
3. Non-Rhythmic Sensory Stimuli: These stimu-

li are random and fleeting connections with nature that can be statistically analysed but not precisely predicted, unlike the built environment, which has evolved into a deliberately predictable space.

4. Thermal & Airflow Variability: A space with good thermal and airflow variability feels refreshing, active, alive, invigorating, and comfortable.

5. Presence of Water: This is a condition that enhances the experience of a place through the visual, auditory, or tactile presence of water.

6. Dynamic and Diffuse Light: It uses varying intensities of light and shadow that change over time to recreate natural conditions.

7. Connection with Natural Systems: It refers to being aware of natural processes, particularly seasonal and temporal changes that are typical of a healthy ecosystem. A space with a strong connection to natural systems inspires a sense of belonging to a larger whole, making you more attuned to the changing seasons and the cycles of life.

The "Natural Analogues Patterns" address organic, non-living and indirect evocations of nature and include:

8. Biomorphic Forms & Patterns: Symbolic references to contoured, patterned, textured or numerical arrangements that persist in nature.

9. Material Connection with Nature: Materials and elements from nature that, through minimal processing, reflect the local ecology or geology and create a distinct sense of place.

10. Complexity & Order: Rich sensory information that adheres to a spatial hierarchy similar to those encountered in nature.

The "Nature of the Space Patterns" address spatial configurations in nature, including:

11. Prospect: An unimpeded view over a distance, for surveillance and planning.

12. Refuge: A place for withdrawal from environmental conditions or the main flow of activity, in which the individual is protected from behind and overhead.

13. Mystery: The promise of more information, achieved through partially obscured views or other sensory devices that entice the individual to travel deeper into the environment.

Nature in the Space Patterns	Natural Analogues Patterns	Nature of the Space Patterns
1. Visual Connection with Nature	8. Biomorphic Forms & Patterns	11. Prospect
2. Non-Visual Connection with Nature	9. Material Connection with Nature	12. Refuge
3. Non-Rhythmic Sensory Stimuli	10. Complexity & Order	13. Mystery
4. Thermal & Airflow Variability		14. Risk/Peril
5. Presence of Water		
6. Dynamic & Diffuse Light		
7. Connection with Natural Systems		

Table 1: The fourteen biophilic design patterns defined by Browning et al. (2014).

14. Risk/Peril: An identifiable threat coupled with a reliable safeguard.

One last pattern was introduced by Downton et al. (2017):

15. Virtual Connection with Nature: It represents a view of a simulated representation of natural elements, living systems, and natural processes. Examples include artificial skies, animatronics and portrayal of nature via virtual reality (Downton et al., 2017a, 2017b).

Consequently, the link between biophilic design and friluftsliv appears natural after examining the patterns outlined earlier. The concept of friluftsliv has its origins in Swedish history, with a societal movement towards friluftsliv dating back to the late 19th century in Sweden, when industrialisation, urbanisation, and demographic changes brought about significant shifts in society (Beery, 2013). In its early days, friluftsliv shares many similarities with biophilic design. The Swedish Touring Association (STF) was founded in 1885, establishing new, organised ways for many Swedes to connect with nature. Along with other organisations and events that emerged around the turn of the 20th century, these helped lay the foundations for the contemporary nature-inclusive cultural identity (Sandell & Sörlin, 2008). Over time, the definitions of friluftsliv have evolved, incorporating different nuances, partly due to its use in education. One definition provided by Dahle (2003) is as follows: “friluftsliv, first and foremost, is about feeling the joy of being out in nature, alone or with others, feeling pleasure and experiencing harmony with the surroundings”. Accordingly, biophilic design and, more broadly, biophilic cities support friluftsliv and vice versa.

## SWEDISH ARMONY IN THE STOCKHOLM BUILT AREA

The paper examines the existing built environment and contemporary initiatives that promote biophilic design within the Stockholm metropolitan area (Figure 1). In this regard, three case studies are presented: (i) Hammarby Sjöstad district, recognised as a successful example where integrated

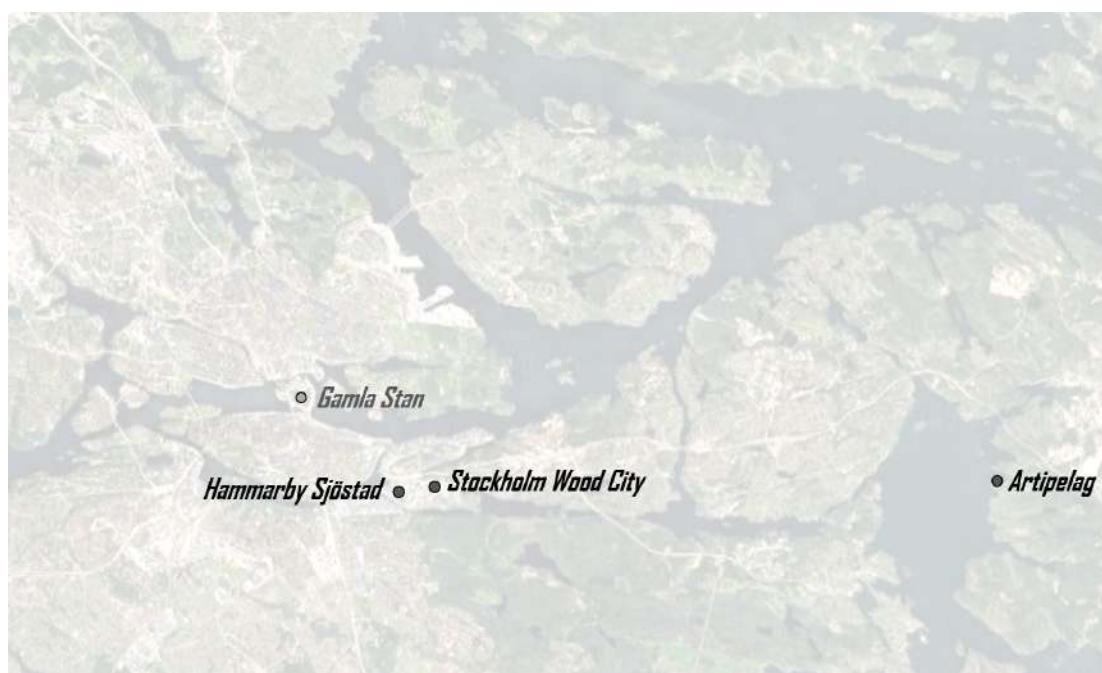


Figure 1: Map of Stockholm's built-up area highlighting the historic centre (Gamla Stan) and the locations of the three case studies selected. Author's elaboration.

systems for energy, water, and waste have transformed a degraded area into a paradigm of sustainable urban living; (ii) the Stockholm Wood City, a forthcoming development by Atrium Ljungberg, which aspires to be the world's largest mixed-use wooden neighbourhood; (iii) Artipelag, a cultural facility situated in the Stockholm Archipelago, where the architecture harmoniously integrates with the natural environment. The scope of these projects varies, spanning from a single structure to an entire urban district. Nonetheless, as Beatley (2016) articulated, “Biophilic cities should consider nature at all levels, from the microscopic to the bioregional and continental” (Beatley, 2016).

## HAMMARBY SJÖSTAD

Hammarby Sjöstad is a prominent example of sustainable urban redevelopment in Stockholm. Initially designed to support the city's bid for the 1990s Olympic Games, it has since become a model for eco-district planning (Hammarby Sjöstad – HSEF, n.d.; Svane et al., 2011). The area is centred around Hammarby Lake, which enhances the neighbourhood's aesthetic appeal and recreational value and also plays a key role in the integrated stormwater and wastewater management system. The visual connections with water and vegetation are striking, and green corridors support biodiver-

sity and encourage pedestrian mobility.

Although the district does not incorporate advanced digital systems for virtual interaction with nature, some attempts have been made to visualise ecological flows and sustainability processes through digital information panels and environmental monitoring displays. These offer a limited but noteworthy example of "Virtual Connection with Nature," particularly in terms of communicating the area's energy and water cycles to residents and visitors.

The area features medium-density residential buildings with integrated balconies, green roofs, and access to shared semi-public courtyards. Passive solar orientation and district heating systems enhance thermal comfort. However, while the presence of water and natural light is strong, patterns such as mystery, risk/peril, and biomorphic forms are less explicitly represented, reflecting a more rational and modernist urban design language rather than one driven by natural symbolism or sensory diversity.

## ARTIPELAG

Located on Värmdö Island in the Stockholm Archipelago, Artipelag is a cultural centre that integrates contemporary art, nature, and architecture. Designed by Johan Nyrén Architects, the building is nestled within a forested landscape that opens up to the sea (Artipelag, n.d.). Every element is designed to enhance the visitor's experience of nature. Natural materials such as untreated pine, granite, and glass are used extensively. Floor-to-ceiling windows allow expansive views of the forest and water, creating a seamless visual and spatial connection with the outdoors.

The surrounding landscape features winding forest trails, rocky outcrops, and boardwalks, offering a diverse range of sensory experiences, including the scent of pine, the sea breeze, and the sounds of birdsong. The spatial organisation includes refuge spaces (e.g., quiet nooks and seating alcoves) and areas of prospect and awe, such as panoramic terraces. Artipelag exemplifies nearly all biophilic design patterns, particularly those related to sen-



Figure 2: Main features of Hammarby Sjöstad that support biophilic design and friluftsliv. Author's pictures and elaboration.

sory engagement, spatial complexity, and emotional resonance.

In terms of virtual connections, Artipelag integrates curated digital experiences through its multimedia art installations that often depict natural themes, further enhancing visitors' conceptual connection with the environment. While these are secondary to its physical setting, they contribute to a hybrid sensory experience that aligns with the 15th biophilic pattern.

## STOCKHOLM WOOD CITY

Currently in the planning stage, Stockholm Wood City is an ambitious project by Atrium Ljungberg that aims to become the world's largest urban area built entirely from wood (Stockholm Wood City, n.d.; Stockholm Wood City - a Groundbreaking Project | White Arkitekt, n.d.). Spanning 250,000 square metres in Sickla, south-east of

Stockholm, the development is expected to feature housing, offices, and commercial spaces, with a strong emphasis on sustainability and human well-being. The use of cross-laminated timber (CLT) aids in carbon sequestration and improves thermal performance, providing a warm and tactile materiality (Residential District 7 – The Starting Point for the World-Unique Stockholm Wood City | White Arkitekt, n.d.).

The masterplan features green corridors, urban forests, and community spaces, all designed to promote biodiversity and foster social interaction. Emphasis is placed on daylight access, natural ventilation, and proximity to green infrastructure. While the project scores highly in terms of its material connection with nature and planned ecological integration, some biophilic qualities, such as non-rhythmic sensory stimuli, mystery, and risk or peril, remain hypothetical at this stage, pending the execution of detailed architectural and lan-

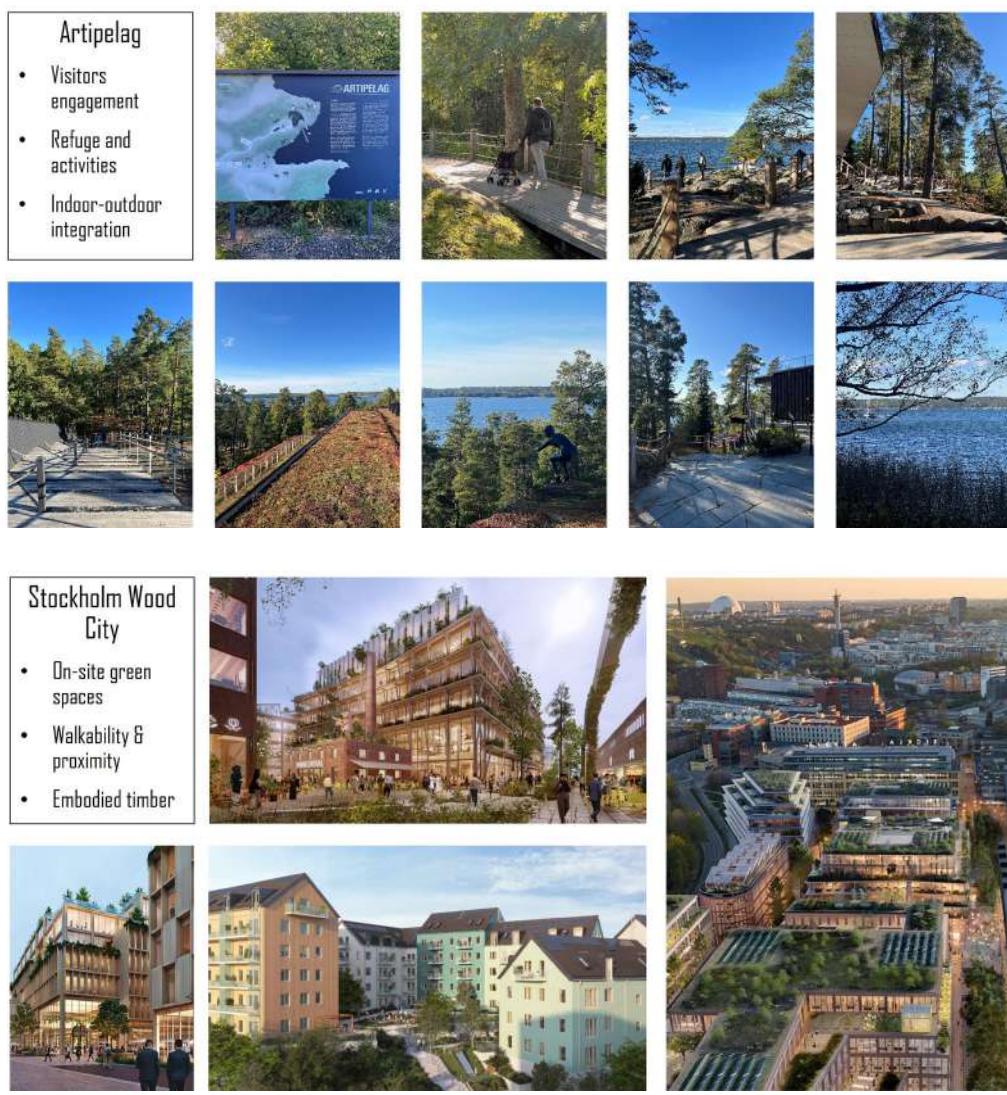


Figure 3: Main features of Artipelag that support biophilic design and friluftsliv. Author's pictures and elaboration.

Figure 4: Main features of Stockholm Wood City that support biophilic design and friluftsliv. Author's elaboration. Source for the pictures: <https://www.al.se/en/sickla>, Accessed 2025-07-03.

andscape designs.

Notably, Stockholm Wood City offers substantial potential for embedding "Virtual Connection with Nature" into its design vision. Planned smart infrastructure and digital platforms could support immersive simulations of local ecosystems, real-time environmental feedback (e.g., air quality, biodiversity monitoring), or virtual green corridors in indoor environments. These applications could help maintain a connection to nature even in denser or enclosed settings, enhancing biophilic engagement through technology.

#### COMPARISON ACROSS THE PATTERNS OF BIO-PHILIC DESIGN AND FRILUFTSLIV

Table 2 presents a comparative qualitative analysis of Hammarby Sjöstad, Artipelag, and Stockholm Wood City about the fifteen biophilic design patterns (including the added pattern of "Virtual Connection with Nature" from Downton et al., 2017) and three main characteristics that fulfil the friluftsliv spirit. The comparison is proposed from the author's perspective and reveals important insights about the practical implementation of biophilic principles in Swedish urban contexts. Hammarby Sjöstad, although highly effective in environmental engineering and infrastructural sustainability (Iveroth et al., 2013), shows more moderate performance in symbolic and phenomenological aspects of biophilic design. The area excels in water integration, daylight, and natural systems connectivity, aligning with the functionalist approach of Scandinavian urbanism (Figure 2). However, its lower scores in biomorphic forms, mystery, and risk/peril suggest that these qualitative aspects are often underrepresented in contemporary urban design, which still prioritises efficiency and legibility. While Hammarby Sjöstad is an urban district, it successfully incorporates friluftsliv through:

- Daily green engagement: Residents regularly stroll, cycle, and relax lakeside. Green courtyards, waterfront boardwalks, and semi-wild areas, such as reed beds, provide spaces for everyday outdoor contemplation.

Biophilic design pattern/Friluftsliv feature		Hammarby Sjöstad	Artipelag	Stockholm Wood City
Nature in the Space Patterns	1. Visual Connection with Nature	Views of seaside/lake, and parks	Panoramic forest and sea views	Planned views of green corridors
	2. Non-Visual Connection with Nature	Sounds and scents from water and trees	Sea breeze, pine scent	Ventilation and greening features
	3. Non-Rhythmic Sensory Stimuli	Bird activity, water reflections and sound	Bird activity, reflections and rustling leaves	Future biodiverse corridors
	4. Thermal & Airflow Variability	Microclimates via courtyards	Open terraces, forest shade	Design for airflow and comfort
	5. Presence of Water	Water is central to design	Sea and wetland features	Retention ponds, canal integration
	6. Dynamic & Diffuse Light	Building orientation, daylighting	Filtered forest light	Daylight design and materials
	7. Connection with Natural Systems	Wetlands and biodiversity zones	Indigenous flora/fauna	Green roofs, native landscaping
Natural Analogues Patterns	8. Biomorphic Forms & Patterns	Limited biomorphism	Curved shapes, organic architecture	Wood facades with patterning
	9. Material Connection with Nature	Local stone and wood elements	Exposed wood, granite	Extensive timber use
	10. Complexity & Order	Organically-influenced layout	Natural complexity in architecture	Wood grains and structural logic
Nature of the Space Patterns	11. Prospect	Sea/Lake views, elevated sightlines	Seas views, open galleries	Planned open views
	12. Refuge	Balconies and intimate spaces in courtyards	Niches, benches in quiet areas	Courtyards and enclosed entries
	13. Mystery	Tree-lined paths	Winding trails	Winding paths in the landscape
	14. Risk/Peril	Some elevated walkways	Glass overhangs above cliffs	Elevated boardwalks planned
	15. Virtual Connection with Nature	Digital environmental displays, GlashusEtt	Digital nature-themed art	Intelligent systems, immersive simulations
Friluftsliv	Physical Immersion	****	*****	***
	Active Recreation	****	*****	****
	Everyday Green Access	*****	***	****

Table 2: Qualitative assessment of the three selected case studies against the fifteen patterns of biophilic design and their support for friluftsliv.

- Mobility that connects: The holistic transit network encourages active movement in outdoor settings.
- Users' awareness: Interactive dashboards, educational signage, and GlashusEtt foster awareness of ecological processes in everyday life. GlashusEtt is an environmental centre that has been realised in the district to provide inhabitants with information and education about all aspects of sustainable urban planning and to encourage them to adopt a more sustainable lifestyle (Hammarby Sjöstad, Stockholm, Sweden | Urban Green-Blue Grids, n.d.).

Hammarby Sjöstad embodies *friluftsliv* in an urban setting. It combines the hustle and bustle of city life with easy access to water, green spaces, and a range of everyday outdoor activities. Although it does not offer a deep wilderness experience, it incorporates nature into daily life in a meaningful way, reflecting contemporary Swedish biophilic urbanism.

Among the case studies, Artipelag emerged as the most comprehensive example in terms of responding to biophilic design patterns, supporting earlier findings by Kellert et al. (2008) and Ryan et al. (2014). They emphasised the importance of immersive, multi-sensory experiences and spatial narratives in successful biophilic environments. Artipelag's integration with its landscape reflects a deep ecological consciousness that aligns with the emotional and psychological objectives of biophilic design, including refuge, mystery, and virtual connections (Figure 3). Artipelag is a quintessential embodiment of *friluftsliv*:

- Visitors' engagement: They engage physically with the archipelago through sailing, walking boardwalks, swimming, and exploring trails.
- Refuge and activities: The site supports both meditative retreat (quiet forest benches, panoramic terraces) and active exploration through art-nature walks.
- Indoor-outdoor integration: It fosters continuous sensory engagement by allowing visitors to sit at café tables amidst natural backdrops or move seamlessly from gallery to forest. Consequently, it strongly activates *friluftsliv* by

providing a deeply immersive natural experience, one that physically and spiritually merges human-made and natural realms. However, its location naturally supports adherence to the main biophilic patterns, but it is unlikely to be accessible daily from the city centre, limiting its impact on citizens' everyday life.

Stockholm Wood City offers a forward-looking vision, especially through its emphasis on wood as a primary material and the inclusion of biodiversity corridors (Figure 4). These design choices reflect the growing interest in structural timber as a way to reconnect urban environments with natural systems. However, the project's current phase limits assessment to planned strategies rather than actual experiences. The moderate scores in sensory and experiential categories (Table 2) highlight the challenge of turning biophilic ambitions into real user experiences. The project holds significant potential for *friluftsliv*, depending on how it is executed:

- On-site green spaces: Nearby small parks, woodland areas, rooftop gardens, and green corridors are designed to encourage daily outdoor interaction and engagement.
- Walkability & proximity: Located near transit, the plan encourages walking and cycling throughout natural settings, aligning with the outdoor lifestyle principle.
- Embodied timber: Interiors featuring exposed wood evoke a sense of naturalness, even within indoor spaces.
- Digital-enhanced nature: Future digital engagement tools could amplify the connection to nature in confined environments.

While still prospective, Stockholm Wood City holds substantial promise for fostering *friluftsliv*, transforming urban living into an active, nature-rich experience, if green spaces are accessible, biodiverse, and user-centric upon completion. Incorporating the 15th pattern, "Virtual Connection with Nature," as proposed by Downton et al. (2017), introduces a contemporary dimension to biophilic design that considers the role of digital and mediated experiences of nature. This can include virtual landscapes, multimedia representa-

tions of natural processes, or interactive installations that simulate natural environments. While Artipelag achieves this only minimally through curated art and media, the concept invites further exploration in urban developments like Stockholm Wood City, where digital integration might complement physical biophilic strategies and extend access to natural experiences within indoor or dense urban contexts.

## CONCLUDING REMARKS

The reviewed literature indicates that Swedish architectural practices have evolved to embrace both environmental sustainability and social well-being. Projects like Stockholm Wood City and Hammarby Sjöstad serve as benchmarks for integrating timber, renewable energy, and green infrastructure at both building and urban scales. Therefore, the Artipelag cultural hub exemplifies the integration of art and nature through architecture.

The findings also align with the Swedish cultural concept of *friluftsliv*, a philosophy that emphasises outdoor life, connection to nature, and well-being through everyday experiences in natural environments. Among the three projects, Artipelag most profoundly embodies *friluftsliv*, offering immersive physical access to the archipelago's forests, trails, and coastline, despite not being located in an urban context. Hammarby Sjöstad supports *friluftsliv* primarily through its accessibility to green and blue infrastructure. Residents benefit from a network of pedestrian and cycling paths, lakeside promenades, and open courtyards that foster everyday encounters with nature. Stockholm Wood City shows conceptual alignment with *friluftsliv* through its emphasis on walkable green corridors, rooftop gardens, and planned urban forests. However, as it is still in the planning phase, its actual capacity to enable spontaneous outdoor living and direct contact with wilderness-like environments remains to be seen. Overall, the analysis underscores that while infrastructural and ecological systems are necessary, they are not sufficient for full biophilic integration. Desi-

gners and planners should strive for holistic strategies that incorporate sensory diversity, symbolic richness, and emotional depth, thereby truly fostering a reconnection between people and nature in urban contexts.

Future research should investigate the long-term effects of biophilic design on occupant health and explore ways to integrate sustainable welfare into urban policy. Improving Life Cycle Assessment (LCA) methods for biobased materials could help address technical barriers to achieving carbon neutrality in construction. Recent reviews highlight the benefits of biophilic design for mental well-being, energy efficiency, and quality of life, aligning with Sweden's tradition of blending nature with architecture and the concept of *friulftsliv*. By utilising engineering, green infrastructure, and biophilic principles, urban life can be enhanced and its environmental impact reduced. As Sweden advances sustainable building practices, more empirical research and policy updates are needed to navigate ecological, economic, and social trade-offs. Sweden's holistic approach integrates architecture with nature, advanced materials, and green design to foster sustainability and well-being.

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