

# BIOPHILIC DESIGN

Strategies to generate wellness  
and productivity



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**Legacy Salmon Creek Medical Center's healing garden is both remarkable and typical. healing gardens provide restorative and coping resources.** (Source: ZGF Architects, LLP)

## Understanding Biophilia

“Biophilia” is a term coined by the German social psychologist Erich Fromm in 1964 to describe the human attraction to all things alive and vital. In *Biophilia* (1984), Wilson sought to explain the desire to be connected to nature, and to link evolutionary and ontogenetic development within the natural world as the primary cause for this affinity. Early human survival depended upon finding a rich environment that provided food, shelter, protection, and the presence of water. Those individuals who could recognize these resources and harvest the bounty were presumably more evolutionarily fit, and more likely to succeed. Indicators of such a supportive environment include lush vegetation, and the possibility of prospect and refuge to find prey and simultaneously avoid predators. As a concept or theory, this desire or affinity for nature is generally recognized, but only within the past 40 years have we begun to study and understand this connection in a rigorous scientific manner. Even less time has been spent on the active application of these insights within design.

Roger Ulrich's research documenting the healing power of nature in the clinical context of a hospital was a watershed moment for the design industry. Research conducted using an evidence-based design methodology showed that compared to views of a brick wall, ostensibly ordinary views of trees and plants improved healing outcomes, including shorter stays, reduced need for painkillers. Ulrich's findings helped to support a design approach that could embrace nature and human delight rather than mere operational efficiency. The discovery was truly a “win-win”; not only is the individual patient experience and outcome improved, the hospital benefits economically from shorter stays, which improve its ability to serve a greater population with the facility's increased capacity.

Accordingly, our healthcare practice was the first within ZGF Architects LLP to embrace the inclusion of nature as an explicit programmatic element. Early efforts employed biophilia directly, by providing connection through immediate access or views, or direct representation of natural elements. Doernbecher Children's Hospital not



**The recently completed Seattle Children’s Hospital, “Building Hope” expansion integrates biophilia as a central design strategy.**

(Source: ZGF Architects, LLP)

only capitalizes on its challenging sloped site to provide views through the verdant hillsides. In addition, images of flora and fauna inspire graphics and signage within the children’s play areas.

While restorative gardens date back to medieval monasteries, the inclusion of healing gardens in the modern healthcare complex is arguably the first truly new biophilic design element. Legacy Salmon Creek Medical Center’s healing garden is both remarkable and typical. Located above the diagnostic podium on the third floor, the garden improves what might have been a non-occupancy rooftop in an earlier-generation hospital. Paths wander through colorful and aromatic gardens that create a multi-sensory experience and encourage patients, visitors, and staff to take some time to enjoy the fresh air and sunshine. Containing a chapel and a variety of seating areas, the garden provides places for seclusion and respite, as well as opportunities for social interaction. As Roger Ulrich states in *the Effects of Gardens in Health Outcomes: Theory and Research*, healing gardens provide restorative and coping resources through increased movement and exercise, social support, increased control in the form of temporary escape and access to privacy, as well as natural distractions.

While healing gardens represent an additional expense in hospital design, many healthcare clients recognize their value, especially as this programmed outdoor space can be provided more economically than enclosed interior space. LEED for Healthcare similarly acknowledges healing gardens’ benefits, by providing two credits specifically tailored around access to outdoor space for patients, visitors, and staff.

### **Seattle Children’s Hospital**

The recently completed “Building Hope” expansion integrates biophilia as a central design strategy. Biophilic design elements play a crucial role in bringing a sense of whimsy for children and their visitors as well as enhancing the spatial qualities beyond the patient room. Navigation through this large, 330,000 sf bed tower

facility is enhanced through the provision of glazing at the end of circulation corridors, opening views to provide orientation as well as a connection to the verdant Puget Sound region. Soft, curvilinear walkways connect the nurse’s stations and patient rooms, improving views to treatment areas and providing a calm visual landscape. Playful, graphic artwork depicts regional Northwest nature scenes with color and content to support way finding. The murals provide a panoply of variety and detail that invite a child to imagine and discover, and the sense of surprise is reinforced by unexpected elements elsewhere, like a brass leaf or paw print embedded in the terrazzo floors.

The connection to nature is reinforced in patient rooms as well. Generous windows bring in sunlight and provide views to the surrounding context. Research over the last ten years is confirming that the changing color temperature and the quality and quantity of daylight through the day reinforces circadian rhythms, which can benefit human health, healing, and productivity. Images of nature are supplemented by materials that evoke nature; real wood is still rarely used in American hospitals, but an imitation wood headboard brings warmth to the clinical environment. Playful, colored-glass exterior shades not only cut peak solar loads as part of the integrated energy strategy, but also emphasize the movement of the sun as the colors and shadows move and change.

As part of its agreement with the community when it negotiated its expansion to an adjacent parcel, Seattle Children’s Hospital agreed to include a generous, landscaped buffer to the neighborhood. Many existing trees on the perimeter were retained and supplemented with planting to create a linear garden and path that weaves through the vegetation—a pleasant amenity for the hospital and neighborhood alike. Some foundations from the prior residential apartments become stormwater retention elements, blurring the boundaries between the man-made and the natural.

Just as biophilic design was becoming more commonplace in healthcare, and studies of educational

**The atrium of the Army Corps of Engineers Headquarters functions as the lungs of the building, fully embodying both biophilic and sustainable design principles.**

(Source: ZGF Architects, LLP)

applications were quantifying its benefit through measurable outcomes like test scores, the business community began to recognize its value. If connection to nature had measurable benefits for the sick, and performance benefits for students, certainly it could be valuable in the business environment as well. A new wave of research started to study and quantify the economic benefits in the workplace. The fact that salaries and other personnel expenses represent the great majority of a business' expenses meant that even small improvements from biophilic design could have a significant bottom-line impact. *The Economics of Biophilia* (2012, Terrapin Bright Green), arguably the most accessible compendium of biophilic research for the design community, estimates salaries and benefits to be 86% of a company's operating costs, with another 4% accounted for by absenteeism and presenteeism (staff at work, but unproductive). Numerous studies have quantified the benefit of views and/or daylight in increasing productivity at work, discovering benefits that include reduced absenteeism, greater time spent at the desk, and increased quality and quantity of work output.

Another area of benefit, less quantified by research, is in the recruitment and retention of staff. Replacing a departed staff member can be expensive; one study estimates the cost of advertising, interviewing, hiring, and training a new worker at up to 3 times the salary of the new worker. In a survey of Millennials in a prominent northwest headquartered business, 65% of those surveyed stated that the physical surroundings significantly impact mood and satisfaction in their work experience, and ranked natural light and windows as the most important criteria for optimal working conditions. It makes sense that biophilic office landscapes can be more attractive for next-generation talent; workers are more likely to come into work every day and are more likely to stay for the long haul.

As biophilia in the built environment has grown from its healthcare origins to influence the design of offices, schools, and cities, researchers have described its elements of design. Stephen Kellert, a former student

of Wilson, categorizes environmental features, natural shapes and forms, natural patterns and processes, and light and space, culminating in better-informed descriptions of place-based relationships and a more evolved relationship between humans and nature. What is clear from his work, as well as other taxonomies, is that biophilia can be much more than nature in a space (or a view from a space). Sunlight, plants, water, the use of wood and other natural elements are intrinsically appreciated by occupants, but their provision is not always possible or advisable. Natural analogues, or elements that have nature's processes and complexity, like natural forms and fractal structures, or that embody the mutability and responsiveness of nature, can also contribute to the biophilic response. Finally, spaces that stimulate basic human responses, like comfort, curiosity, or excitement, might also be considered biophilic.

### **Army Corps of Engineers Headquarters**

The Army Corps of Engineers Headquarters, at the Federal Center South Building 1202 complex in South Seattle, represents the fullest embodiment of biophilic design principles in a ZGF project. Located on the banks of the Duwamish River, a waterway that has experienced a history of channelization and pollution before current remediation efforts, the facility embodies the mission of the Seattle division, with its integration of engineering with environmental sustainability. The curved horseshoe shape of the three-story building, driven by the needs to control solar gains by orientation and to limit overall heat loss through the envelope, echoes the oxbow forms of the historic Duwamish. The essential form of the building is driven by two space types: a 60' wide office floor plate (the "Oxbow") maximizes the availability of daylight and view to the occupants; while conference rooms and other amenities ("the Commons") are centralized and wrapped by the Oxbow, creating programmatic efficiencies and promoting collaboration and interaction through their shared utilization. The Oxbow offices are steel structure: cheaper and more efficient to construct, but embodying the biophilic principle of resiliency in its diagrid structure:





**Green infrastructure in the Washington, DC Southwest Ecodistrict uses plants, soil, and microbial ecology to cleanse surface water.** (Source: Courtesy of NCPC. Image by ZGF Architects)

the triangulated exterior steel columns create a truss and structural redundancy should a catastrophic event occur. The interior Commons is created from timbers reclaimed from an existing warehouse on site; the repurposed wood creating a natural and warm aesthetic and a direct physical and visual tie to the history of the site.

The atrium links the “Commons” and the “Oxbow” and serves multiple functions. It acts as the lungs of the building, serving as the return air plenum and using the buoyancy of warm air to convey the return air stream to heat exchangers at the top of the atrium. It brings abundant daylight to both the offices and conference rooms. But these functions, as important as they are in contributing to one of the most energy efficient office buildings

in the country, arguably pale in impact to the social heart of the building. With its three levels, timber-clad bridges, stairs, and overlooks, the atrium embodies the theory of “prospect and refuge,” the idea that human beings (like our hunting and gathering ancestors) are most comfortable in places where we might command a sweeping view, but at the same time are able to avail ourselves of protection and safety.

The atrium floor is outfitted with a dry river bed motif with shingled flagstones, drift wood, ground plantings and small trees. The river system ripples throughout the design and is used for way finding, graphic design, and to create visual and literal ties to the climate and the region. The tributaries of the Duwamish as well as the Duwamish



itself are represented in graphics on the stair towers and source stones distributed through the atrium. The source stones, large boulders with a river meander carved into the top surface, are connected to the stormwater collection system, and gurgle with captured and treated stormwater during rain events. The gurgle provides a gentle auditory tie to the daily weather patterns. The incorporation of the river system provides a multi-sensory environment and level of complexity unfolds over time.

### Southwest Ecodistrict

National Capital Planning Commission's and General Service Administration's SW Ecodistrict in Washington, DC, is a large urban scale project that looks to natural systems to inform green infrastructure design that exceeds DC's aggressive stormwater requirements. Green infrastructure uses plants, soil, and microbial ecology to cleanse surface water. In addition to cleaning water, the plants and trees create a human scale and reduce the heat-island effect, thereby contributing to a reduction in building cooling loads. These nature-based systems improve the urban experience through the display of water and its inherent life giving properties. In the SW Ecodistrict, 10<sup>th</sup> Street is a visible and engaging alignment of resource conservation and biophilia. The design goal was not only to provide a strategy for meeting aggressive conservation targets but to bring in natural elements that expands the value of the place into a destination for outdoor experiences.

Due to its proximity to national monuments, governmental offices, and the Potomac River Basin, 10<sup>th</sup> Street connects many visitors, workers, and future residents from the National Mall to the Potomac River. As a part of DC's Monumental Core, 10<sup>th</sup> Street is an innovative "smart street design" that balances green infrastructure with multimodal street use that varies with time of day and season. Water is the unifying theme and coupled with lush vegetation, it creates a new destination to which people can migrate and find different niches that offer seasonal thermal comfort and a variety of spatial

experiences. This design solution brings together important living cues that stimulate instincts that harken back to early human survival and foster feelings of safety, environmental support, and harmony with nature—all together contributing to a feeling of wellbeing.

Outdoor green space, another aspect of biophilic design, has been shown to be good for business, and to promote healthier lifestyles. Harnik and Welle illustrated in their report *Measuring the Economic Value of a City Park System* a 5% cost premium to properties adjacent to parks in Washington, DC. Additionally, a study by The Trust for Public Land quantified that the increased physical activity associated with the use of park systems in Sacramento, CA was associated with healthcare savings of \$19.8 million for the local community. A high-performance district can lead to happy, healthy, high-performance people through providing resources for reinforcing social, cultural, and environmental bonds.

When thoughtfully designed buildings are enhanced with carefully crafted outdoor space, people are nurtured, supported, and connected to their regional setting in a deep and meaningful way. As Judith Heerwagen, a behavioral psychologist, Program Expert with the GSA Office of Federal High-Performance Green Buildings, and biophilic pioneer, states, "The goal of biophilic design is to create places imbued with positive emotional experiences, enjoyment, pleasure, interest, fascination, and wonder, that are the precursors of human attachment to and caring for place. Using inspiration from both the local natural environment and vernacular cultural expressions to create a sense of place is critical to biophilic design." This concept leads one to envision biophilic design as much more than "shrubbing up a building." Rather, and crucially, it is a design philosophy that provides latitude for execution, resulting in a holistic built environment that supports people, reinforces natural ties, and is rooted in place.

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