

From infancy we concentrate happily on ourselves and other organisms. We learn to distinguish life from the inanimate and move toward it like moths to a porch light....To explore and affiliate with life is a deep and complicated process in mental development. To an extent still undervalued in philosophy and religion, our existence depends on this propensity, our spirit is woven from it, hope rises on its currents.

— E.O. Wilson 1984  
“Biophilia”

# Biophilia, Health, and Well-being

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If there is an evolutionary basis for biophilia, as asserted by E.O. Wilson in the opening quote, then contact with nature is a basic human need: not a cultural amenity, not an individual preference, but a universal primary need. Just as we need healthy food and regular exercise to flourish, we need ongoing connections with the natural world. Fortunately, our connections to nature can be provided in a multitude of ways: through gardening, walking in a park, playing in the water, watching the birds outside our window, or enjoying a bouquet of flowers.

The experience of nature across evolutionary time periods has left its mark on our minds, our behavioral patterns, and our physiological functioning. We see the ghosts of our ancestors' experiences in what we pay attention to in the environment, how we respond, and what the experience means to us. [The biophilia hypothesis and supporting research tells us that, as a species, we are still powerfully responsive to nature's forms, processes, and patterns](#) (Kellert & Wilson 1993, Kellert et al. 2008). Using knowledge of our affinity for nature, adapted and refined over millions of years, we can generate experiences of health and wellness through the environments we create. Work environments can become both more relaxed and productive, homes more harmonious, and public spaces can become more inclusive; offering a sense of belonging, security, and even celebration to a wider cross section of people.

To understand the deep underpinnings of biophilia and its manifestation in today's cultural and physical landscape, we need to go back in time to our ancestral life as mobile hunting and gathering bands. Buildings are newcomers on the evolutionary scene — a mere 6,000 or so years old. For the vast majority of human existence, the natural landscape provided the resources necessary for human survival, chief among them water, sunlight, animal and vegetable food, building materials, shelter, vistas, and fire. The sun provided warmth and light as well as information about time of day. Large trees provided shelter from the midday sun and places to sleep at night to avoid terrestrial predators. Flowers and seasonal vegetation provided food, materials, and medicinal treatments. Rivers and watering holes provided the foundation for life — water for drinking and bathing, fish and other animal resources for food. Waterways also provided a means of navigation to reach distant lands.

### **Our Restorative Commons: Linking Nature to Human Health and Well-being**

The Restorative Commons idea represents a significant new approach to the development of common urban spaces. Like restorative garden design, it incorporates findings from recent and interdisciplinary research on human experiences with the natural environment. The Restorative Commons approach also builds upon best practices in urban restoration ecology as well as the persistent concerns for equitable access to nature-rich environments in urban settings. Nature is beneficial to all, regardless of age, gender, race, or ethnicity and it should be available to all urban dwellers, not just those who can afford to live on the edges of parks and open spaces. [Connection to nature on a daily basis reinforces the values of respect and care for the environment that are necessities for sustainable communities.](#)

However, not all nature is equally attractive or beneficial. Spaces with dead and dying plants and trees signal habitat depletion and are largely avoided. In contrast, places with rich vegetation, flowers, large trees, water, and meandering pathways that open suddenly to views are sought out by many as places of relaxation and enjoyment. These features characterize the most beloved urban parks and arboreta across the globe. But even small spots of nature — a flower pot, tree,



Brooklyn window box and fire escape gardens enrich both inside and outside views.

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or a small garden — also delight. That is the real story of our connection to nature — it has many faces and many ways to create positive experiences in our homes, offices, backyards, or common spaces. The genetic basis for biophilia does not, of course, dismiss cultural, geographic, or ecotype specificity. In fact, using inspiration from both the local natural environment and vernacular cultural expressions for creating a sense of place is critical to the success of biophilic design.

### **The Value of Nature to Human Health and Well-being**

Improved moods and reduced stress are the most consistent benefits of nature contact across research studies, regardless of whether they are controlled laboratory experiments or field studies. Furthermore, contact with nature can be purely visual or multi-sensory, active engagement (walking, running, gardening) or passive (viewing only). Benefits are found in multiple settings, multiple cultures, and across the age span, from early childhood to late adulthood.

Although the belief in the therapeutic benefits of nature contact is ancient, the first well controlled empirical test of this hypothesis was published in 1984 by Roger Ulrich using data from a hospital setting. Ulrich tested the effect of window views on hospital patient outcomes. Half the patients had a window that looked out onto a brick wall while the others viewed an outdoor landscape with trees. All patients had the same kind of surgery, with the two different view groups matched for age, gender, and general health conditions. Ulrich found that patients with the tree view used less narcotic and milder analgesics, indicating lower pain experience. They also stayed in the hospital for a shorter time period and had a more positive post-surgical recovery overall than did patients who had the view of the brick wall.

A decade of subsequent research by Ulrich and colleagues at Texas A&M University, largely in laboratory experiments, reinforces the findings from the hospital study. Subjects exposed to a stressor recover faster and more positively if they are shown nature scenes or urban scenes with nature, rather than urban scenes devoid of natural elements. Subjects viewing the completely natural scenes do the best overall, with the greatest and most rapid reduction in physiological stress and more rapid mood enhancement. Ulrich's work has shown that nature contact can be beneficial, whether it is real or simulated. In fact,

in many environments, such as windowless spaces, simulations may be the only way to create beneficial experience. A study of windowed and windowless offices by Heerwagen and Orians (1986) supports this conclusion. They found that people in windowless spaces used twice as many nature elements (posters and photos especially) to decorate their office walls than those who had window views to natural areas outdoors.

Research on nature benefits has blossomed from this early beginning to encompass a huge body of studies and findings (see Kellert et al. 2008, for an overview of biophilia research and applications). A few select benefits of nature and natural processes explored in the literature are touched on here.

### **SUNLIGHT**

We have known for a long time that people prefer daylight environments and that they believe daylight is better for health and psychological functioning than is electric light. However, a clear delineation of the health and well-being benefits is relatively recent. We know now that bright daylight has medicinal properties. It entrains circadian rhythms, enhances mood, promotes neurological health, and affects alertness. (Figueiro et al 2002, Heerwagen 1990). Research in hospital settings shows that patients in bright rooms recover more rapidly from illness, show reduced pain levels, take fewer strong analgesics, and stay in the hospital fewer days than patients who are in more dimly lit rooms located on the north side or in locations where nearby buildings block sun penetration (Walch et al. 2005). The benefits of sunlight can be experienced in even brief walks outdoors on a sunny day or through design of spaces that integrate daylight and sun into the interior.

### **OUTDOOR GREEN SPACE**

Research conducted in outdoor spaces expands on the benefits discovered in laboratory settings (Sullivan et al. 2004, Kweon et al. 1998). The study of **public housing projects** in Chicago by Sullivan and colleagues (2004) from the University of Illinois has found many benefits from having large trees close at hand. Using behavioral observations and interviews, the researchers found that housing developments with large trees attracted people to be outdoors and, once there, they talked to their neighbors and developed stronger

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social bonds than people in similar housing projects without green space and trees. Furthermore, related studies found that children performing activities in green settings have shown reduced symptoms of Attention Deficit Hyperactivity Disorder (Faber et al 2001, Kuo and Faber 2004). The researchers concluded that providing “green time” for children may be an important supplement to medicine and behavioral therapies. The research from these studies supported one of the most extensive tree planting program in Chicago’s history.

In another large scale urban nature project, researchers in the Netherlands are conducting a nationwide study of the benefits of green space — which they call Vitamin G — at the household, community and regional levels (Groenewegen et al. 2006). Using national health survey data arrayed on a geographical information system that shows the location of green spaces, the researchers have found preliminary evidence that residents who are closer to green spaces, including household gardens and neighborhood parks as well as large green spaces, have better health profiles than residents who are farther away. To develop these profiles, researchers used data from the Netherlands national health survey on physical and mental health and perceptions of social safety and also conducted interviews of residents living near or at a distance from green spaces. The data analysis controlled for socio-economic factors, which have known links to health outcomes. Future research will focus on identifying the mechanisms behind the relationships, particularly stress reduction, emotional restoration, physical activity, and social integration.

## GARDENS AND GARDENING

There is also growing evidence that both active and passive contact with gardens provides psychological, emotional, and social benefits. In their book “Healing Gardens...”, Cooper-Marcus and Barnes (1995) show that benefits of gardens include recovery from stress, having a place to escape to, and improved moods. Benefits also occur with **horticulture therapy**, especially in clinical settings and nursing homes. Other studies provide evidence that dementia and stroke patients show improved mobility and dexterity, more confidence, and improved social skills as a result of gardening activities. (Rappe 2005, Ulrich 2002). According to Ulrich, gardens will be more likely to be

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**Previous Page:**  
Washington Market Park,  
Manhattan.

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calming and to ameliorate stress if they contain rich foliage, flowers, a water feature, congruent nature sounds (bird songs, moving water), and visible wildlife, particularly birds.

Other researchers also have found improvements in emotional functioning and reductions in stress. For instance, a laboratory study of “green exercise” tested the effects of projected scenes on physiological and psychological outcomes of subjects on a treadmill. They found that all subjects benefited similarly in physiological outcomes, but that subjects who viewed pleasant nature scenes (both rural and urban) scored higher in measures of self-esteem than those viewing totally urban scenes or “unpleasant” rural scenes with destroyed landscapes (Pretty et al. 2003, 2005). Similar results have been found in field studies by Hartig and colleagues (1991) who looked at the stress reducing effects of walking in an urban environment with nature as compared to a similar walk without natural elements.

### **NATURE AND CHILD DEVELOPMENT**

The cumulative research on the benefits for children of playing in natural environments is so compelling that it has resulted in an outpouring of response to Richard Louv’s (2005) book, “Last Child in the Woods: Saving our Children from Nature Deficit Disorder.” Playing in outdoor environments, whether at home, school, or camp, has sustained benefits for social, emotional, and cognitive development in children. Nature provides both the platform and the **objects for play** (Kahn and Kellert 2002). It encourages exploration and building among older children which aids orientation and wayfinding, group decision-making, knowledge of how to respond to changing contexts, and improved problem-solving. Among younger children, small-scale natural environments with props (flowers, stones, sticks, water) stimulate imaginative play which is considered a cornerstone of social and cognitive development.

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### **Qualities and Attributes of Nature in Biophilic Design**

Our fascination with nature is derived not just from natural elements, but also from the qualities and attributes of natural settings that people find particularly appealing and aesthetically pleasing. 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 (Kellert et al. 2008). Although these biophilic design practices are not yet integrated into standards or guidelines, there is increasing interest in this topic, particularly as it relates to sustainability and social equity. We know from everyday experience that nature is not equitably distributed in urban environments. Those who can afford to do so live near parks, have large street trees and rich landscaping around their homes, and work in places that have design amenities. However, as the section below shows, there are many ways to incorporate biophilic design features throughout the **urban built fabric**. While living nature is always highly desirable, it is possible to design with the qualities and features of nature in mind, thereby creating a more naturally evocative space. Design imagination can create many pleasing options out of this biophilic template:

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### **HERACLITEAN MOTION**

Nature is always on the move. Sun, clouds, water, tree leaves, grasses — all move on their own rhythms or with the aid of wind. Katcher and Wilkins (1993) hypothesize that certain kinds of movement patterns may be associated with safety and tranquility, while others indicate danger. Movement patterns associated with safety show “Heraclitean” motion that is a soft pattern of movement that “always changes, yet always stays the same.” Examples are the movement of trees or grasses in a light breeze, aquarium fish, or the pattern of light and shade created by cumulus clouds. In contrast, movement patterns indicative of danger show erratic movement and sudden change, such as changes in light and wind associated with storms, or birds fleeing from a hawk.

### **CHANGE AND RESILIENCE**

All natural habitats show cycles of birth, death, and regeneration. Some life-like processes, such as storms and the diurnal cycle of light, also may be said to show developmental sequences. When stressed, natural spaces show remarkable signs of resilience. Yet, often in our built environments, stress leads to the onset of deterioration (e.g., vacant and abandoned buildings) that seems inevitable and

incapable of renewing itself. Resilience is affected by the web of relationships that connect the composition of species within an ecological community. Waste from one animal becomes food for another; unused space becomes a niche for a newcomer; decaying trees become resources and living spaces for a variety of plants and animals. The use of recycled elements and the natural aging of materials can create this impression of resilience in built environments (Krebs 1985).

### VARIATIONS ON A THEME

Natural elements — trees, flowers, animals, shells — show both variation and similarity in form and appearance due to growth patterns. Nicholas Humphrey (1980) refers to this phenomenon as “rhyming” and claims that it is the basis for aesthetic appreciation — a skill that evolved for classifying and understanding sensory experience, as well as the objects and features of the environment. He writes, “beautiful ‘structures’ in nature and art are those which facilitate the task of classification by presenting evidence of the taxonomic relationships between things in a way which is informative and easy to grasp.”

*Clematis* spp. and Boston Ivy (*Parthenocissus tricuspidata*) on a Brooklyn rooftop garden display change and resilience across the seasons.

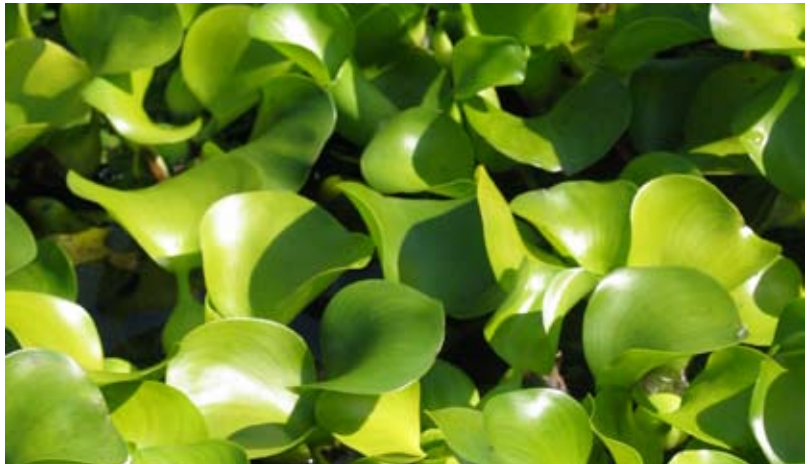
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Children transform their play environment with found natural materials.  
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A closer look at plants forms reveals “rhyming” and “discovered complexity”.  
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Designers could more effectively use the principles of rhyming in a wide array of applications — in the design of circulation systems that use varied sensory conditions to reinforce wayfinding, in interior spaces with varied patterns and color, and for transitions between the outdoors and indoors.

### **DISCOVERED COMPLEXITY**

All living organisms display complex design that may not be apparent at first glance, but is discovered through sensory exploration. The desire to know more about a space or object with increased exploration is considered by many to be at the heart of learning: the more you know, the more you want to know and the deeper the mystery becomes. In contrast to living forms and spaces, most built objects and spaces are readily knowable at first glance, and thus do not motivate learning and exploration. Although complexity is a desirable feature, spaces and objects that are too complex are difficult to comprehend. The key may be the combination of ordering and complexity that allows comprehension at higher levels first and then engages our sensory systems at a more detailed level with successive exploration (Hildebrand 1999, Kaplan and Kaplan 1989).

### **MULTI-SENSORY**

Natural habitats are sensory rich and convey information to all human sensory systems, including sight, sound, touch, taste, and odor. Life-supporting processes, such as fire, water, and sun, also are experienced in multi-sensory ways. Many of our built environments shun sensory embellishment, creating instead caverns of grey and beige, as well as outdoor soundscapes that stress rather than soothe. Although the vast majority of research in environmental aesthetics focuses on the visual environment, there is growing interest in understanding how design appeals to multiple senses. Both the Japanese practice of “Kansei engineering” and emotion-centered design are grounded in links between sensory perception and emotional responses to artifacts and to specific features of products (McDonagh et al. 2004; also see [www.designandemotion.org](http://www.designandemotion.org)).

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.



## TRANSFORMABILITY

Natural outdoor spaces appeal to children because they are transformable and have multiple uses. As Robin Moore notes, what children really need for play is “unused space and loose parts” (Moore and Cooper-Marcus 2008). If given the opportunity, children will use whatever they find in nature as play materials. Leaves, rocks, sand, water, branches, and flowers are all used to construct and transform an ordinary space into a magical one through imaginative play. Natural spaces also support imaginative play more effectively than most built structures because their features are readily transformed into different contexts. In a study of children’s play in Seattle, Kirkby (1989) found that the most popular place on an elementary school yard was a cluster of shrubs that children could transform into a house or a spaceship, using flowers and twigs as play artifacts. Transformability and multi-use are much discussed in the design world, but seldom implemented.

## Reflection

This brief overview of research on biophilia and human well-being is only the tip of a widening knowledge base that says strongly and unequivocally that people need daily contact with the natural environment. Fortunately, the research also shows that there is a multiplicity of ways to ensure that people get their daily dose of “Vitamin G.” Indoor sunlight, flower pots on the doorstep, large street trees, vest pocket parks, rooftop gardens, green roofs, large parks, water features, views to a garden, and even positive images and representations of nature all contribute daily perks and emotional uplifts that together generate improved health and well-being for urban residents and for those confined to indoor environments.

I would like to end with an anecdote from a recent talk on biophilia to a group of designers. After discussing the emotional and physical benefits of nature and, as a good scientist, talking about the need for more research to clarify mechanisms and build a better business case for biophilic design, an interior designer in the audience asked me: “Why do we need more research? Don’t we already know this? Why aren’t we putting money instead into creating these kinds of environments?”

Why, indeed? When a body of research reinforces what we know intuitively and emotionally, isn’t this really the best guide for the design?

The ideas and principles behind biophilia, built upon our understanding of human evolution in a biocentric world, enrich the design palette enormously. The biggest challenge we face is to ensure that the benefits are equitably distributed to people of all ages, abilities, and economic status. This can happen when we look at every design as an opportunity to invest in human health and well-being.

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