

# biophilic design

## For The First Optimum Performance Home™

Julie Stewart-Pollack, ASID, IDEC

### synopsis

**Biophilic design attributes are elements and qualities of the physical environment that connect us to the physical, psychological, and cognitive benefits derived from direct experiences with nature.**

**Biophilic design attributes include: dynamic natural light, natural ventilation, access to open and/or moving water, frequent opportunities for spontaneous interaction with nature, sensory connections with nature, complexity and order, mystery, prospect and refuge, fundamental natural forms, and local natural materials.**

### Preliminary Analysis Of The Biophilic Design Attributes Of The Optimum Performance Home™ At The Sea Ranch

Sustainable design and development, in its many definitions and interpretations, is gaining tremendous momentum in the United States and around the world in both developed and developing countries. Standards for sustainable building materials and technologies, and environmentally responsible design strategies, such as the U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED®) rating program, have made environmentally responsible design and building more accessible and easier to evaluate. In the U.S. alone, over 531 million square feet of commercial building space has been registered or certified under LEED since the first LEED rating system was released in 2000. With the creation of the new LEED for Homes rating system, interest in residential sustainable design is expected to soar in the next few years as homeowners discover that living in a healthy, resource-efficient sustainable home is not only possible, it is highly desirable.

However, sustainable design is typically regarded as a collection of "best practices" for resource conservation and improved environmental quality that rarely addresses the physical, psychological, and social consequences associated with living almost exclusively in built environments designed primarily to isolate and insulate us from nature. Although all sustainable design strategies and standards—including LEED—involve some considerations for human physical health, such as improved indoor air and environmental quality, many design professionals and environmental scientists believe that we must do even more. If sustainable design is to be truly embraced by the public, it must expand its considerations to include quality of life issues involving total human physical and psychological health and well-being.

When Harvard biologist Edward O. Wilson introduced to the world in 1984 the concept of Biophilia (the inherent need of humans to interact and affiliate with nature to achieve and maintain optimum health and well-being), he laid the foundation for the development of a new design paradigm. Based upon research in multiple disciplines revealing that interaction with nature provides a variety of physical, psychological, and cognitive benefits rarely found in built environments, this new design paradigm expands significantly upon the definition of sustainable design to include the essential relationships between human beings and nature, and between natural environments and built environments.

Studies of our inherent need for nature suggests that the natural world is a defining part of the human psyche; a major source of our sense of identity; physical, emotional, and cognitive development; and an important foundation for development of our aesthetic and spiritual experiences. They further

suggest that when we design and build without an understanding of this fundamental fact, we not only harm the planet, we diminish the quality of human experience and lose the wellspring of our health and well-being.

### Biophilic Design Attributes

As discussed in Issue 3, May/June 2006 of *Ultimate Home Design*, the new design paradigm that takes sustainable design to the next level is called Biophilic Design. Biophilic Design recognizes the inherent human need for nature together with sustainable and universal design strategies to create environments that truly enhance life. The Optimum Performance Home™ at The Sea Ranch, one of two custom home projects in California in the LEED for Homes pilot program, provides an excellent opportunity to study the process of biophilic design from site development and landscaping to architecture and interior design. By utilizing certain design strategies called biophilic design attributes, the design of the home will connect its

**"Biophilic design recognizes the inherent human need for nature together with sustainable and universal design strategies to create environments that truly enhance life."**

occupants to nature and its many benefits in a variety of ways.

Biophilic design attributes are elements and qualities of the physical environment that connect us to the physical, psychological, and cognitive benefits derived from direct experiences with nature. We prefer these natural attributes in part because they literally bring buildings to life physically through the use of design strategies and materials, and symbolically through an understanding of deeply rooted affiliations, associations, and meanings. Biophilic design attributes include: dynamic natural light, natural ventilation, access to open and/or moving water, frequent opportunities for spontaneous interaction with nature, sensory connections to nature, complexity and order, mystery, prospect and refuge, fundamental natural forms, and local natural materials.

The following preliminary analysis of the Optimum Performance Home's biophilic attributes is based upon the current site, landscape planning, and architectural design of the home as described in the first four issues of *Ultimate Home Design* magazine. These attributes will be expanded upon and enhanced through the biophilic interior design of the home.

Some general strategies are described in this article, and future issues will discuss the development of these and other strategies that will be used to integrate biophilic attributes throughout the Optimum Performance Home at The Sea Ranch.

**Dynamic natural light** (rhythmical living light, patterns of brightness and shadow, sparkle)

The most significant difference between our experience of natural light and artificial light is that natural light is constantly changing in direction and intensity. The overall rhythm of sunlight moving from day to night and from season to season reveals and highlights colors, patterns, and textures; subdues and constantly changes them; then reveals them again in an entirely new way. Changing patterns of brightness and shadow, sparkle, and reflection capture and redirect our attention, helping to relieve stress and mental fatigue.

The correct placement and orientation of windows and skylights in buildings is critical to capturing dynamic natural light. Light should enter spaces from at least two different directions to enhance the experience of the sun's movement, eliminate glare, and provide changing patterns of brightness and shadow. Each of the four directions provide distinct lighting effects and experiences. For example: southern exposure provides warmth via passive solar gain; northern exposure produces flatter more diffused light; and eastern and western exposures afford the most dramatic experience of light movement.

Light should also enter spaces from different heights. For example, windows located high in the wall allow light to reflect off the ceiling and penetrate more deeply into the room. Light from above via skylights, transom windows, solar tubes, and clerestory windows adds increased depth and movement.

The design of the Optimum Performance Home incorporates dynamic natural light in a variety of ways. The sun penetrates into and throughout the three-building compound with primary living spaces oriented east, west, and south. Natural light enters all critical spaces from two or three directions (none are required or desired in the wine cellar and home theatre). Southern exposure provides an infusion of bright, natural light through the solarium into the kitchen area and will provide passive solar warmth and ambient light to the kitchen, home office, and solarium. Skylights placed throughout the home provide infused, ever-changing light from above.

As the design of the interior of the home takes shape, materials that respond to changes in the light's direction, intensity, and color will be used to enhance the experience of dynamic natural light. Artificial light will be designed to mimic natural light as much as possible and to provide individual control over brightness and direction.

**Natural ventilation** (movement of air, changes in air temperature, airborne scents)

**OPTIMUM PERFORMANCE HOME  
AT THE SEA RANCH, CA**  
SCALE: 1/16" = 1'-0"

- |                   |                   |                    |                           |
|-------------------|-------------------|--------------------|---------------------------|
| 1 Garage          | 9 Projection Room | 17 Utility/Storage | 25 Garden/Water Feature   |
| 2 Elevator        | 10 Home Theatre   | 18 Sauna           | 26 Recycle/Trash/Wood     |
| 3 Dog Run         | 11 Wine Cellar    | 19 Stream/Pond     | 27 Driveway/Guest Parking |
| 4 Workshop        | 12 Hot Tub        | 20 Master Bath     | 28 Covered Deck           |
| 5 Laundry         | 13 Courtyard      | 21 Master Suite    | 29 Guest Bedroom          |
| 6 Vanity          | 14 Vestibule      | 22 Deck            | 30 Guest Bath             |
| 7 Covered Walkway | 15 Dining Room    | 23 Solarium        | 31 Library/Music Room     |
| 8 Home Office     | 16 Kitchen        | 24 Living Room     | 32 Equipment Access       |



**UPPER FLOORS**



**LOWER FLOORS**

**Biophilic Design Attributes**

-  Dynamic Natural Light & Natural Ventilation
-  Access To Open And/Or Moving Water
-  Compound Mystery
-  Prospect & Refuge (Views)

Human beings were not meant to live in closed and sealed environments. We may be able to exist there, but we do not thrive there for long. The movement of fresh air through a space changes everything. It alters our perception of temperature, changes a static environment into one of subtle movement, and brings the world into our homes through scents carried on the breeze.

Few sites offer the potential for natural ventilation that The Sea Ranch site enjoys. The orientation of the home provides cross ventilation in all critical spaces through windows, doors, and operable skylights through which fresh air from the Pacific Ocean breezes will circulate. Interior materials and design elements that respond subtly to air movement will be used to enhance the experience of natural ventilation.

**Access to open and/or moving water** (visual, acoustical, symbolic qualities)

Water is one of the most evocative, universally shared symbols of life and a powerful biophilic attribute. We are instinctively drawn to water as a source of survival, as well as for aesthetic and recreational pleasure. In addition to human beings' historical patterns of habitat selection that have always favored living near the water, some of our most cherished and revered buildings, such as Frank Lloyd Wright's Fallingwater, use water as a primary design element.

Distant views of the Pacific Ocean from a variety of inside and outside spaces link the Optimum Performance Home to its symbolic associations with the sea. The planned excavated pond situated at the rear of the property serves not only a functional role as part of the hydrologic plan; it creates a biophilic focal point for the landscape surrounding the home and a habitat for local vegetation and wildlife.

Two private outdoor/nature areas are designed around water. Within the courtyard and visible from select interior spaces such as the master suite, the in-ground hot tub provides both visual and physical interaction with water in a natural setting. The private garden includes a water feature visible from the living room and the second-story library/music room. Additional interior water features will be designed to provide visual, acoustical, and symbolic connections to the compelling proximity of the home to the sea.

**Frequent opportunities for spontaneous interaction with nature, including other species** (integration of and free-flowing movement between interior and exterior spaces, visual and/or physical access to wildlife)

Biophilic design views the site and building as a series of exterior and interior spaces woven together in a tapestry. By integrating the natural elements of the site into the form of the architecture itself, we experience the unique relationships between interior and exterior from multiple perspectives as we

move from space to space within the home. Visual and physical barriers between indoor rooms and outdoor spaces dissolve into a mosaic of inside-outside spaces.

By using the walls and wings of the home to define "outdoor rooms," the experience of living is extended into a sheltered natural environment. Both distant views and views of nearby nature are important to this experience. Distant views link us to the greater natural order of the site, while nearby nature links us to the intricacies and immediate sensory pleasures of the site.

The architecture of the Optimum Performance Home is formed within, around, and about the natural features of the site. Free-flowing movement between indoor and outdoor spaces is enhanced by multiple transition areas such as covered walkways, courtyard, decks, and a garden that visually and physically extends the livable space into the natural environment. Three levels of views will be enjoyed: controlled views that look into the courtyard, private garden, or prepared places on the property maintained by the owners; local views that look out onto nearby nature; and expansive views that look out to infinity and include the Pacific Ocean and "big sky" views.

Pervious surfacing of the driveways, parking areas, and walkways maintain stronger connections with the natural immediate surroundings by eliminating solid pavement and retaining all potential runoff in the immediate watershed. The natural flow from inside the home to the outdoor paths link the home to nearby walking trails, gardens, stables, and riding trails along the 10 miles of coastline and further connects the occupants to the site and its natural surroundings.

**Sensory connections to nature** (physical, visual, material connections between interiors and nature)

While most built environments provide somewhat shallow and limited sensory experiences as compared to nature, biophilic design deeply engages all of the senses—in much the same way as sitting near the ocean, walking through the forest, climbing a mountain, or working in the garden. It is not a passive experience, but rather one that reminds us every moment that we are alive and a part of the life of the planet.

The four previously discussed attributes—natural light, ventilation, access to water, and opportunities to encounter nature from multiple perspectives—all directly enhance our sensory connections to the natural world and are abundant in the Optimum Performance Home. The surrounding natural setting of the home itself is so compelling, in part because it provides such a rich source of these attributes, and the site-specific architectural design takes full advantage of each.

Interior materials, colors, patterns, textures, and artwork will draw the qualities and features of the architecture and landscape inside enhancing a seamless interior/exterior sensory experience. This does not mean necessarily using exactly the

same materials, but rather materials that embody the qualities and features most desired from the architecture and the landscape.

**Complexity and order** (the relationship of variety and intricacy within underlying natural patterns of order)

Diversity and intricacy abound in the natural world. From micro to macro, nature's almost infinite variety provides environments for all species to live, learn, and thrive. But what makes it all work are underlying natural patterns of order that hold the diversity, variety, and intricacy together to maintain coherence. Natural patterns of scale and proportion, balance and harmony, novelty and familiarity, help us to organize and make sense of the complexity of the natural world. Biophilic design uses these same patterns to organize design elements and create built environments rich with information.

The architectural design of the Optimum Performance Home varies in scale and proportion appropriate to the site and surrounding landscape features. The façade, fenestrations, and surface details provide strong vertical elements in patterns that contrast harmoniously with the overall horizontal footprint of the home. Interior materials, furnishings, and details will reflect the multi-layered but elegant complexity of colors, patterns, and textures found at The Sea Ranch site.

**Mystery** (enhances the desire to explore, discover, and learn from the complexities of nature)

The relationships of complexity and order found in natural environments often take on the quality of mystery, defined by environmental psychologists Rachel and Stephen Kaplan as, "Something in the setting (that) draws one in, encourages one to enter and to venture forth, thus providing an opportunity to learn something that is not immediately apparent from the original vantage point."

Mystery arouses our intuition-driven curiosity and encourages us to interact more fully with our environments. In nature, mystery is experienced, for example, as we move through shadowed and shaded areas toward brightly lit areas, where distant views are partially obscured through foliage or disappear around a bend in the path. Biophilic designs create mystery in much the same way as nature does by sequencing interior and exterior spaces and elements so that some are partially screened from views (distant and near) as we move through and around the spaces. The compound layout of the Optimum Performance Home at The Sea Ranch creates a series of interior spaces interwoven with exterior spaces that are "revealed" as one moves through the home and surrounding exterior spaces. As the design of the interior of the home progresses, interior spaces will be planned to further enhance the subtle qualities of mystery that are found in the surrounding natural environment by creating spaces and partially screened views that change and expand as one moves through the series of indoor and outdoor rooms.

**Prospect and refuge** (strategic viewing conditions from a position of safety and security)

From the first crude shelters of our earliest ancestors to the most advanced, modern built environments available today, our homes have always been chosen and designed to provide primarily a place of protection. But all too often today that protection almost completely insulates and isolates us from the natural world and the many benefits we gain from interaction with nature. The attribute of prospect and refuge combines the desired levels of safety and protection with the ability to connect visually to a view of our surroundings—an advantageous combination historically for survival that

continues today to provide the benefit of relief of mental fatigue and stress, as well as for aesthetic experiences.

Pulitzer Prize-winning Harvard biologist and originator of the concept of Biophilia, Edward O. Wilson, observes our apparent universal desire for conditions of prospect and refuge this way: "...it seems that whenever people are given a free choice, they move to open tree-studded land on prominence overlooking water...Those who exercise the greatest degree of free choice...congregate on high land above lakes and rivers and along ocean bluffs." We are attracted to and appreciate these types of natural environments because, as Wilson explains, we are "responding to a deep genetic memory of mankind's optimal environment."

This is the environment from which the Optimum Performance Home derives its form, its orientation, and its design. The home overlooks the sweeping prospect of the Pacific Ocean, shielded from the road by natural buffers of native fire-adaptive trees, as well as meadow habitat brushes, flowering plants, and ground cover. Sheltered decks with panoramic views provide refuge and privacy. The home's design features a combination of inside/outside, large/small, shared/individual, and public/semi-private/private spaces offering many characteristics of prospect and refuge. The library/music room on the second floor is a particularly good example, with prospect in four directions via windows on three sides and a dramatic skylight overhead. The interiors of the home will use lighting, and furniture selection and placement, as well as visual screening elements to further enhance the prospect and refuge experience.

**Fundamental natural forms** (biomimetic models, fractals, natural progressions of scale, rhythm, proportion, repetition, symmetry, gradients)

Biophilic design views nature as the ultimate design model. Nature's forms,

geometric progressions, and patterns are studied and translated into the forms, progressions of scale and proportion, and patterns of the building and interiors.

This approach is based upon the science of Biomimicry introduced in 2002 by science writer Janine Benyus. She explains Biomimicry in this way: "The core idea is that nature, imaginative by necessity, has already solved many of the problems we are grappling with. Animals, plants, and microbes are the consummate engineers. They have found what works, what is appropriate, and, most important, what lasts here on Earth.... After 3.8 billion years of research and development, failures are fossils, and what surrounds us is the secret to survival."

By examining and seeking to understand the forms, processes, and patterns of nature, biophilic design is able to solve naturally some of the challenges we encounter when designing sustainable built environments. For example, using graduated repetition of scale is one effective way to help meet a primary objective and challenge in building homes at The Sea Ranch: integrate the structure with the site. Exterior elevations of the three buildings of the Optimum Performance Home illustrate how the buildings begin as low horizontal forms

that progressively rise vertically similar to the surrounding landscape.

**Local natural materials** (connect the site to the building and interior spaces)

Biophilic design emphasizes using natural materials native to the site and surrounding to create sensory connections between the built and immediate natural environments. Care must be taken during site preparation, construction, and specification of building and interior materials to avoid using endangered local natural resources or resources that, by removing them for use, will diminish or threaten established habitat for other species.

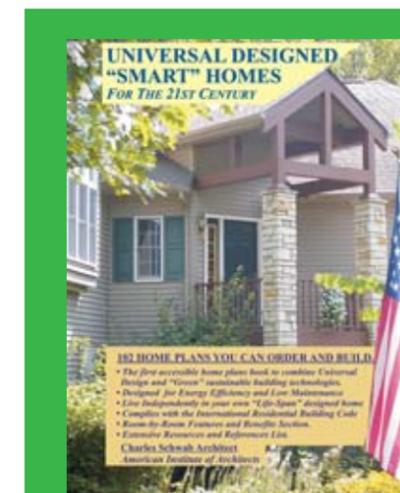
Some of the strategies for using local natural materials in the site preparation of the Optimum Performance Home include: preserving the fertile layer of topsoil for use in landscaping with native plants, and using natural groundwater management so that the unique watershed characteristics of the seasonally marshy meadow are maintained. In addition, damaged pines that were cleared from the site were stockpiled to be chipped to cover bare ground exposed after construction. These chips will also be used as much for mulch as a temporary site control

during construction to prevent the discharge of sediment. Finally, local, natural surfacing materials (floors, walls, countertops, cabinetry, etc.) will be used in the interiors to further connect the home to the site.

In future articles, we will examine how biophilic design attributes help to provide many of the physical, psychological, and cognitive benefits derived from the experience of nature, and how these attributes will be integrated in the interiors of the Optimum Performance Home at The Sea Ranch. **UHD**

#### The Author

Julie Stewart-Pollack, ASID, IDEC, is an environmental designer, interior designer, and member of the design faculty and Coordinator of the Green Design Area of Emphasis at Rocky Mountain College of Art + Design in Lakewood, Colorado. She is co-author of the ASID award-winning book, *Designing For Privacy And Related Needs* and author of the soon to be released book, *The Need For Nature: A Premise For The Design Of The Built Environment*. Julie has published several articles on sustainable design and the human need for nature and has an accredited CEU course entitled "The Need For Nature In Healing Environments And The Workplace." She is a frequent guest lecturer and speaker on sustainable design and built environment issues, and is a member of the USGBC and the Sustaining Design Task Force of the Interior Design Educators Council. As a consultant specializing in sustainable design and education, she works with architects, designers, educators, and institutions to increase awareness and understanding of sustainable design issues, principles, and practices.



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