Biophilic Design

We will never achieve an ethical architecture that is beautiful and sustainable until nature is integral and at the core and at the substance and being of the architecture, not added on. If it ain’t beautiful, it can’t be sustainable. Buildings must shelter and inspire.

—Steve Kieran, architect, paraphrase of lecture, “Toward an Ethical Architecture.” Yale University School of Forestry and Environmental Studies, New Haven, CT, February 3, 2005

As noted, restorative environmental design emphasizes two complementary goals: (1) avoiding, minimizing, and mitigating the adverse effects of building construction and development on natural systems and human health, and (2) promoting positive interactions between people and nature in the built environment. Unfortunately, the second objective is often neglected in modern design and development. Yet, humans evolved in a biological—not artificial or manufactured—environment and continue to depend on ongoing contact with nature for their physical and mental well-being. Sadly, however, the quality and character of the contemporary built environment has increasingly isolated people from the beneficial experience of natural systems and processes.

Reducing the adverse effects of modern development is arguably the first and more basic priority of restorative environmental design, but we must go beyond this limited objective to also identify how buildings and landscapes can foster human lives of meaning and satisfaction by celebrating our dependence on nature as an irreplaceable core of intellectual creativity and emotional capacity. The label “positive environmental impact” or, preferably, “biophilic”
design describes this second dimension of a comprehensive approach to restorative environmental design. The fundamental objective of biophilic design is to elicit a positive, valued experience of nature in the human built environment.

Incorporating biophilic design into modern development is critical. Over the long run, few low environmental impact designs will prove to be sustainable or contribute significantly to a more benign society if the developments lack significant biophilic design features and characteristics. When people are not emotionally and intellectually attached to the buildings, landscapes, and places around them, they will rarely be motivated to commit the resources and energies needed to sustain (“keep in existence”) these features. Low environmental impact design innovations will inevitably become conventional, if not obsolete, in our rapidly changing world. When this happens, will a building’s occupants be sufficiently motivated to maintain and restore the structure or will they neglect and eventually abandon it? Buildings and landscapes that people do not associate with a positive experience of nature will almost always be discarded overtime, because they are not perceived as aesthetically appealing or connected to people’s emotional and intellectual well-being. Low environmental impact design that relies only on motivating people to avoid harm and damage to natural systems and human health fails to offer a positive vision of how we can achieve lives of meaning and satisfaction through our experience of the natural world. Therefore, the rhetorical question must be: What is more sustainable—a technologically complex, low environmental impact building isolated from the natural world and abandoned once its high technology systems are no longer novel, or constructions that people revere and recycle generation after generation because they affirm an enduring and inherent affinity for the natural environment? As psychologist Judith Heerwagen has argued:

[Human] performance and well being . . . depend not only on the absence of significant [environmental] problems, but also on the presence of particular kinds of features and attributes in buildings . . . . The challenge of green design is . . . . to integrate into buildings the positive biophilic features of our evolved relationship with nature and to avoid biophobic conditions.¹

Architect Rafael Pelli similarly remarked that sustainable design must achieve “more than a series of solutions to technical problems. It must also seek to create something that transcends the solving of specific problems, resulting in a valued reality in a special and beautiful place.”² The basic goal of restorative environmental design is to rekindle and renew our compromised connections with the natural world.
The additional emphasis here on biophilic design should not be interpreted as advocating a subjective aesthetic over the more rational, objective standard of technical efficiency that characterizes low environmental impact design. Indeed, the opposite is the case. Satisfactions and benefits associated with biophilic design foster adaptive behavior that is instrumental to human welfare, including better health, reduced stress, improved emotional well-being, enhanced productivity, and increased problem solving and creativity. Design and development that satisfy only people’s physical and material needs will not succeed if they deny other biophilic affinities for nature that are crucial to people’s long-term physical, mental, and spiritual well-being.

The Bastille Viaduct

One project that restored contact with nature in an urban context is Bastille Viaduct, or Promenade Plantée, located in the eastern section of Paris, France (Illustration 20). The viaduct includes an elevated greenway (or “linear park”) with commercial areas—glass street-level enterprises—located below its supporting arches. The promenade is situated on a former rail line originally constructed in the nineteenth century and is nearly three miles long, thirty feet high, and thirty- to one-hundred-feet wide. It consists largely of brick and was converted to a park-like promenade in 1998, designed by landscape architects Philippe Mathieu and Jacques Vergely.

The viaduct’s conversion has revitalized the area socially and economically. The promenade on top of the viaduct contains a mosaic of gardens and pathways that include flowerbeds, trees, pergolas, bamboo forests, water gardens, and savanna-like areas. The walkway runs the length of the viaduct, periodically connecting to the ground, to the shops below, and to adjacent buildings via paths and stairs. The elevated viaduct allows the user to gaze out at the buildings and streets below while feeling removed from the noise and bustle of the city. The promenade’s extensive vegetation and garden-like qualities add to this feeling of serenity. The greenway offers a remarkable pedestrian experience in an urban setting, in effect, an arrow of vegetation running through the heart of the city’s clamor and congestion.

The promenade’s popularity is enhanced by the successful conversion of the street-level vaults into commercial space. The resulting combination of shops, gardens, and pedestrian pathways has spurred a revival of the once-depressed East Paris area. Attracted by the promenade’s open space, park-like qualities, and pedestrian access, new residents and businesses have renovated residential, commercial, and office space in the wider area. The environmental
restoration of the viaduct has been a major catalyst and unifying element for the neighborhood’s overall revitalization.

The aesthetic and recreational appeal of the promenade has been central to its success, providing a valued connection between people and nature in a highly urban setting. The three miles of linear open space offer an extraordinary amenity for both residents and workers. The integration of the promenade and the old brick viaduct fosters a strong vernacular connection to the city’s past. Both environmental restoration and historic tradition informed the promenade’s reconstruction in contrast to its possible destruction.

However, the promenade’s design largely fails to incorporate many features of low environmental impact or ecological landscape design, which detracts from the project’s overall relevance as a model of restorative environmental design. The walkway, which consists mostly of formal gardens and exotic plantings, makes little attempt to include native vegetation or to construct an ecologically self-sustaining environment. The nonindigenous plants require intensive management, including a regimen of watering, fertilizing, and treating with chemicals that reflects its imposed and contrived aesthetic. Nor does the promenade offer much in the way
of food, shelter, or migratory corridors for native wildlife; thus, it does little to heal the prevailing breach between Parisian culture and its local ecology. The commercial spaces also lack low environmental impact design features, with scant attention paid to energy and resource use, waste generation and disposal, and material and product impacts. Still, the promenade represents an innovative and important accomplishment that has enhanced the economic and social well-being of its neighborhood by connecting people to nature in an urban setting.

Attributes of Biophilic Design

Biophilic design can be encountered in a building’s facade, interior environment, decorative features, and exterior landscape. It can be directly, indirectly, or symbolically revealed and can sometimes occur unconsciously, without deliberate creation or even sometimes explicit recognition. This subjective element of biophilic design underscores its ancient qualities, which often tap into inherent human affinities for nature that people frequently fail to recognize. Consequently, many of the world’s most admired buildings and landscapes possess prominent biophilic features that are often barely appreciated yet exert powerful effects on us (Illustration 21). Architectural historian Grant Hildebrand alludes to this more subjective, inherent quality of biophilic design when he suggests:

We are biologically predisposed to liking buildings and landscapes with prominent natural elements. When we cannot actually place ourselves in a natural setting, we make some effort to provide ourselves with substitutes. There is evidence that we like to have around us natural archetypes or simulations of them. The point is not that a building or landscape resembles nature but that some architectural scenes accord (e.g., in form and space, in light and darkness) with an archetypal image of the natural world. \(^3\)

The challenge is to more specifically identify those biophilic design features that reflect a human affinity for the natural world and, thus, to create a satisfying and beneficial architecture. What are some of these biophilic features? They include natural lighting, natural materials, natural ventilation, shapes and forms that mimic natural features and processes, views and prospects of nature, and more. Psychologist Judith Heerwagen has developed a list of biophilic design features, which are presented in Table 5.1.

To deepen our understanding of biophilic design beyond this broad listing, this chapter will describe two basic dimensions of biophilic design: organic design and vernacular design.
Illustration 21. The Sydney Opera House, designed by Jorn Utzon, possesses prominent organic qualities, particularly its bird and sail-like features viewed against the Sydney Harbor.

Organic Design

Organic design can be defined as building shapes and forms that directly, indirectly, or symbolically elicit a human affinity for natural features and processes. Direct experience is contact with largely self-sustaining features of the natural world, such as a wooded landscape, a natural stream, or unfiltered air and light. Indirect experience is contact with natural elements that require continual human input and control—for example, a potted plant, a manicured lawn, or an aquarium tank. Symbolic experience involves contact not with living, or real, nature but, rather, with its ornamental, metaphorical, or vicarious representation. This can include decorations simulating natural shapes and forms, interior furnishing of refashioned wood and stone, or pictures and symbols of landscapes and organisms. The direct experience of nature does occur in buildings and especially in landscapes, but more typically the built environment emphasizes the indirect and particularly the symbolic experience of the natural world.

The term *organic design* originated with the famed architect Frank Lloyd Wright, although he described it in often obscure and varied ways. Still, his interest in the subject relates to
Table 5.1
Elements of Biophilic Design

|Prospect (ability to see into distance) | Brightness in the field of view (windows, bright walls) | Ability to get to a distant point for a better view |
|                                        | Horizon/sky imagery (sun, mountains, clouds)          | Strategic viewing conditions |
|                                        | View corridors                                        |                               |
|Refuge (sense of enclosure or shelter)  | Canopy effect (lowered ceilings, screening, branchlike forms overhead) |                               |
|Water (indoors or inside views)         | Glimmer or reflective surface (suggests clean water)   | Moving water (also suggests clean, aerated water) |
|                                        | Symbolic forms of water                                |                               |
|Biodiversity                            | Varied vegetation indoors and out (large trees, plants, flowers) | Windows designed and placed to incorporate nature views |
|                                        | Outdoor natural areas with rich vegetation and animals |                               |
|Sensory variability                     | Changes and variability in environmental color, temperature, air movement, textures, and light over time and spaces | Natural rhythms and processes (natural ventilation and lighting) |
|Biomimicry                              | Designs derived from nature                            | Use of natural patterns, forms, and textures |
|                                        | Fractal characteristics (self-similarity at different levels of scale with random variation in key features rather than exact repetition) |
|Sense of playfulness                     | Incorporation of decor, natural materials, artifacts, objects, and spaces whose primary purpose is to delight, surprise, and amuse |
|Enticement                              | Discovered complexity                                  | Information richness that encourages exploration |
|                                        | Curvilinear surfaces that gradually open information to view |

this discussion in two important respects. First, he asserted that the appeal of buildings and landscapes is frequently a function of their connection and relation to features of the natural environment. Second, he suggested that most successful architecture possesses a harmony and integrity originating in nature or, as he suggested, a characteristic of "being true to [their] nature." Wright often captured these organic qualities in his architectural creations, including Fallingwater (located in Bear Run, Pennsylvania), Taliesin East (Spring Green, Wisconsin), Taliesin West (Scottsdale, Arizona), the Johnson Wax office building (Racine, Wisconsin), his "Prairie" style of design, and other creations. These constructions frequently emulate or evoke features found in nature. To Wright, the most enduring designs possessed organic qualities of harmony and symmetry that are often encountered in the natural world and iteratively developed over time. He explained his approach to organic design as follows: "Nature is a good teacher. I am a child of hers, and apart from her precepts, I cannot flourish. I cannot work as well as she, perhaps, but at least I can shape my work to sympathize with what seems beautiful to hers. . . . Any building . . . should be an elemental, sympathetic feature of the ground, complementary to its nature-environment, belonging by kinship to the terrain."

Wright's work emphasized incorporating natural shapes and forms, especially in his residential designs—in particular, Fallingwater, his personal residences Taliesin East and Taliesin West, and his Prairie-style homes. These creations reveal important elements of organic design and some dimensions of vernacular design. However, his work reflects almost no aspect of low environmental impact design, a limitation of Wright's greatness that certainly was not unusual for his time.

Nonetheless, several important organic design features emerge from examining Wright's residential structures. These concepts include an emphasis on natural materials (especially wood and stone), natural lighting, and qualities of the environment incorporated into building interiors and experienced through exterior views. Wright stressed fitting structures into the landscape, seen especially in the parallel relation of his Prairie-style homes to the relative flatness of their savanna landscapes, which make them appear to emerge out of, rather than dominate, the ground. Wright also insisted on what he called the organic principles of simplicity and directness of design, with the house or artifact needing to be molded and connected to its environmental context. He suggested: "Nothing is more difficult to achieve than the integral simplicity of organic nature amid the tangled confusion of the innumerable relics of forms that encumber life for us. To achieve it in any degree means a serious devotion to the 'underneath' in an attempt to grasp the nature of building a beautiful building beautifully, as organically true in itself, to itself and to its purpose as any tree or flower."
Wright also emphasized simulating the dynamic character, or “plasticity,” often encountered in nature—forms altering or adapting themselves to changing conditions over time and space. His designs can, thus, appear to transform or mature in response to changing lighting and seasonal features, an effect frequently enhanced by his extensive use of natural materials, natural lighting, and dramatic exterior views in complementary relation to warm interiors. Wright’s structures reflect an intuitive understanding of nature’s appeal. Features that enhance this affinity for nature in Wright’s residential designs include the following, which are drawn from the work of Grant Hildebrand:

- High ceilings and a sense of spaciousness in main living areas
- Extensive natural lighting and vistas of the exterior landscape
- Living spaces high above the terrain that provide extended views
- The play of natural light seen through clear and decorative glass
- Fireplaces within low-ceiling interiors creating a feeling of refuge
- Large overhanging eaves and cantilevers engendering a sense of connection to the exterior landscape
- Conspicuous terraces offering distant views and a feeling of peril and excitement
- Winding paths and concealed entryways fostering feelings of safety and security
- Buildings integrated into the landscape through the use of long horizontal planes
- Visual connections between interior rooms, many with outside views, and few closed interior spaces (or what Wright called “destroying the box”)

Fallingwater—arguably Wright’s most accomplished creation—particularly illustrates many of these organic design features. The house fits extraordinarily well into its surrounding hillsides, particularly the adjacent ledges and forest (Illustration 22). Most dramatically, it sits astride a stream nearly on top of a waterfall. Precariously poised above the cataract, the house remarkably blends ledge, water, rock, moss, and forest. Cantilevered terraces thrust into space accentuate the home’s dramatic proximity to the falls. Living room spaces feature abundant windows and natural lighting, the use of natural materials, and frequent fireplaces, achieving an overall satisfying confluence of limitless possibilities within the protective nest of a sheltered environment.

These organic design features attract thousands of visitors each year despite Fallingwater’s remote Pennsylvania location. Most visitors want to see the home’s dramatic connection to the natural environment, especially the waterfall and its near incorporation into the household. Yet,
Illustration 22. Frank Lloyd Wright's famous residential design Fallingwater fits extraordinarily well into its surrounding hillside and nearby stream and rests nearly atop a waterfall.
Wright’s celebrated creation lacks many important aspects of restorative environmental design, particularly low environmental impact and vernacular design features. The structure uses some regionally derived materials, but achieves little sense of connection to indigenous culture or ecology. Indeed, most of Wright’s constructions possess few low environmental impact or vernacular design features. Rather, they proclaim an attitude of wastefulness, a lack of concern for energy and other resource uses, and a philosophy of art over nature. Indeed, Fallingwater’s most dramatic design feature—its location beside the watercourse and nearly on top of a waterfall—would not even be allowed today, given its destructive effects on the riparian environment.

Still, as Wright’s creations demonstrate, people are attracted to and become attached to buildings and landscapes that successfully incorporate organic qualities into their design. This can be seen in much traditional architecture, in which some of the most admired and enduring constructions possess prominent organic features. By contrast, the alienation associated with much contemporary architecture reflects an excessive reliance on fabricated materials, artificial lighting, controlled climatic conditions, straight-line geometries, homogeneity of design, scales rarely if ever encountered in nature, substitution of the synthetic for the natural, and an indifference to local ecology and culture.

Writer David Pearson describes organic architecture as “rooted in a passion for life, nature, and natural forms . . . full of the vitality of the natural world with its biological forms and processes.” He identifies several broad features of organic design, including their tendency to be

- Inspired by nature
- Unfolding, like an organism, from the seed within
- Existing in the “continuous present”
- Following (natural) flows, flexible, and adaptable
- Satisfying social, physical, and spiritual needs
- Growing out of the site
- Celebrating a spirit of play and surprise

He suggests that these attributes depend on such features as natural light, natural materials, wind, air, soil, geology, water, and other characteristics of the natural environment. Although useful, these attributions remain vague and elusive. The following discussion thus will use the simpler categories of direct, indirect, and symbolic experience of nature to describe various attributes and characteristics of organic design. But first, let us consider a recent example of organic design in modern architecture.
The International Netherlands Group (or ING) Bank complex, an office, commercial, and residential development outside Amsterdam, The Netherlands, was initially conceived during the late 1970s but not completed until 1987 (Illustration 23). Designed by architect Anton Alberts, who was inspired by the work of the philosopher and designer Rudolf Steiner, the project includes half a million square feet in ten connected buildings. The developers envisioned creating a community as much as a bank headquarters, uniting architecture, work, commerce, and residence in an overall complex. This goal was partially achieved, although most of the complex’s residents seem to differ economically, culturally, and occupationally from the typical bank employee.

The ING complex incorporates organic design elements as well as, to a lesser extent, those of low environmental impact design. A striking organic feature is the lack of straight-line geometries that characterize so much of office construction today in favor of the curvilinear forms more often found in the natural world. Also, lighting fixtures, furniture, wall coverings, columns, and art objects consciously strive to simulate the shapes of nature. Water is frequently designed into the exterior landscaping and even occasionally is encountered in interior features, such as a handrail and staircase that incorporate the sight and sound of water. Building heights are modest to foster a more human scale, and gardens are often located near the buildings. Natural lighting, ventilation, and materials are used extensively throughout the complex, with the natural lighting having helped to substantially reduce energy consumption. Other low environmental impact features include the use of waste heat as an energy source, the use of locally and sustainably produced products and materials, and water conservation practices.

As noted, the ING complex was inspired by the ideas of German designer and philosopher Rudolf Steiner. Architectural critic Günther Feuerstein described Steiner’s design approach as follows:

Rudolf Steiner speaks of an “organic building style” and supplies this with a number of metaphors pointing to biological phenomena [of] plants, human beings, and animals. . . . Buildings can be described as close to Expressionism and to organic architecture. . . . Steiner repeatedly compared human physicality, though spiritualized, with his architecture. The buildings are interpreted as bodies. 10

The ING project introduced many changes in the decision-making process to encourage its design goals. These included long-term planning and a close, consensual relationship among
Illustration 23. The International Netherlands Group Bank's complex of office, commercial, and residential buildings in Amsterdam, The Netherlands, designed by Anton Alberts, is an early and still relevant example of restorative environmental design.
architects, engineers, executive management, and employees. Organic and low environmental impact objectives were emphasized at the outset and infused into all phases of design, development, and construction. This interdisciplinary planning process—viewed as essential to the project’s success—is described in the Rocky Mountain Institute's book *Green Development*: "This process . . . included, first, a vision for what was to be created . . . [and] second . . . integrated planning and design, in which the performance goals were identified up-front . . . involving four overlapping components: whole-systems thinking, front-loaded design, end-use/least-cost considerations, and multidisciplinary teamwork." 

The ING project is an inspiring though only partially effective attempt at restorative environmental design. Although its achievements have purportedly resulted in improved employee satisfaction, productivity, and morale, many organic design features remain incomplete and only partly successful. The project’s low environmental impact design features are also limited in scope and effectiveness. Vernacular design elements are not extensive or well integrated, despite the use of local materials and the attempt to create a community. The ING complex feels imposed on its social setting and landscape, uncomfortable with either its cultural or ecological context. Still, the project is highly innovative and its organic design accomplishments impressive and relevant.

*Direct Experience of Nature*

Direct attributes of organic design result in the relatively immediate experience of nature in buildings and constructed landscapes. Natural lighting and natural ventilation are common expressions of direct organic design (Illustration 24). These features can be the result of deliberate design decisions, such as large operable windows, or the by-product of technical innovations, such as chimney stacks, light shelves, and buildings orientated to the sun and prevailing winds. Natural lighting and ventilation are basic properties of the natural environment, although the quality of their experience varies considerably depending on such factors as amount and kind of vegetation, relationships between building interiors and exteriors, and exhaust and road placements. The decision to enhance natural lighting and ventilation can profoundly affect occupant well-being, including health, motivation, morale, and other aspects of physical and mental well-being and satisfaction.

Other natural features that can be designed into buildings and constructed landscapes include plants, soil, water, geological forms, and even fire or animal life. These environmental elements—which can occur in building interiors but more often appear in exterior settings—often exert considerable physical and psychological effects. Their impact varies depending
on the quality of the design. An isolated encounter with a single element of exotic vegetation is typically a sterile, contrived form of contact with nature that holds little consequence. For example, designs featuring only trivial contact with a "prisoner" plant confined within a planter tend to offer little more than a decorative, superficial experience (Illustration 25).

By contrast, designing a coherent and functionally organized natural system that includes diverse vegetation, soil, water, and even animal life can stimulate people's senses, emotions, intellect, and spirit, resulting in considerable aesthetic, naturalistic, and other biophilic satisfactions. The quality of any direct contact with nature in the built environment is often constrained by the practicalities of cost, opportunity, and technology. Still, with commitment and imagination the direct experience of nature in buildings and landscapes can be achieved, resulting in many benefits to people.

Direct design of nature can also incorporate views of the exterior environment. One attraction and advance of modern glass buildings—despite their potentially adverse ecological
Illustration 25. Prisoner Plants: The palm disappearing into the hard surface floor and the isolated lobby planter reflect the widespread practice of treating plants as mere decoration.

 impacts—is the extraordinary visual access they afford of the outside. This exposure to the natural environment has been invaluable in many urban locations that contain major natural landmarks, such as large rivers, estuaries, and mountains. However, the pleasure of seeing these vistas can sometimes be diminished by building heights that are greatly out of scale with the human experience, precipitating anxiety and threat as much as satisfaction. Still, visual access to the exterior environment is often a highly gratifying feature of organic design.

Exposure to water near or even within buildings can also foster the direct experience of nature in the built environment. The sight, sound, and even smell of water often exert positive psychological effects, especially when the water is conspicuous, moving, and inhabited by vegetative or animal life (Illustration 26). After reviewing many studies of the human attraction to water across diverse cultures, geographer and environmental psychologist Roger Ulrich concluded: “Water features consistently elicit especially high levels of liking or preference.”12 Similarly, critic and designer John Ruskin long ago observed: “As far as I can recollect, without a single exception, every Homeric landscape, intended to be beautiful, is composed of a fountain, a meadow, and a shady grove.”13
Illustration 26. (top and bottom) Sight, Sound, and Smell of Water: The view of buildings across an urban lake and the presence of a more formal water fountain reflect the powerful effect of water in the built environment.
Creating the experience of water in the built environment can be technically challenging, and water that is poorly designed into buildings and landscapes can be disturbing. As Grant Hildebrand remarks: "Water is not a universal feature of pleasurable settings, and ... can suggest danger in certain instances." However, when well connected to other natural features (e.g., soils, geological forms, plants, and animal life), water incorporated into building interiors and landscapes can be profoundly satisfying. Most successful water designs mimic natural forms and processes. In some restorative environmental designs, the experience of water has also been successfully connected to several building functions, such as irrigation, plumbing, wastewater treatment, stormwater protection, and insulation. The design potential of water has been described well by architect Charles Moore in his classic study of water and architecture. Yet, Moore notes how often the absence or distorted expression of water in modern architecture reflects a growing human estrangement from the natural world. He suggests:

Water is a natural material, and ... although controlled by gravity and natural laws, it can be coaxed, shaped, and transformed. We can try to achieve harmony with nature, we can try to ignore it, or we can try to master it—or we can find ourselves, at the end of the twentieth century, in a confused, ecological attempt to do all three at once. As we in our century have steadily removed ourselves from the ideals of nature ... we have risked losing intimate contact with water. ... Water, in all its variations, interpretations, and presentations, shares a simple, common origin. It has inherent, immutable properties that time cannot alter.

However, buildings must also regulate the direct experience of nature and frequently exclude it from the interior environment. Take, for example, fire, which is typically suppressed because of the potential danger it poses. Yet the manipulated experience of fire within building interiors is a celebrated source of warmth, cooking, comfort, and protection, with its controlled use long viewed as a sign of civilization. Fire possesses great symbolic significance, and its experience in homes especially forms a highly satisfying, coveted element of organic design. Fireplaces allow this basic element of nature to penetrate a building's core and produce an experience of color, satisfaction, and movement. But, to be fully satisfying, fire must be revealed in ways that demonstrate its confident dominance and mastery.

Designing animal life into the built environment can be especially challenging. Technology, cost, and aesthetics often strongly discourage the presence of animals in building interiors. Modern health and safety factors, in particular, emphasize the maintenance of an antiseptic environment. Yet, when creatively designed into atriums, lobbies, and other public and private spaces, the pres-
Illustration 27. Ivy Covered Walls: The University of Michigan Law Quadrangle achieves a highly organic effect with its ivy-covered walls and integration into the vegetated landscape.
ence of butterflies, fish, and even higher vertebrates (e.g., birds) can produce a visually exciting and satisfying contact with nature. Effective wildlife design can be emotionally and intellectually arresting, providing physical and mental restoration as well as a feeling of connection to the natural world.

The building facade itself can sometimes incorporate natural features. One common example is ivy and other vines climbing on exterior building walls (Illustration 27). A more unusual development in recent years has been the development of green roofs, which use vegetation to accomplish both biophilic and low environmental impact design objectives (Illustration 28). Low environmental impact goals include improved insulation, reduced stormwater runoff, lessened heating and cooling loads, diminished heat island effects, and reduced noise and air pollution. In addition, green roof design can also provide plant and animal habitat that enhances human relaxation, imagination, intellect, creativity, health, and productivity, especially in urban areas often lacking vegetation and open spaces.

The external landscape offers the greatest potential for designing the direct experience of nature. This can occur in constructed landscapes that include native plants and animals as well as food and cover for such wild species as fish, birds, and sometimes mammals. Ambitious designs can create habitats where wildlife flourishes and is highly accessible, including wetlands, vegetative corridors, and self-sustaining forest communities. Although the direct experience of nature in buildings and landscapes is frequently inhibited by the limitations of resources, knowledge, and technology, the greatest constraint is often a lack of imagination and the willingness to
seek more compatible connections with nature in the built environment. With commitment, an experientially rich, sensuous, and deeply satisfying architecture can be created that puts us in touch with all of our visual, tactile, and other sensory attractions to the natural world.

*Indirect Experience of Nature*

Nature in buildings and landscapes can become so controlled and manipulated that it produces a radically altered state of nature requiring ongoing human management and intervention. Examples of such manipulated contact with the natural environment include planters decorating an interior lobby, fish in an aquarium tank, or formally designed fountains. Greatly transformed from their natural state, these features typically depend on continual human management and control to exist. But if these indirect expressions of nature are well designed, they can be deeply satisfying and beneficial (Illustration 29). Designing the indirect experience of nature often involves manipulating such environmental elements as vegetation, animal life, light, air, water, materials (e.g., stone, wood, cotton, hides, wool, leather), and even natural processes, such as aging, weathering, and climate. Categorizing these features as indirect experiences of nature can often reflect more a matter of judgment than an absolute statement of fact.

*Illustration 29.* Indirect Experience of Nature: An example of the indirect experience of nature, this university courtyard possesses many biophilic elements despite its monoculture of grass and its formal fountain requiring continuous human input.
Illustration 30. Inside Gardens: Commerzbank (left), an office tower in Frankfurt, Germany, designed by Norman Foster and Associates, has achieved exceptional energy efficiencies through its solar orientation, natural lighting, and double-wall construction. An innovative biophilic feature is its five “winter gardens” (right), with one located every thirteenth floors.

An example of incorporation of the indirect experience of nature into a building’s interior is Commerzbank in Frankfurt, Germany, which was designed by the firm Norman Foster and Associates (Illustration 30). An especially innovative organic design feature of this modern office building is its five “winter gardens,” which are located every thirteenth floor and span three stories each within the sixty-five-story structure. These gardens are essentially interior parks that consist of plants linked to various geographic areas representing differing compass directions. The gardens have also been connected to the building’s natural ventilation and lighting objectives and have reportedly helped to improve its energy performance.

The gardens allow employees to have an unusual indirect experience of nature within a tall, vertical structure—an important, innovative accomplishment because nearly all human contact with the natural environment takes place on the horizontal plane at ground level. The multiple three-story gardens dramatically alter this dynamic and have purportedly improved employee morale and productivity in the process. The gardens also diminish the typical hierarchical, status-differentiating effects of tall office towers, promoting instead a more
Illustration 31. (top and bottom) Natural Materials, Shapes, and Forms: These interior and exterior designs reflect the powerful effects achieved by using natural materials as well as mimicking and simulating natural shapes and forms.
Illustration 32. Prospect and Refuge. Views to a distant scene through an arch can provide a satisfying experience of refuge and prospect, as this Yale University scene demonstrates.

egalitarian contact among people, which more often characterizes parklike settings. However, Commerzbank’s organic design features do not extend much beyond the gardens and the commanding views offered by the largely glass facade. Its modernist style and reliance on nonnative vegetation tenuously connects the structure to the surrounding area’s culture and ecology. Although an impressive, ground-breaking accomplishment, Commerzbank still fails to meet the ideal of restorative environmental design.

Designing the indirect experience of nature often involves manipulating natural materials. The human affinity for natural materials is so deeply ingrained that artificial substitutes (e.g., imitation plastic)—no matter how striking the replication—often does not elicit much pleasure. Artificial materials typically seem fake; lacking strong evocative power, they rarely capture the subtle qualities of, for example, the grain of wood, the weathering of stone, or the sensory experience of once-living materials (such as the smell of leather or the feel of silk). It is difficult to imitate natural materials effectively because of their complexity: dynamic natural forms must adapt to myriad environmental influences over time in the struggle to survive, cope, and evolve. Natural materials communicate a logic that few imitations can replicate, despite human cleverness, ingenuity, and technology (Illustration 31).

The indirect experience of nature often reflects a response as much to a natural process as to a specific substance or organism. Some buildings, landscapes, and furnishings influence
us deeply because they reveal the effects of weathering and historic transition, possessing what might be called the "patina of time." This evidence of aging can be seen in old walls, moss-covered roofs, or corroded stone, all of which reveal the dynamic forces of time. Certain materials—stone, wood, tile, stucco—appeal to us because they reveal the texturing of shape and forms in response to aging and adaptation and sometimes even have other life forms attached, such as mosses, lichens, and vines.

What factors create a satisfying indirect experience of nature in buildings and forms? Drawing on the work of geographer Jay Appleton, Grant Hildebrand has emphasized the effects of six paired elements that reflect the inherent human affinity for nature often encountered in highly evocative building and landscape designs. Hildebrand labels these complementary properties prospect and refuge, enticement and peril, and order and complexity. Prospect reflects the discernment of distant objects, a human tendency that has contributed evolutionarily to our ability to locate food, water, safety, and security. Prospect allows us to detect far-off movements, perceive distant objects and resources, and spy potential threats. In buildings and landscapes, it is often afforded through outstanding views, feelings of

Illustration 33. The ordered complexity of Mont St. Michel entices the visitor to explore and discover, while its perilous site implies uncertainty, risk, and thrill.
spaciousness, and light and brightness. *Refuge,* by contrast, reflects the complementary human desire for shelter and protection. Building and landscape designs that foster a sense of safety, comfort, warmth, and intimacy through the use of comfortable interior rooms, a fireplace, or a secluded garden often achieve a sense of refuge. As Hildebrand describes: "Refuge is spatial circumspection, darkness, and limited view; prospect is spatial openness, brightness, and extended view" (Illustration 32).\(^{18}\)

*Enticement,* the first property of the second pairing, reflects the desire to explore, discover, and expand one's knowledge, a characteristic that has proven crucial to human adaptation and development. Buildings and landscapes can enhance our exploratory drive by providing opportunities for exercising imagination and creativity—for example, in response to natural detail and diversity that stimulate inquisitiveness, immersion, and interpretation. *Peril,* on the other hand, reflects the desire for mystery, challenge, and even risk that simultaneously attracts and repels. This effect can be achieved, for example, through the use of overhanging balconies, elevated passageways, obscured pathways, or heights that excite, challenge, and thrill as well as unsettle us. These design features encourage exploration and discovery but are often accompanied by the inclination to proceed with prudence and caution (Illustration 33).

In the final pairing, *complexity* reflects the human desire for detail, variety, and mystery, which throughout human evolution has enabled us to make difficult choices and to secure resources in response to the natural world (Illustration 34). *Order* is an equally basic inclination that reflects the desire for pattern, structure, and organization. Successful building and landscape designs frequently contain complexity and order in dynamic relation to each other, whereas designs that emphasize only one property often frustrate and disappoint. For example, complex designs that lack order frequently foster confusion, while exceedingly orderly designs that lack complexity can produce boredom. Hildebrand describes the value of this complementary relation: "Order and complexity are ... necessary allies. Order without complexity is monotony, and is felt to be that in the deadly repetition of much speculative American [tract] housing of the late 1940's. ... Complexity without order, however, is not more satisfying. Scenes ... difficult to organize and interpret [are] not only rated low in preference; they [are] actually resented. The ... American commercial strip is an example."\(^{19}\)

The work of psychologists Rachel and Stephen Kaplan, which also draws on Jay Appleton's insights, also considers how building and landscape designs can incorporate the indirect experience of nature.\(^{20}\) Kaplan and Kaplan use the terms *coherence, complexity, legibility,* and *mystery* to explain this design tendency. They suggest that people are attracted to buildings and landscapes that are rich in environmental complexity and mystery and that
Illustration 34. Order and Complexity: Widespread complexity characterizes this building's varied shapes and planes, yet the building is pleasing overall because its many naturalistic elements remain ordered.
offer frequent opportunities to wonder, imagine, explore, and discover. At the same time, they emphasize that successful designs frequently incorporate elements of coherence and legibility that avoid confusion and a feeling of chaos while also fostering a sense of orderliness and meaning.

Indirectly incorporating nature into building and landscape designs frequently results in satisfying and successful constructions. Some of the most sought after and costly structures possess many indirect elements of nature, as revealed by research conducted by psychologist Judith Heerwagen and ecologist Gordon Orians. They report, for example, a decided preference (among randomly selected subjects) for building and landscape features that include distant vistas of nature, abundant opportunities for refuge and shelter, and facilitated movement and way finding. These and other design attributes that reflect the human affinity for nature are frequently preferred because they stimulate imagination and problem solving within safe environments, a condition instrumental for human evolution and development.

Symbolic Experience of Nature

The experience of nature in the built environment often occurs symbolically or vicariously, particularly within building interiors and facades. Building and landscape designs that involve contact with nature are frequently revealed through representation, allusion, and metaphorical expression. Moreover, such experience occurs far more often than generally recognized and significantly affects people's responses to and satisfaction derived from the built environment. Nature is represented symbolically through various guises—including decoration, ornamentation, pictorial expression, and shapes and forms that simulate and mimic nature—and in a wide diversity of building features—such as walls, doors, entryways, columns, trim, casements, fireplaces, furnishings, carpets, fabrics, art, and sometimes even an entire facade (Illustration 35).

The vicarious experience of nature in the built environment is revealed in obvious ways but often in highly subtle, obscure forms that may be difficult to recognize as reflections of the natural world. One example is an auditorium in my workplace. The room includes many simulations of nature in its floral-, leaf-, and fern-like patterns woven into the brick, wood, and ironwork and liberally employs natural materials, such as wood and stone. It also features sinuous organic curves that, on closer inspection, mimic shapes commonly encountered in nature—for example, in its arched ceiling, in the decorative ribs supporting the ceiling's vertical columns, and in the ordered complexity of the decorative brickwork and large spatial volumes of the high triangular room. Despite the room's practical inadequacies and lack of modern efficiencies, it is
Illustration 36. (above and opposite) Naturalistic Symbols: Naturalistic symbols occur widely in the built environment, as revealed in the floral patterns, animal figures, and organic shapes of these building facades.
Illustration 37. Botanical Columns: Column capitals are often crowned with the shapes of plants, animals, and organic forms as depicted in John Ruskin’s classic examination of Gothic architecture.

highly revered, especially among alumni who have become alarmed by the prospect of losing the room as the school prepares to build new facilities. Building designs that successfully draw on the human affinity for nature, even when indirectly and vicariously experienced, often exert a powerful hold on human emotion and imagination.

Many symbolic representations of nature in the built environment can be easily discerned. Such features include floral patterns in material adorning couches, carpets, curtains, and fabrics; animal figures carved into walls and mantels; organic forms etched along doorways and eaves; fern- and shell-like shapes carved atop capitals and columns; naturalistic designs woven into grills, walls, and fences; honeycomb- and egg-like forms embedded into arches, domes, and ceilings; environmental scenes painted in glass and carved into stone; and, on occasion, even the sound of water emanating from a fountain or the distant fragrance wafting from flowering
shrubs (Illustration 36). These symbolic designs of nature occur throughout human history and across all cultures, though perhaps less so in modern, urban society. The ubiquity of these environmental simulations reflects a universal yearning often incorporated into building interiors and sometimes into exterior landscapes. In his classic work *The Grammar of Ornament*, Owen Jones describes a universal tendency for ornamentation that not only employs nature as model but, “whenever any style of ornament commands universal admiration, . . . will always be found to be in accordance with the laws which regulate the distribution of form in nature.”

Architectural historian George Hersey has also described the symbolic representation of nature in buildings and landscapes. He identifies an extraordinary diversity of these representations in the built environment, including shapes and patterns drawing on nearly all life forms, including cellular and microscopic organisms; invertebrate taxa, such as mollusks and insects; vegetation, such as ferns, flowers, and trees as well as their leaves; vertebrate creatures, including fish and fowl and, to a lesser extent, mammals; and even elements of human anatomy, not unusually the simulation or actual representation of reproductive organs. The extraordinarily widespread prevalence of these naturalistic representations prompted Hersey to suggest the following in the single case of plants:

One cannot hope to discuss the architectural use of plant ornament in a single chapter or even a single book. It is universal. . . . For example, among flowers and leaves, spiral phyllotaxis appears in the form of overlapping rows that radiate from a center to an outer rim. These and other comparable
Illustration 39. Gothic Architecture: Gothic architecture often includes organic forms that simulate the natural environment. Cesar Pelli’s Ronald Reagan Airport, which is a reinterpretation of gothic architecture, simulates a forest canopy with its soaring vaulted roof.

arrangements show up over and over again in architectural ornament... Probably the commonest botanical specimens in all of Western buildings are Corinthian capitals [see Illustration 37].

The symbolic representation of natural forms and processes is often experienced intuitively—at times even unconsciously—in building design. For example, Yale University’s hockey rink resembles an organic form, prompting many students to call it “the pregnant whale” (Illustration 38). Yet, from above, it more closely resembles the shape of a fern. Examining the motives of the rink’s famous architect, Eero Saarinen, George Hersey suggests that Saarinen probably did
not copy the shape of either a fern or a whale but, rather, that he unconsciously drew on instinctual affinities for organic forms. Hersey writes: "Saarinen was not . . . watching his fingers put forth leaves. [But,] with pencil and paper he was . . . mimicking structures found in nonhuman nature."24 This intuitive tendency can be found in other well-known Saarinen designs, such as the striking birdlike form of the former Trans World Airlines terminal at New York’s Kennedy Airport, which may help to explain the airport’s notable appeal.

Nineteenth-century critic and designer John Ruskin praised the symbolic representation of nature in architecture, especially those found in Gothic design.25 He commended the extraordinary range of simulated natural representations that occur in Gothic architecture's arches, columns, window ways, entry portals, doors, roofs, vaults, domes, ceilings, and facades. These designs reveal columns rising fanlike and sculpted, calling to mind ancient forests; elaborate capitals with an astonishing array of floral, leaf, and fernlike patterns; and an explosion of simulated organic forms drawing on qualities of light and shape mirroring the natural world (Illustration 39). As Ruskin describes:

In that careful distinction of species, and richness of delicate and undisturbed organization, which characterize the Gothic design, there is the history of . . . thoughtful life, influenced by habitual tenderness, and devoted to subtle inquiry; and every discriminating and delicate touch of the chisel, as it rounds the petals or guides the branch, is a prophecy of the development of the entire body of the natural sciences. . . . Whatever is in architecture fair or beautiful is imitated from natural forms . . . a sympathy in the forms of noble building with what is most sublime in nature.26

These varied Gothic depictions of nature can be found in churches, cathedrals, palaces, and civic buildings throughout the world (Illustration 40). Kent Bloomer, a noted authority on the theory and practice of ornamentation, observes how often ornamentation in buildings reflects natural forms and functions and related cycles of environmental growth. He argues that much Gothic and other building ornamentation is a metaphorical language of conversation between the organic and inorganic, where through symbol and design nature is reclaimed in human artifice and fabrication. Bloomer comments on Ruskin's praise of the organic in Gothic architecture as follows:

Ruskin’s theories about the beauty, power, and distribution of ornaments were . . . rooted in the conviction that manifestations of nature revealed a sacred order capable of providing the most significant principles of architectural design. . . . Ruskin formulated principles of design that incorporated sculptural ornaments representing foliage [and other organic elements]. . . . An
Illustration 40. Yale University’s Harkness tower in New Haven, Connecticut, designed by James Gamble Rogers, is an exceptionally beautiful illustration of the many organic qualities of Gothic architecture.
Symbolic depictions of nature in building and landscape design are often disguised. Metaphorical representations of the natural world rely as much on instinctual affinities as on explicit depictions of environmental forms (Illustration 41). These architectural elements evoke sentiments that tap into our inherent responses to the patterns, movements, light, shape, and space encountered in nature. People prefer the textures, curvilinear forms, rounded and spherical surfaces, movements, and plasticity typically encountered in nature to the rigid, straight-line, abstract, and contrived geometries of artificially fabricated and designed forms and materials. Even the arresting effect of a constructed human artifact like a city skyline often owes its appeal to the varied, vertical shapes reminiscent of a complex forest as to any particular engineering marvel or technology. This effect is especially noticeable when the skyline is seen in juxtaposition to a prominent natural feature viewed from afar, such as a river or a mountain. Perhaps this helps to partially explain the pronounced effect of New York City’s skyline as viewed against the Hudson or East River, and why—in addition to the horrific human tragedy of September 11, 2001—we lament the destruction of the lower Manhattan profile, particularly how the World Trade towers rose like gigantic living forms out of an organic-like skyline despite their having been little more than simple rectangular boxes (Illustration 42).

Similarly, on closer inspection, the irresistible qualities of such revered structures as Notre Dame Cathedral, the Taj Mahal, and New York City’s Grand Central Station often reveal powerful organic qualities of light, color, material, texture, shape, and form that have been symbolically borrowed from the natural world. Inspired by nature, they grip the human imagination, communicating a subtle connection to the natural environment, even when the origin of our feelings remains obscure. Take Grand Central Station, for example (Illustration 43). A detailed examination reveals extensive natural materials of stone and marble; organic shapes carved into its elaborate metal work; a spaciousness in its central vault reminiscent of the outside world; sunlight descending from large rectangular windows; and even the simulation of an evening sky replete with constellations in an overarching ceiling.

Like other aspects of experience rooted in human genetics, these symbolic forms elusively reflect our affinity for nature. We take them for granted, often recognizing and appreciating their virtues when they are threatened or have been destroyed. This symbolic expression is an important aspect of the “pattern language” of timeless, celebrated creation that is described by architect Christopher Alexander in his seminal work on the subject.28 Grant Hildebrand has
Illustration 41. (above and opposite) Metaphorical Representations of Nature: An affinity for nature in buildings often appears in disguised, or metaphorical, form. Both of these buildings draw on instinctual affinities for the natural world revealed in arches, pediments, tree-like shapes, and other naturalistic forms.

also explored how often building features symbolically evoke the human affinity for nature. Citing a single cathedral nave, he writes: “Complex natural surroundings . . . rich in quantity and variety of resources . . . Each new image presents novel elements and relationships that also develop from and relate to what we have already seen; seemingly repeated elements and seemingly repeated intervals whose multitudinous minor variations make each iteration as different from any other, and as alike, as individuals of the same species.”

As Hildebrand intimates, many successful building designs evince an “organized variability” that is often encountered in nature. A basic architectural feature or decorative pattern mimicking some natural feature is initially established and then replicated in varied, albeit predictable, ways. When isolated or repeated exactly, these patterns often strike us as boring or monotonous, but when revealed in slightly altered and patterned ways, they frequently seem to constitute wholes that appear coherent, organized, and attractive. Many successful building designs reveal such compositions of varied connection and relationship. When this occurs in a dynamic, integrated fashion, the complexity rarely repels; rather, its aesthetic appeal rises from a combination of replication and variation experienced in an orderly, predictable pattern. This tendency in nature and in human design has been referred to as “biomimicry,” also the title of a seminal book by Janine Benyus. As Judith Heerwagen writes:
Illustration 42. Top: The lower Manhattan skyline seen across the Hudson River suggests the vertical heterogeneity of an old-growth forest. Bottom: The destruction of the World Trade towers greatly diminished this effect, even though the towers were little more than rectangular boxes.
Illustration 43. New York City's Grand Central Station achieves its biophilic effect as a result of not only its spacious inner vault but also its subtle naturalistic elements, including the widespread use of natural materials and the organic shapes of its many features.

"Many of the world's most revered buildings contain biomimetic features. . . . They draw on design principles of natural forms. They have intricate fractal patterns in their spatial layouts and surface materials. They contain small, random variations in key elements rather than making exact replicates of forms, visual patterns, and spaces."30

Symbolically incorporating the shapes and forms of nature into the design of the built environment has also been called "biomorphic" architecture. Philosopher Yannick Joye defines biomorphic architecture as "designs whose shapes are similar to the formal grammar of living things." Examples of biomorphic architecture include both "stylized imitations" of living organisms (e.g., plants and animals) and more subtle simulations that reflect the "structural properties" encountered in the natural world (e.g., the replicated patterns and shapes of shells and leaves). Biomorphic design has been linked to the inherent human affinity for natural forms that—when successfully expressed—can enhance human physical and mental well-being.31

Architectural design that contains symbols of nature can often produce highly appealing and powerfully experienced places, drawing strength from an instinctual human emotional and intellectual proclivity for the natural world. Consider my recent encounter in the
boardroom of a powerful institution. The room possessed an aura of power. When I looked about for the source of this effect, I noted high ceilings etched in floral relief and decorated moldings and pillars carved in fern- and leaf-like patterns. Looking down, I viewed a floor glowing with burnished wood, on which lay “oriental” rugs festooned with floral designs. Leather chairs circled the enormous burled wood table, floral patterns decorated the fabrics of the perimeter couches and hanging curtains, and an iron chandelier with curving branch-like arms hung from the ceiling. Natural light bathed the room, issuing from its oversized windows. I looked out one of the windows and saw a pleasing view of trees and shrubs, although another, far less satisfying window confronted only hard, artificial surfaces. This experience is only one example among many of how often we infuse the organic into interior and exterior settings to produce places of special power and meaning.

To be successful, symbolizing nature must avoid being merely decorative. It must also be integral to the building’s design, woven into its context and structure, seamlessly moving from the human to the natural and back to the human again. We require far more understanding before being able to fully comprehend the complexities of symbolic design. However, we can conclude by returning to the nine values of biophilia discussed earlier, noting how often effective organic design gives rise to and affirms these values, underscoring the appropriateness of the designation “biophilic building design.”

Building and landscape design often reflects the utilitarian value of nature through material and physical security achieved by manipulating the experience of air, water, and other natural resources. This can occur in conventionally constructed buildings that protect people from the heat and cold of the external environment, or through more innovative technologies, such as wastewater treatment systems that use natural processes to purify wastes and sometimes even cultivate foods. However, a utilitarian value of nature in the built environment must be balanced, neither so excessive that it cuts off people from nature nor so weak that we feel vulnerable and unprotected. Pursuing a utilitarian value of nature also should not diminish or suppress other equally important biophilic values.

Negativistic and dominionistic values of nature in the built environment also emphasize the provision of shelter and protection from the elements, including wind, water, and geological forces. However, if expressed too excessively, these designs can dysfunctionally separate people from the natural environment, yielding structures that isolate us from nature’s emotional richness and intellectual stimulation. Effective buildings and landscape designs must also foster the feelings of awe and wonder associated with perilous features of the natural world. Aesthetic, humanistic, and symbolic values of nature designed into the built environment can create beauty
and a sense of connection as well as stimulate our interest, curiosity, and creativity. The incorporation of naturalistic, scientific, and moralistic values of nature into building and landscape design also fosters a sense of exploration, discovery, and inspiration. Some of our most cherished structures extol the human craving for an enduring and meaningful creation. By transforming the rigid geometry of material form into something seemingly timeless, we can achieve a sense of harmony and of participating in a larger and related world.

Vernacular Design
A critical aspect of restorative environmental design is buildings and constructed landscapes that connect to the places where they occur. This is referred to as vernacular design, defined in this book as the tailoring of the built environment to the particular physical and cultural places where people live and work. This meaning reflects the ordinary dictionary definition of the term vernacular as "native to . . . a particular country or region, . . . endemic, . . . relating to or characteristic of the style of architecture and decoration common in a particular region, culture, or period." This definition underscores how vernacular design connects people and nature to a particular cultural and ecological setting.

As we have described, low environmental impact and organic design are essential elements of sustainability requiring considerable knowledge, ingenuity, and investments of energy, time, and technology to achieve. Yet, without vernacular connections to the culture and ecology of place, buildings and constructed landscapes are rarely sustained over the long term. Without a deep commitment and feeling of stewardship toward the places where the constructions occur, we generally do not devote the necessary physical, emotional, and intellectual resources needed to sustain these architectural accomplishments over time.

As described in chapter two, successful vernacular design evokes what both landscape architect Frederick Law Olmsted and Nobel Prize–winning biologist René Dubos called the "spirit of place." When people are familiar with and meaningfully connected to the social traditions and natural settings of the places where they live, they become attached to that place’s characteristic customs, traditions, and buildings and landscapes. The term spirit suggests that when this relationship among culture, environment, and architecture is pronounced, these places become alive for us, a part of our collective consciousness and identity. Building and landscape designs that affirm the spirit of a place reinforce our commitment to and stewardship for these places.

Effective vernacular design is the fusion of culture and ecology within a particular biogeographical context. This accomplishment reflects the accumulated wisdom of a people and environment in adaptive relation to each other. Successful vernacular creation mirrors the
iterative evolution of people in response to both natural and social forces. When this vernacular has been expressed effectively, both culture and nature become modified and even enriched by the exchange. Four critical elements of vernacular design can be identified, each of which is described in the following sections. These elements include the need to design

- In relation to the ecology of a place
- In relation to the cultural and social traditions of a place
- In manner that fuses culture and ecology, thus creating an emergent property within a biogeographical and historical context
- In ways that avoid “placelessness,” in which a distinctive culture and ecology become so subverted that an area loses its special identity and spirit of place

*Designing in Relation to the Ecology of Place*

Effective vernacular design involves buildings and landscapes that are compatible with the ecology of their place at the site, ecosystem, and watershed levels. Achieving this compatibility requires knowledge of and sensitivity to various biophysical characteristics, including hydrology, soil, flora, fauna, atmosphere, and landscape features (e.g., wetlands and other distinctive ecosystems). Pioneering landscape architect Ian McHarg\(^{36}\) used the phrase “designing with nature” to describe the appropriate matching of design and development with the physical, biological, and ecological properties of a geographic area, most particularly to its watersheds marking the interface of terrestrial and aquatic systems.

Designing with nature requires knowledge of physical parameters—such as water quantity and flow, surface and subsurface geology, and soil and aquatic chemistry—as well as an understanding of a broad matrix of biological variables—such as species composition, abundance, distribution, population dynamics, food and energy chains, prey-predator relations, and rare and imperiled, indigenous and nonindigenous, and keystone and ecologically important species. Vernacular design further requires knowledge of the ecological context of constructed buildings and landscapes, particularly ecosystem functions, structure, and dynamics. Comprehensive biophysical assessments and inventories ranging from the immediate building site to associated landscapes and watersheds must be conducted to obtain this information.

Following the principles of landscape ecology can help generate such knowledge and understanding across spatial and temporal levels. It can further help maintain and restore the functional integrity of affected ecosystems by identifying ways to minimize disruption and fragmentation of landscapes and watersheds through sensitive design and development. This
can mean preventing the loss of or restoring ecologically important plant and animal species, maintaining critical hydrological and soil features, or sustaining biophysical factors and processes essential to maintaining ecological functions and systems. Landscape ecologists Wenche Dramstad and Richard Forman and landscape architect James Olson have developed useful design guidelines for sustaining ecological integrity. They urge avoidance of the following adverse ecological landscape-level effects of building design and development:

- "Fragmentation" (or breaking up) of large intact habitats into smaller dispersed patches
- "Dissection" (or splitting) of intact habitats into two or more patches
- "Perforation" (or creating "holes") within essentially intact habitats
- "Shrinkage" (or significantly decreasing the size) of one or more habitats
- "Attrition" (or fostering the disappearance) of one or more habitats

Avoiding these disruptive ecological impacts can maintain landscape integrity and functioning by minimizing degradation and disruption to the land, water, and biota so characteristic of much contemporary construction and development. The authors suggest that a basic objective of landscape design is "reducing the landscape fragmentation and degradation so evident around us." This requires land use and construction practices that avoid and minimize the disruption of essential nutrient, energy, and material flows of local habitats and ecosystems. Effective vernacular design must incorporate a view of the landscape as an integrated entity involving characteristic ecosystem patterns and processes that need to be sustained. The overall objective is to achieve "solutions . . . at the landscape level . . . that work with the larger pattern, understanding how it works, and designing in harmony with the structure of the natural system." Such solutions require the protection of important landscape features, including the following:

- Ecological "patches" containing important habitats, species sites, and ecosystems
- Edges, boundaries, or shapes within and among ecological patches that maintain and foster ecological richness and productivity
- Connections, corridors, and linkages between patches and habitats (e.g., riparian corridors) that facilitate the movement of energies, nutrients, and biotic elements across landscapes

Effective vernacular design should also strive to restore and even enrich ecological functioning and productivity. People can add to as well as degrade natural systems. Like other "keystone species"—for example, an elephant on the savanna, an alligator in a water hole,
a polyp on a coral reef, or a sea otter in a kelp bed—people alter the structure, diversity, and productivity of their natural systems. And, like these other keystone species, humans can diminish and potentially add value to their ecological systems. People are not some kind of "weed" species that inevitably degrades or destroys the health of the natural environment. Effective vernacular design suggests that people can instead help maintain, restore, and even enrich the productivity and vitality of their associated ecosystems.

Designing in Relation to Culture and History

Effective vernacular design requires consideration of the cultural and historical character of the places where buildings and other constructions occur. A rich literature exists on the cultural attributes of place (some briefly reviewed here and earlier, in chapter two).\(^40\) The distinctive identity of a place is affirmed by designing in relation to a place's social and historical elements. Important features include regular, repeated events; familiar, valued surroundings; characteristic artifacts and designs; distinctive narrative and storytelling traditions; predictable customs and norms; and a feeling of community and shared relationship. Landscape historian John Brinckerhoff Jackson identified these cultural and historical attributes of place when he wrote: "Qualities I associate with a sense of place: a lively awareness of familiar surroundings, a ritual repetition, a sense of fellowship based on shared experience. It is the result of habit or custom reinforced by what might be called a sense of recurring events."\(^41\)

These cultural and historical features foster an emotional and intellectual attachment to places. Buildings and landscapes that emerge as sites of loyalty and commitment reflect these qualities. These constructions reinforce people's sense of connection and relation to an area. The term roots aptly reflects this degree of psychological and biological association. The phrase deep roots intimates a condition of continuity and stability that describes an established historic and ecological relationship to land and place. The significance of having roots, especially its impact on human well-being, is often underestimated. As writer Simone Weil suggests:

To be rooted is perhaps the most important and least recognized need of the human soul. It is one of the hardest to define. A human being has roots by virtue of his real, active, and natural participation in the life of the community, which preserves in living shape certain particular expectations of the future. This participation is a natural one in the sense that it is automatically brought about by place, conditions of birth, profession and social surroundings. Every human being needs to have multiple roots. It is necessary for him to draw well-nigh the whole of his moral, intellectual, and spiritual life by way of the environment of which he forms a part.\(^42\)
The spirit of a place is a cultural and historical as much as a physical and biological condition. Reinforced by vernacular designs that encourage tradition and shared relationship, it reflects an attachment to an area, a feeling of belonging to both the culture and the land. The spirit of a place is revealed through a locality's distinctive buildings and landscapes—for example, the colonial architecture of New England, the adobe building style of the Middle East and the American Southwest, the white stone structures of the Mediterranean, the thatch roofs of the South Pacific, and more. These distinctive styles sustain an area's identity and become synonymous with its people, a vital thread affirming a characteristic and cherished way of life.

Building and landscape designs infused with the spirit of a place resonate with cultural meaning. They are experienced as positively charged "emotional spaces." More than inanimate wood, stone, glass, brick, or mortar, these structures become life-like placeholders of a distinctive personality and important symbols of a region's identity. They constitute, in effect, carriers of psychological significance that embody an area's singular and even spiritual character. As architect Tom Bender suggests: "A building, like a person, can have a soul ... and can be part of the life of a community. It can be rooted in and convey the spirit of a strong culture and tradition. It can help restore to our surroundings a sense of sacredness and honoring of people, place, and diverse traditions. A building can demonstrate patterns which are sustainable and nurturing of the human spirit and of all life."43

**Designing in Relation to Culture and Ecology**

When reinforced through effective vernacular design, the spirit of a place is neither a cultural nor an ecological phenomenon but rather the integration and creative fusion of the two. The health and integrity of natural systems in human-dominated landscapes depend on positive connections between culture and nature. Likewise, an enduring culture requires a compatible combination of nature and human society. Nature and culture each become transformed through a process of mutual adjustment, with their successful integration resulting in what philosopher Mark Sagoff describes as harmonious places. Sagoff writes: "The concept of place combines the meaning we associate with nature and the utility we associate with environment. The result is an idea of surroundings that arise from harmony, partnership, and intimacy."44

The characteristic vernacular of a place is never the influence of culture or nature by itself but rather the effective combination of the two. This convergence of physical and human forces produces a distinctive vernacular tradition native to an area. This ongoing dialogue and exchange between the human and nonhuman builds an attachment to place. In time, this tradition becomes a source of meaning for its inhabitants, who defend and perpetuate place
identity with loving allegiance. They become stewards of the land and of its culture revealed in characteristic buildings and landscapes. This congruence creates a distinctive and often healthier culture and ecology. Its successful result is what René Dubos called the “genius” of a place. He writes: “The genius of the place is made up of the physical, biological, social, and historical forces which together give its uniqueness to each locality or region. [People] always add something to nature, and thereby transform it, but [their] interventions are successful only to the extent that [they] respect the genius of the place.”

Vernacular design, thus, reflects an emergent state in which people are neither biologically determined nor culturally constructed creatures. Instead, human identity and design are the outgrowth of both learning and genetics. For this exchange to be successful, however, the interaction must occur within familiar, secure territorial boundaries. Effective vernacular design facilitates this subtle process of interaction, adaptation, and exchange of culture and nature within the context of a particular locality.

Unfortunately, most contemporary building design and construction ignores this interdependency of culture, nature, and place. Instead, many modern structures are the consequence of rapid large-scale development, resulting in the maladaptive transformation of both the natural and the cultural environment. Much contemporary architecture ignores the adaptive melding of culture and nature that characterizes good vernacular design, seeking instead to impose an abstract ideology and technology that typically results in the wholesale alteration of the human and natural landscape. Effective vernacular design can be achieved in a modern context of large-scale and short-term construction, but it requires sensitivity, knowledge, and forethought that meaningfully seeks to connect existing social conditions to the health and integrity of local ecological systems.

Designing to Avoid Placelessness

Unfortunately, contemporary architecture and land use practices often debase both culture and ecology and erode existing vernacular traditions. This phenomenon, sometimes referred to as placelessness, diminishes distinctive local and regional identities, often replacing them with uniformity and anonymity. Geographer Edward Relph describes placelessness in this way:

If places are indeed a fundamental aspect of existence in the world, if they are sources of security and identity for individuals and for groups, then it is important that the means of experiencing, creating, and maintaining significant places are not lost. There are signs that these very means are disappearing and that “placelessness”—the weakening of distinct and diverse expe-
riences and identities of places—is now a dominant force. Such a trend marks a major shift in the geographical bases of existence from a deep association with places to rootlessness.46

Various contemporary trends have loosened people's sense of connection, affiliation, and attachment to the places where they work and reside. These trends include declining neighborhoods and communities, rapid social and geographic mobility, urban and suburban sprawl, loss of open space and environmental degradation, and an increasingly global and psychologically disconnected economy. The result has been a physical and mental separation of people from nature and culture. Mark Sagoff describes this phenomenon as one of "becoming strangers in our own land." As he suggests:

Much of what we deplore about the human subversion of nature—and fear about the destruction of the environment—has to do with the loss of places we keep in shared memory and cherish with instinctive and collective loyalty. It has to do with the loss of... security when one relies upon the characteristic aspects of places and communities one knows well. What may worry us most is the prospect of becoming strangers in our own land.47

A sense of placelessness is often linked to large-scale development, short-term construction, and massive earth-transforming technology—practices that often reflect an indifference, if not disdain, for distinctive vernacular conditions. Such an approach to designing the built environment ignores the virtue of compatible connections among culture, nature, and history. Office towers, shopping malls, and housing developments are instead designed in abstract, universal ways that are disconnected from both local culture and ecology. These constructions strike us as anonymous and interchangeable, whether they occur in New York, Los Angeles, Brussels, Beijing, Buenos Aires, or Timbuktu. Rather than bearers of a distinctive regional or cultural identity, they resemble nightmares of anonymity that would more appropriately be labeled generic than contemporary architecture (Illustration 44). This design paradigm is formal and aloof, favoring the interests of professionals over the predilections of people residing within cherished cultural and ecological contexts.

Much contemporary architecture exists apart from history and environment. These constructions are ephemeral, tied to the latest aesthetic fad or cutting-edge technology, often abandoned when their modernist fashions become boring or obsolete. These buildings celebrate placelessness and typically do not foster loyalty among most people nor the commitment to renew and restore them over time. Ironically, the transience of
Illustration 44. (above and opposite) Nightmares of Anonymity: Modern office towers, public housing projects, shopping malls, and residential developments frequently use architectural styles distinguished by their oppressive monotony.
this type of design contrasts with its oft-touted economic and technical efficiencies. Even when this kind of design seeks to include vernacular elements, the attempt is often superficial, a kind of "commodified nostalgia" that mocks established and revered traditions.

Still, how important are these considerations of vernacular design? Is vernacular design an important aspect of restorative environmental design or just a romantic yearning for the past and a mainly negative response to the environmental and social excesses of much contemporary design? If contemporary architecture were to minimize its adverse impacts and foster a more positive connection between people and nature, would the deficiencies of vernacular design become marginal and even trivial? I think not. Sustainability is the commitment to retain, renew, and restore buildings and landscapes over time. Eliciting the motivation and resources necessary to maintain the built environment depends on people making cultural and ecological connections with the places where they live and work.

Restorative environmental design embraces more than building and developing new structures, no matter how environmentally benign or positively connected to the natural environment they are. Vernacular design reflects the additional ingredient of people living in knowing and respectful relation to their historical and ecological context who strive to preserve and protect the architectural and environmental integrity of their places. Lacking this familiarity and connection, people act carelessly toward both culture and nature, tending to look to consuming something new to satisfy their endless cravings in a continual process of excess and wastefulness. Loyalty and commitment to place remain the cornerstone of stewardship.

Low environmental impact and organic designs are necessary but not sufficient conditions for achieving restorative environmental design. Without a goodness of fit between culture, history, and ecology, design and development are inevitably transient and unsustainable. People who are deeply committed to their places and surroundings tend to be intolerant of activities that inflict damage on either the natural or built environments and take steps to counteract this harm. They exercise, as poet Gary Snyder suggests, a sense of "stewardship [that] means . . . find your place on the planet, dig in and take responsibility." Vernacular design reflects the commitment to restore and renew a three-century-old building, once a butcher shop and today a computer store. Architectural forms recycled generation after generation are as much a part of sustainability as investing in the latest waste minimization technology or energy efficient system.

A narrow, shortsighted calculus has convinced many architects, developers, designers, planners, and politicians that they can ill afford the luxury of preserving the human and natural envi-
Environments or meaningfully connecting constructions to the culture and ecology of place. This attitude is a prescription for failure. Communities and leaders paralyzed by the challenge of vernacular design perversely impede their regions' health and prosperity over time.

Conclusion
This chapter has proposed a concept of restorative environmental design that seeks to harmonize the natural and human built environments through implementing the three principles of low environmental impact, organic, and vernacular design. Not coincidentally, these three design objectives reflect the three concepts described in chapter two—ecosystem services, biophilia, and spirit of place—to explain how the human experience of natural systems nurtures and enhances people's physical and mental well-being. Figure 11 suggests that maintaining ecosystem services gives rise to the principle of low environmental impact design; that the maturation and development of biophilic values leads to the objective of organic design; and that engendering a spirit of place fosters the goal of vernacular design.

Restorative environmental design seeks to repair the relationship between nature and humanity in a world increasingly marred by environmental impoverishment and social and psychological alienation. Neither easy nor painless, this achievement will require considerable knowledge, motivation, and skill. Low environmental impact design has moved promisingly toward this goal. However, by becoming the dominant orientation of contemporary sustainable design, this approach by itself cannot restore our frayed relationship with the natural world. If left to function alone, it will yield structures that over time are often perceived as sterile, unappealing, and unworthy of preservation and protection. We will also need designs that foster a positive experiential connection to the natural world and affirm our enduring desire to connect with the culture and ecology of our places.

A personal anecdote may illustrate this difference. A few years ago, I visited several sustainably designed constructions located in the northwestern section of industrial Germany. One complex had incorporated the latest low environmental impact technology and was widely praised for its presumed contribution to the area's economic and social revitalization. The engineering was impressive, but the overall effect was disjointed and unsatisfying. Despite considerable achievements in energy efficiency, the use of less noxious materials, and reduced wastes, the complex felt aloof and alienating. Even its atrium, which incorporated water and vegetative features into the building, seemed more decorative than satisfying.
In a nearby city, I encountered a very different project. This effort also included many low environmental impact design features, such as energy efficiency and less toxic products and materials. But, in addition, it elicited a positive affinity and connection to the natural environment and local culture. Interior spaces featured natural lighting and natural ventilation, the informed use of native vegetation, mediated connections between the inside and outside, and furnishings and decorative features that fostered both indirect and symbolic contact with nature. The surrounding landscape included a constructed lake and restored wetlands linked to the building’s stormwater and irrigation systems that also provided aesthetic and naturalistic benefits for the employees and neighbors. The complex connected well to the local community because it was built in compatible relation to the cultural, historical, and ecological character of the region and nearby river.

At the risk of sounding naive, most intractable problems can be solved, as others have stressed before me, with an attitude of love or, in this case, “LOVE”—Low impact, Organic, Vernacular Environmental design. This acronym reminds us that the literal Latin translation of *biophilia* is “love of life.” The values of biophilia, like the principles of restorative environmental design, require that we seek to harmonize nature with humanity if we are to achieve a just, secure, sustainable, fulfilling, and loving future.

The principles of LOVE call for a new way of thinking about building and landscape design, one that will require an altered design process that includes, at the least,

- Considering all biophilic values in building, landscape, and land use design and development
- Linking all material and resource flows that connect buildings and landscapes to larger biogeographical scales over time
• Incorporating diverse disciplinary understandings in the planning and design of the built environment, especially environmental, architectural, and engineering perspectives
• Connecting the constructed environment to diverse land use, transportation, and open space patterns and processes
• Ensuring long-term planning and analysis prior to development and then mandating measurable performance standards that account for environmental and human impacts of these designs
• Increasing people’s awareness, appreciation, and understanding of the benefits of restorative environmental design
• Enhancing the capacity of buildings and landscapes to adapt to new knowledge and technologies of restorative environmental design over time\[49\]

These elements represent some of the basic procedural changes that achieving the promise of restorative environmental design will require. Clearly, the principles of LOVE and of a new ethic of sustainability will be needed to successfully resolve the modern environmental crisis. Chapter six explores the character of this ethical challenge.