1 LANDSCAPE SUSTAINABILITY FRAMEWORK AND CRITERIA

Always design a thing by considering it in its largest context, a chair in a room, a room in a house, a house in an environment, an environment in a city plan.

—Eero Saarinen

Achieving sustainable environmental design encompasses myriad efforts on the part of both professionals and the public. These efforts—grassroots awareness campaigns that challenge individual citizens to come together to champion good planning for their communities, the realignment of our regulatory structures to facilitate and encourage healthy patterns, the retooling and retraining of our construction and materials industry, and the development of planning and design methods that inform and guide professionals' design processes and ultimately the built environment—are all essential to reversing the destructive patterns of sprawl and the subsequent loss of nature and community that permeate contemporary development of our environment. The complexities and interrelationships of these needed efforts are daunting, yet nearly every person, organization, and profession has a role to play and perspective to contribute.

LANDSCAPE + DESIGN + SUSTAINABILITY

The relationship between and intersection of these three concepts—*landscape, design,* and *sustainability*—form the basis for this book and define the role of the profession of landscape architecture. *Landscape*, referred to by Frederick Steiner as the connective "tissue" of our world, is the medium that hosts, links, and conveys the vast complex of ecological and cultural systems in an intricate fabric of landform and habitats. Though it can be divided into many types of units, it does not and cannot exist independent of its larger whole. Through *design*, humans plan their technological interventions and express creative urges to satisfy individual and societal needs. When deployed in the landscape, design takes on the dynamism of a living, fluid, and changing medium, where decisions made at a site scale have direct impact on and connection to larger scales and vice-versa. Finally, the urgent call for *sustainability* of human development of the environment requires that we begin to recognize the critical role landscape and its design—landscape architecture—must play in uniting fragmented places, healing degraded systems, and engaging

people in healthy relationships with nature. From this perspective, land is a continuum of cultural and ecological influences and responses, where a site boundary acts as a filter rather than a wall, and design holds the potential to draw and propel positive influences to and from the site.

EVOLUTION

Sustainability in landscape architecture until recently was viewed as a specialized branch of the field, heavily associated with ecological design. However, the synthesis of the cultural and ecological qualities of landscape architectural design reflected in contemporary built work blurs the once sharp line between ecological design and culturally resonant "high design."

Several critical benchmarks in landscape architectural theory and practice have contributed to current views about sustainability within the profession (Ndubisi 1997). These benchmarks can be considered within three significant "generations": the first generation occurring roughly between 1960 and 1975 and sparking a general awakening and shift in design approach toward ecological awareness; the second generation occurring between 1975 and 1995 and developing more scientific and specialized areas of interest; and the third/current generation from 1995 to present, which can be characterized as moving toward integration of sustainability within the more generalized practice of landscape architecture.

First Generation: 1960–1975

Systems-Based Model for Landscape Planning. Alongside public outcries critical of the status quo such as Rachel Carson's *Silent Spring* and the founding of environmental movements such as Greenpeace, Ian McHarg's landscape planning techniques in his book *Design with Nature* in 1969 represents the first explicit and systematic consideration of natural and cultural resources in landscape architecture (McHarg 1995). His "layer-cake" approach to determining land use suitability remains the gold standard for design methodology across all disciplines dealing with land use analysis and planning and set the stage for later technological development of Geographic Information Systems. McHarg's work and that of his contemporaries and colleagues, most notably Philip Lewis, focused on large-scale planning projects such as The Woodlands residential community in Texas. These concepts and methods were also applied to site-scale design in determining both the suitable uses for a site, as well as how it might be designed to fit within its surroundings.

Second Generation: 1975–1995

This period is benchmarked by several divergent outgrowths of land planning models developed in the earlier generation.

Regenerative Design. The work of John Lyle, practitioner and professor at California Polytechnic State University at Pomona, developed the concept of regenerative design focused on site-scale subjects. Regenerative design is the idea that development does not just consume resources, but also can regenerate or produce them. Examples of regeneration are recharging groundwater, reusing graywater, producing edible crops in the landscape, or harvesting solar energy (Lyle 1992). The Center for Regenerative Studies at California Polytechnic State University is a living laboratory for these concepts.

Ecological Design Firms. Meanwhile, ecological design firms such as Andropogon Associates in Philadelphia and Jones & Jones in Seattle, both early proponents of landscape sustainability, developed systems-based and context sensitive ecological approaches evident in landmark designs such as the Crosby Arboretum and Paris Pike.

Reclaiming Landscapes. Also during this period, a bold social approach to reclaiming abandoned human landscapes can be identified through projects such as Lawrence Halprin's Freeway Park, which reconnected the divided pieces of Seattle; Richard Haag's Gasworks Park, which reclaimed the waterfront site of a former gas utility for recreation; and later Hargreaves Associates' Byxbee Park, a former industrial site along the San Francisco Bay.

Regional Identity. A focus on regional identity, both cultural and ecological, is part of this generation's contribution. The insight of Michael Hough in his book *Out of Place* (1992) and regionally inspired built work by practitioners such as Phoenix-based Steve Martino embody the value of distinctive regional context in creating landscapes that are "of the place."

Schism between "High Design" and Ecological Design. Along with the more specialized identity of ecological design within the larger profession of landscape architecture, a growing dialogue and debate about the role of creative form-making in sustainable design was forming. There was a strong impression that the profession was still rewarding design work that did not give adequate consideration to ecological function or health, while there was also a common observation that many of the ecologically conceived projects lacked inspiring or memorable form. This debate was crystallized in a 1992 forum featured as a cover story by *Landscape Architecture Magazine* entitled "Is it Sustainable? Is it Art?"

Third Generation: 1995–Present

The Metrics Approach. The current generation of sustainability in landscape architecture is characterized first by a growing interest in the metrics for ecological function and economics in the built environment. The Leadership in Energy and Environmental Design (LEED) Green Building Rating System, developed by the United States Green Building Council, provides a detailed checklist for incorporating a range of ecologically based sustainable design principles into architectural development projects. Site-related components are not a central focus of the system.

Construction-Based Sustainability. The *Sustainable Landscape Construction* book produced by William Thompson and Kim Sorvig in 2000 provides important site-based technical focus for sustainable design implementation. Advances in native plant production and construction technologies have bolstered the ability to implement site elements that were once not possible within conventional construction practices. In a similar vein, the concept of *low-impact design* calls for recharge, filtration, and other on-site treatment methods for stormwater engineering in a time when water resource conservation has become a focus.

Applied Ecological Principles. Articulation of applied ecological principles at the landscape scale has been a critical contribution of Dramstad, Olson, and Forman as developed in their 1996 book, *Landscape Ecology Principles in Landscape Architecture and Land-Use Planning.* The ecological structure and functioning of land in corridors, patches, mosaics, and matrices provide a new language for land-use planning that protect ecological integrity and connectivity.

Ecorevelatory Design. Eco-revelatory design is intended to reveal and interpret ecological phenomena, processes, and relationships (Brown, Harkness, Johnston 1998). This concept has brought exciting synergy of visual drama/appeal and ecological process of such phenomena as stormwater conveyance and reuse that has fueled a new brand of innovative form-making.

Mainstreaming of Sustainability. A particularly prominent aspect of the current generation is that sustainability is moving away from being viewed as a specialized type of landscape architectural practice, focused exclusively on ecological concerns, toward a more mainstream concern for all landscape architecture projects. The concerns of "high design" that emphasize rigorous attention to form-making are being merged with the concerns for ecological integrity.

The Next Generation

As nearly all of the influences just outlined begin to converge, built work is exhibiting a critical synthesis of ecological, social, and cultural landscape considerations. As the "green revolution" takes hold in the global environment, a chief concern for the future of sustainable site development is the need to integrate larger planning efforts to combat sprawl, conserve ecologically intact open space, and create more livable communities with the more specif-

ic and detailed design of sustainable sites. The projects reviewed for this exemplify the benefits of such integration. Future approaches must utilize context-informed site design to address the broader range of criteria included in planning-scale projects.

CONTEXT

The information age has brought a dizzying and seductive amount of unfiltered data to our fingertips. Often it is tempting to simply tune out context, as it provides too much information and can derail the process of defining a problem and taking action. Yet, the tremendous efforts we mount to make objects and technologies sustainable and "green" must all be viewed within the appropriate context. The energy efficiency of using corn as a biofuel, for instance, has been rejected, viewed within the context of how much energy it takes to produce the corn. Similarly, a central problem with sustainable site design is one of contextual scale and integration, where piecemeal solutions negate possibilities for larger cohesive ecological and social function and identity. Simply put, individual green buildings or sites do not necessarily add up to green neighborhoods, communities, or regions:

> Not that all our earnest recycling, our water-scrimping showers, our labors to cool the planet are futile, but our larger lapses raise the fundamental question of where and how—and whether—we should be building anew. …The vision of a sustainable planet begins with the individual but requires planning on a large scale—not just locally, but regionally, nationally and internationally—to endure. It becomes increasingly clear that only if we encourage and participate in land planning on a larger and political scale can we consider ourselves builders of a truly sustainable world and not just hammer-wielders building little green islands in a sea of subdivided land.
>
> —Jane Holtz Kaye 2002

The U.S. Green Building Council has recognized this need for larger-scale planning through its LEED ND (Neighborhood Development) program, which is aimed at neighborhood-level planning to provide better control and coordination of larger systems of transportation, building massing, and other elements. This is on the heels of its widely followed and highly influential program for sustainable building construction, in recognition of the growing concern for the larger community context.

Yet this is not a book about land use or community planning per se. While professional planning activities address important analysis, strategy, and policy direction, they rarely result in direct built work. Rather, this effort is aimed at approaching the basic building block of development: the site, that singular piece of the larger land complex, whether it contains a building or exists primarily as a landscape—with an eye toward regional context, applying planning principles to site design. Sites that are conceived with an overview of the larger, hierarchical systems of the environment, both ecological and cultural, stand a much better chance at protecting and enriching—sustaining—the site environment and its inhabitants. Further, sites that design experiences, elements, and visual character that help site users "read the texts of their surroundings" go beyond physical resource conservation achievement to create meaning based on understanding of our relationships and interactions with our environments (Steiner 2002). Designing with context in mind holds potential not only for the sustainability of the site itself, but also for the greater sustainability of the neighborhood, area, or region.

Now more than ever, information without clear and appropriate frameworks for selection and application can be counterproductive and even damaging. The framework presented here retains focus on site design, but aims to strengthen or repair connections to context that are lost or unrealized through piecemeal site planning. Further, it aims to utilize sensitive and artful site design to reveal and express regional values and identity.

This framework offers a way to consider and integrate information about context—in the form of physical constructs such as watersheds and neighborhoods, and in the form of nonphysical constructs such as local history and community attitudes—in the process of site design. It identifies two basic contextual situations for a sustainable site design problem: pioneer and integrator.

Sustainable Pioneer

Where the project's region is generally more challenged in ecological and/or cultural terms, the site can be considered a *sustainable pioneer*. Three of the case studies presented later in the text, a corporate headquarters in McLean, Virginia, a private residence in Phoenix, Arizona, and an industrial development in Milwaukee, Wisconsin, fit this description. The design for a sustainable pioneer site can introduce sustainable form, function, and philosophy to a larger area that lacks integrated cultural and ecological health. The term *pioneer* connotes the idea that these projects are trailblazers, leading a trend that will grow and transform the larger environment. The sustainable pioneer site can impart its trailblazing effect in a variety of ways. It can revitalize lost or broken networks of cultural or ecological function between the site and its surroundings, or reintroduce forgotten heritage or invisible bioregional character of the area. Nevertheless, it can also create self-reliance and wholeness for the site independent of its surroundings. In other words, it may have an important catalyzing effect on the surrounding lands or it may simply be one small island of sustainability unto itself, which when repeated across the region will create the transformation.

Sustainable Integrator

A *sustainable integrator* is a site whose design can reflect the health and stability of its sustainable context. Three of the case studies presented later in the text, an urban park in Portland, Oregon, a water purification facility in Hamden, Connecticut, and a park visitor center in Sandstone, West Virginia, fit this description. The success of each can be said to be linked to the intact political, cultural, and ecological character of its region. These projects answer the question: How do we build upon the success of the surroundings? Integration or connectivity of ecological and human systems is recognized as one of the key criteria for sustainability in this framework. There are two kinds of contextual connectivity addressed here: *physical* and *symbolic*. Physical connectivity, such as improvement of a portion of a stream buffer along a larger system, improves regional ecological health. Symbolic connections, such as use of repurposed local materials, provide a vehicle for human engagement critical to sustainable site making. The sustainable integrator project can knit together discontinuous intact systems and typically improves upon the site's predesign value and health.

CRITERIA

Existing frameworks for creating and evaluating sustainable design fall primarily into two categories: those that offer qualitative, theoretical, or values-based criteria; and those that prescribe specific quantitative or standards-based criteria (Edwards 2005). While many of the former tend to be highly influential and formative, the most actively utilized and applied systems tend to be the latter, where focused, tangible, and measureable directives and benefits are identified. The widely followed LEED program, mentioned earlier, for instance, is a point system for design and certification of high-performance green buildings. This program considers the embodied energy of materials and systems used in the building process and the operation of a building and its site. The benefits of certification, in addition to the energy savings and other environmental resource gains, include long-term economic benefit and the cachet of social consciousness that accompanies the attainment of silver, gold, or platinum certification levels. It rates sustainability in the areas of sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor air quality, innovation and design process. A similar program for the measured evaluation and recognition of designed landscapes has been introduced with the Sustainable Sites Initiative, a joint effort of the American Society of Landscape Architects, the Ladybird Johnson Wildflower Center, and the United States Botanic Garden. The areas of focus for this program are hydrology, soils, vegetation, materials, and human health and well-being.

An essential characteristic of these types of frameworks—and what makes them so eminently attractive and useful—is that they can be applied to nearly any project, regardless of site or its place within the urban to rural transect of the developable environment. Another key characteristic is that they retain clear focus on measureable technical and scientific criteria, leaving artistic, cultural, and social criteria cleanly out of the mix for the most part.

Alternatively, the framework presented here is centered on crafting sustainable landscapes based largely on a site's relationship to its unique natural and cultural context. This context may be rural or urban, Northeastern or Southwestern, environmentally or economically stable or distressed—all these and many other contextual conditions create distinct opportunities and challenges for sustainable design. Context relevant to site design occurs at a range of strategic scales that begins at the regional level—the Central Plains/Midwest region for instance—and proceeds through state, watershed, local, and neighborhood levels, right down to the site-adjacency context where a site's physical relationship to its neighbors is direct and tangible. In some contexts, native plant communities may be a particularly relevant factor; in other contexts, patterns of historic development and land use may be a more relevant factor. While these aspects cannot be easily measured, they do offer specific opportunities and needs for sustainability.

The aesthetics of sustainability in the landscape have long been a point for debate, some arguing that attention to visual quality has been sacrificed by the concern for sustainability, others pushing for new conceptions of beauty and imageability to embrace the "messiness" of nature. To this end, the framework also develops qualitative criteria that address questions of form-making and meaning related to sustainability and context.

With the ultimate goal to derive sustainable site *design process* guidelines, what follows here is a baseline establishment of *criteria* for sustainable landscapes. These criteria serve both to further define a sustainable landscape framework in which site and regional concerns are integrated and to provide the basic parameters used for the selection of the case studies, which illustrate the qualitative outcomes. The criteria draw from many wide-ranging and foundational developments in thinking about land, landscape, planning, design and case study research, and place these within five major themes for implementing and evaluating landscape sustainability. The five landscape sustainability criteria: connectivity, meaning, purpose, efficiency, and stewardship, each in their own way forge a relationship between a site and its context.

Comparative Criteria for Sustainable Landscape Design

The following provides brief comparative outlines for several frameworks that exist for sustainable design.

Qualitative Frameworks:

Andropogon Associates' Ecological Site Design Guidelines

- Create a participatory design process
- Preserve and re-establish landscape patterns
- Reinforce the natural infrastructure
- Conserve resources
- Make a habit of restoration
- Evaluate solutions in terms of their larger context
- Create model solutions based on natural processes
- Foster biodiversity
- Retrofit derelict lands
- Integrate historic preservation and ecological management
- Develop a monitored landscape management program
- Promote an ecological aesthetic

Sanborn Principles—Urban Design Foundations for Sustainable Communities

- Healthy indoor environment for occupants
- Ecologically healthy
- Socially just
- Culturally creative
- Beautiful
- Physically and economically accessible
- Evolutionary

Values of Place—Essence of Timeless Design, Human-Centered Building, and Personal Responsibility

- Diversity
- Beauty and aesthetics
- Accidental meeting places
- Surprise and discovery
- Resource efficiency
- Leaving your mark
- Human form emerging naturally from its place

Principles of Smart Growth—www.smartgrowth.org

- Range of housing opportunities
- Walkable neighborhoods
- Community and stakeholder collaboration
- Distinctive attractive communities with sense of place
- Development decisions are predictable, fair, and cost-effective
- Mix land uses
- Preserve open space in critical areas
- Variety of transportation
- Place new development where existing infrastructure/development occurs
- Compact building design

Sustainable Landscape Construction Principles—Thompson and Sorvig

- Keep healthy sites healthy
- Heal injured sites
- Favor living, flexible materials
- Respect the waters of life
- Consider the fate and origin of materials
- Know the costs of energy over time
- Celebrate light, respect darkness
- Quietly defend silence
- Maintain to sustain

Quantitative Frameworks:

LEED—New Construction v2.2

- Sustainable Sites
- Water Efficiency
- Energy and Atmosphere
- Materials and Resources
- Indoor Air Quality
- Innovation and Design Process

LEED-Neighborhood Development—Pilot Program

- Smart Location and Linkage
- Neighborhood Pattern and Design
- Green Construction and Technology
- Innovation and Design Process

Sustainable Sites Initiative

- Water Waste
- Water Pollution
- Biodiversity and Invasive Species
- Resource Waste
- Energy
- Soil
- Air

Connectivity

Sustainable landscape solutions must evidence:

- site to context connections
- cultural systems and natural systems connections
- temporal connections that recognize the life of landscapes over time

We live in an era and culture where phenomena like fractal geometry and Google Earth have begun to give us new views of how things are interconnected and in many cases, how these connections have become compromised or destroyed. Fractals, a term coined in the 1980s by mathematician Benoit Mandelbrot, are objects with geometric structure that display self-similarity at various scales. Magnifying a fractal structure reveals small-scale details similar to the large-scale characteristics. Although fractals have similar patterns at a variety of magnified scales, the smaller-scale details are not *identical* to the whole. In fact, its structure is infinitely complex, though the process of generating it is based on an extremely simple equation. The phenomenon of similarity at various scales provides a window on the order, structure, and organization of complexity. With a visual appeal that comes from its balance of complexity and unity, the concept of fractals has been applied and examined in the creation of fine art and other fields in which geometry is relevant.

Fractal patterns are found across vast scales everywhere in nature in small objects such as snowflakes and ferns, as well as large landscapes such as coastlines and mountain ranges. Ian McHarg, in *Design with Nature,* first directed environmental designers to notice these patterns and build with environmental fitness in mind, so that these patterns could be preserved and woven throughout the built environment. The book *A Pattern Language,* written by architect Christopher Alexander in the 1970s, applies the idea of observing and linking successful or proven human patterns at different scales to the built environment. From regions, communities, neighborhoods, and sites, down to buildings, rooms, and windows, *A Pattern Language* proposes a hierarchical, structured way of designing. Whereas McHarg developed a systems-based methodology that responds to each design subject's unique qualities and circumstances, Alexander's methodology uses more of a "recipe" approach with a list of somewhat idiosyncratic patterns that can be applied to any problem and location.

Technological advances in digital geographic information systems and satellite imagery allow us to instantaneously zoom from viewing the entire earth from outer space to our own backyard or latest project site. A vast array of geographic systems information floats out in cyber space, and though there are widely varying scales of accuracy and precision, designing with spatial context in mind has never been more possible.

Site to Context Connections

The most tangible work of landscape architecture—the creation of places of meaning, visual delight, and spatial identity—occurs at the site scale at which human perception operates. But we can look to critical contributions of landscape architecture that occur at larger scales of planning like the neighborhood or community, which, though less tangible and visually iconic than site-scale design outcomes, are equally compelling and arguably more valuable. Much of the most important 19th-century work of landscape architect Frederick Law Olmsted—the "Emerald Necklace" of the Boston Parks system, the Stanford campus, Chicago's Columbian Exposition—occurred at the larger planning level, where study and understanding of the neighborhood, the community, and the region allowed for sensitive siting and land use relationships. These same planning examples, with their far-reaching impacts on whole communities, however, also come with familiar sites that have imageable, physical qualities. The Backbay Fens, Commonwealth Avenue Parkway, and the Public Garden are memorable landscapes precisely because they fit within and enhance their urban context and larger open space framework. The linking of larger community planning concepts and knowledge of site context with more immediate site planning and design concepts provides powerful results on many levels.

The *new urbanism* movement is an example of society's growing recognition of the need to think outside the building and think outside the site, to address the needs of sustainable smart growth. With its combination of principles that emphasize pedestrian connectivity, mixed land uses,

compact development that allows for open space preservation, well-defined districts, and the importance of the civic realm, new urbanism calls for a return to the patterns of traditional town planning and a rejection of the patterns of unplanned sprawl that dominated the second half of the 20th century. More importantly, it places the design of sites and architecture within a very contextual realm—each piece of the community is dependent on its neighborhood, district, and community structure. Many of the concepts of new urbanism can be traced back to the ideas of Kevin Lynch and his theory of good city form. In *Image of the City*, Lynch defines the memorable elements of the city as related to him by everyday citizens—landmark, district, node, path, edge. These are connective elements and structures that organize urban environments and make them legible, interesting, diverse, and whole.

In creating site-to-context connections, we can think about *functional* physical connections such as circulation corridors, vegetation patches, or hydrological features, which encourage the larger flow and health of the landscape. We can also think about *spatial* connections such as how a site may be configured as an open or a wooded site to either link with or contrast against its surroundings. Another way to think about site-to-context connections is in *program development*, where the type of park you might wish to develop is highly dependent on the surrounding land uses and the variety of other parks that are available in the local area. Finally, we can use *formal* connections to context to create unity and meaning related to regional vernacular materials and architecture and natural forms.

Natural and Cultural Systems Connections

An end to thinking of natural and cultural landscapes as occurring in two separate realms was suggested by McHarg and elaborated on by Anne Whiston Spirn in *The Granite Garden*. The growing trend toward renewal of natural process in urban environments through stream daylighting and dechannelization, urban forestry, green roofs, and permeable paving is proof that integration of natural process in human development is not only possible, but needed and desired.

The scientific concept of ecology has, until very recently, been studied primarily within the realm of the natural world and has not been applied to the physical development, or design, of the human world. While the notion of "human ecology" was explored as a branch of sociology and geography in the early 20th century, it became disconnected from the physical world to focus on more economic, demographic, and political approaches. Frederick Steiner proposes a new interpretation of human ecology, which denies this historic disconnection and encourages more integration of physical and social science. Ecologist Richard Forman and his colleagues broke this barrier in their development of landscape ecology principles that were specifically developed for use in landscape architecture and land use planning. Steiner, a landscape architect, proposes that the critical issues of sustainability and sustainable development require that we more actively and aggressively engage these principles in applying the concepts of ecology to the planning and design of built human environments (Steiner 2002). The integration of human and natural forms and functions—as in regenerative human ecosystems such as wetlands stormwater treatment systems—is a critical expression of connectivity.

Temporal Connections

The concept of historic preservation originated through the effort to preserve historic buildings and other antiquities. Buildings are nearly completely human constructs; they can be enormously imposing and influential, but can easily and instantaneously be demolished. They represent very particular eras of human culture, evoking powerful form associated with history and a society's collective memory. Alternatively landscapes endure and evolve over millennia, but are in many ways ephemeral and transformable. The image of cultural history reflected in landscape can be subtle and vulnerable, especially when intermixed with that landscape's natural history. The landscape acts as a canvas over which cultures and ecological forces play out; seasonally, yearly, in eras and epochs. The concept of historic preservation has evolved to encourage a less static, more layered notion of history, in which ruins and artifacts of older ideas can comfortably and functionally coexist with new uses, forms, and ideas. Scholars of

the cultural landscape, including most notably May Watts, J. B. Jackson, Kevin Lynch, Roderick Nash, and William Cronon, have examined the American landscape for its imprint of our history and changing cultural constructs. Designers such as Richard Haag, in his 1970s Gasworks Park, were among the first to apply a new, more layered and living historic sensibility to the design of open space sites.

Meaning

Sustainable site design solutions must evidence:

- a well-defined sense of place
- engagement of site users with landscape process and phenomena

In the study of the social scientific concept of hermeneutics, which is "the art of understanding," philosopher Wilhelm Dilthey proposed the notion of the *hermeneutic circle*: "In order to understand the determinate meanings of the parts of any whole, we must approach the parts with a prior sense of the meaning of the whole; yet we can know the meaning of the whole only by knowing the meanings of its constituent parts. This is not a vicious circle, in that we can achieve a valid interpretation by a mutually qualifying interplay between our evolving sense of the whole and our retrospective understanding of its component parts." (Abrams 2005)

The hermeneutic circle of emotional, intellectual, and conceptual meaning and identity in the landscape is an important component of sustainable design within the In Site/Out framework, and a concern that is relatively absent in most other frameworks. While many indigenous landscapes hold specific meaning for people in their natural form, created landscapes can utilize creative expression that interprets and reveals human ecological and cultural interactions with the landscape, and conveys an attitude for protection of and integration with intact indigenous landscapes. The conveyance and understanding of site meaning associated with sustainable processes and phenomena can create affinity for landscapes that inspire stewardship for the site itself and greater understanding of its place in the larger environment. Yi Fu Tuan's study of environmental perception of the landscape created the term *topophilia:* "the affective bond between people and place or setting," to describe this force of environmental experience.

The creation of meaning in the landscape can take the form of the gestalt—through the creation of a holistic sense of place. It can also take the form of smaller elements within the site that provide momentary engagements of the site user with specific processes or phenomena, such as a boardwalk that brings the user through a restored wetlands, or a bench placed at a point that focuses the user on a distant view of landform.

Sense of Place

Genius loci, latin for the "spirit of place," is a concept that has been linked to landscape and place-making ever since 18th century poet Alexander Pope wrote his *Epistle IV*:

> Consult the genius of the place in all;
> That tells the waters to rise, or fall;
> Or helps th' ambitious hill the heav'ns to scale,
> Or scoops in circling theatres the vale;
> Calls in the country, catches opening glades,
> Joins willing woods, and varies shades from shades,
> Now breaks, or now directs, th' intending lines;
> Paints as you plant, and, as you work, designs.

Since that time it has developed as one of the most widely agreed principles of landscape architecture: that landscape design should be inspired by and seek to preserve and enhance the unique character, function, and history of a site within its context. The creation of meaningful and memorable landscapes—landscapes that sustain us physically and mentally—is nearly always derived from a careful analysis and expression of the spirit of the place.

Reflection of and respect for regional culture and ecology is one of the most powerful forms of deriving meaning and sense of place. Michael Hough in *Out of Place* advocated for a regional sensibility in the development of landscapes at a time when the homogenization of our built environment was beginning to be recognized. The unique built patterns and forms of an area which have evolved in answer to its particular geographic and historic context comprise the communal identity that sets one region apart from another—such as the southwestern United States with its arid cli-

mate and mid-20th century era of development as compared with the northeastern United States with its temperate climate and mid-18th century base of development.

Recognizing a site's place within the urban/rural transect is a critical aspect of creating appropriate patterns of density and character in the built environment. The concept of transecting was first developed as a methodology for documenting and understanding the physical world, where a line was drawn across a landscape and sampling of biological or geophysical phenomenon performed to draw conclusions about the larger landscape's pattern and character. Applied to human development and environmental planning, the concept has been used to combat the indiscriminant application of the sprawling pattern and character of suburban development to nearly all new development, regardless of context. This has begun to bolster both compact and dense development in more urban areas, as well as clustered and open space conservation-minded development in more rural areas.

Process and Phenomena Engagement

Joan Woodward, in *Waterstained Landscapes,* offers a compelling and poetic call to integrate bioregional character, form, and function in the design of sites. The concept of "waterstain" is explained as the regional patterns of contrasting conditions—wet spots in a dry landscape for instance—that create the figure (or matrix) as perceived against the ground (or patches) in a landscape. While suggesting an ecological imperative, she emphasizes the spiritual and aesthetic urge for identity and meaning that can be satisfied with landscapes that reflect the combined imprint of natural systems and cultural systems. In answer to our vast and growing collection of generic and overly standardized places which James Kunstler skewers in *The Geography of Nowhere,* Woodward chronicles her ficticious character's quest to know and understand the "waterstain" of her arid Colorado Front Range region and apply this knowledge to the design of her home landscape. This requires looking beyond the heavily irrigated urbanized regions into the larger regional scales of the landscape.

The concept of eco-revelatory design was articulated and explored in the 1998 traveling exhibition of work mounted by three colleagues from the University of Illinois at Urbana-Champaign. The concept centers on the design of landscapes to reveal and interpret ecological phenomena, processes, and relationships (Brown, Harkness, Johnston 1998). The exhibit included both real and visionary projects from a variety of academic and private practitioners that innovatively expose, juxtapose, or narrate ecological processes from regenerative fire, to stormwater conveyance and reuse, to urban soils regeneration. This concept is in part a reaction to a conventional treatment of landscape to hide or disguise "unsightly" processes such as piped stormwater, and in part a reaction to the standard practice of costly and artificial suppression and control of ecological landscape process, as with monocultural landscapes of lawn and heavily pruned shrubs.

These themes were sounded earlier through the work of Robert Thayer, professor of landscape architecture at the University of California at Davis, who explored the challenges of sustainable landscape design in his 1994 book *Gray World, Green Heart*. Thayer posits that in contrast to mainstream landscape architecture of the time, which remained driven by cosmetic notions of aesthetic quality, design that fosters active and engaging user experience of regenerative processes, such as open stormwater conveyance, is a powerful tool for creating understanding, acceptance, and diffusion of sustainable practices. "One of the problems today is that the average citizen no longer realizes he or she is a part of nature. Landscape architects, more than almost any other profession, have the potential of reconnecting that citizen with nature by immersing him or her in an experience; by promoting, for example, urban forestry and allowing the land to breathe instead of imposing extensive paving . . ." This was the salient conclusion of architect Bob Berkebile on the proper role and greatest potential contributions of landscape architecture to sustainable development in a 1992 forum sponsored by *Landscape Architecture* magazine.

Purpose

Sustainable site design solutions:

- treat landscape as spatial and living medium
- fulfill land-based cultural and ecological program goals

The landscape is omnipresent and everywhere—often thought of as the ground upon which figure is set, or the blank canvas—and as such there is the tendency for it to be thought of and treated as background or negative space in development. Most environmental designers recognize the positive spatial, living, and dynamic qualities of landscape and the need to create hierarchy by assigning relative importance to some landscapes as primary spaces and allowing others to be treated as the connective tissue or interstitial spaces. Due to unawareness, this distinction often gets lost in translation to the built environment.

Landscape as Spatial and Living Medium

The treatment of landscape as background has a number of distinct unsustainable effects. First, it generally diminishes the care and attention given to land and its critical ecological and cultural systems which collectively form the basis for regional sustainability. The spatial qualities of landscape—the creation of enclosure, canopy, and a sense of scale and proportion, to name a few, through the configuration of landform and vegetation—can provide strong physical identity that generates focus on and value for the landscape, independent of understanding and meaning discussed above. This was the original impetus for the recognition of the value of the types of landscapes that now comprise our National Park system. While it is difficult for most people to relate the landscape of Yosemite to that of their own backyard or neighborhood park, the living and life-giving physical systems and their need for care are the same. In developed landscapes, the creation of positive, highly valued form and function is not dependent on its size or on the funds invested, but rather, the spatial treatment and organization of the elements used in the landscape.

A second unsustainable consequence of allowing the landscape to be treated as background is that it diminishes the understanding of the landscape as a living, dynamic, integrated organism. Segmenting the land into individually owned parcels, unrelated to landform patterns, creates a framework by which this understanding is thwarted and the site landscape is treated as independent of its neighbors, its larger functional identity and physical lifelines.

Land-Based Program Goals

Common land use designations assign purpose to land primarily through architectural identity: commercial, residential, or industrial, for instance. In this schema, the purpose and potential function of the landscape is reduced to supportive roles such as entry, parking, visual framing, etc. The sole category in which the landscape itself is the primary subject is typically "open space," which conveys a sort of blank quality and little sense of value or function. Within the realm of open space, landscapes are defined as park, preserve, greenway, green, etc.—also not very useful for directing program development. Sustainable landscape design is aided by the development of landscape-based programmatic function for all landscapes, whether open space sites or sites that accommodate development. People live in houses, shop in stores, and get medical treatment in hospitals. These are architectural program types that are based on how people use different types of buildings. In the landscape, we don't typically accommodate these specific types of cultural uses, but instead are concerned with satisfying a combination of cultural and ecological purposes. Cultural functions such as civic or social gathering and quiet contemplation are integrated with ecological functions such as stormwater management and landscape restoration. The notion of integrating concerns of context in sustainable site design supports the need for land-based programming as it expands the potential function of a site by connecting to its larger neighborhood or regional opportunities and goals.

Efficiency

Sustainable site design solutions:

- require relatively low resource inputs for implementation and maintenance
- create economic, human health, and social benefits
- satisfy multiple land uses

The relationship between conservation and efficiency was first explored during the progressive conservation movement of the early 20th century, at a time when the percep-

tion of unlimited resource abundance was beginning to fade, but rapid scientific progress instilled a sense of power to extend the resource base, using good economic and political planning and technology. The reclamation ideal whereby marginal lands were improved to become more useful, such as draining swamps and irrigating desserts, exemplified this interpretation of conservation as efficiency (Nash 1990). By the 1990s, the flaws in this exploitative approach had become evident to all but the most entrenched. Vice-president Al Gore, with his book *Earth in the Balance* and later film *An Inconvenient Truth*, brought unprecedented awareness of the natural resource and global warming crisis to a listening and sobered public.

Conservation of natural resources through the "reduce, reuse, and recycle" mantra was the original plea that led to our current green revolution. Most widely accepted contemporary criteria for sustainability are still centered on the concept of efficiency, primarily as pertains to use of energy, water, and other materials so as to maintain a dependable, renewable supply of these resources. But increasingly a more comprehensive view of conservation connects such efficiency to healthy systems—physical systems such as atmospheric and hydrological systems, agriculture and public health; as well as social systems such communities, economics, and education.

Low Inputs

The xeriscape movement, where drought-tolerant plantings are suggested as a replacement for irrigated landscapes in arid zones, is a landscape-based example of efficiency required as a result of expanding need for a limited resource. The *Sustainable Landscape Construction* handbook developed by William Thompson and Kim Sorvig was the first comprehensive landscape-focused set of guidelines that addressed efficiency in the developed landscape. With principles that encourage low-input landscapes through water, soil, and indigenous vegetation conservation; site protection and repair; impermeable surface reduction; light and noise pollution control; and recycled, renewable, and low-embodied-energy materials use, the strategies are primarily geared to design implementation- and construction-stage decisions rather than site planning and visual design decisions.

The treatment of water in the landscape is perhaps one of the most crucial and evolving forms of resource efficiency. While elaborate and costly stormwater systems aggressively remove water from conventionally designed and engineered sites, conversely, substantial energy is expended on introducing off-site water to sites to irrigate plant material. So a basic means of reducing water and energy inputs is through the creative harvesting of water from where it is not desired—on structures, pavements, and high-traffic areas—and applying it where it is desired—in vegetated areas and subsurface aquifers.

Self-Maintaining

Another important aspect of the efficiency criteria related to low inputs is the need for landscapes to be more self-maintaining. The postconstruction life of built landscapes, whether planned as such or not, typically ends up involving intensive and "one-size-fits-all" maintenance regimes. Endless mowing, irrigating, fertilizing, and replanting cycles are aimed at maintaining a cultural landscape ideal that is not in tune with natural cycles or patterns. While small, or even larger, areas of the landscape may be desired as lawn or more controlled or culturally expressive vegetation, these areas should be more targeted while larger areas of the landscape could be allowed to exist as naturalized areas that are established to eventually require little to no maintenance. Natural plant communities and landscape forms such as meadows, woodlands, and wetlands provide readily adaptable forms that can be meshed with larger landscape context or exist as isolated patches. While no managed landscape can truly be "maintenance free," these naturalized types of spaces offer reduced labor and cost, visual drama inspired by nature, and ecological biodiversity. In undeveloped nature, landscapes evolve and change completely in response to natural forces; it is important to distinguish between these and human naturalized landscapes that do involve some degree of control and management.

Economic, Health Benefits: Value-Added Landscapes

In *The Ecology of Commerce*, economist Paul Hawken likens the evolution of economic systems to that of ecological

systems. In immature ecosystems, such as an early successional grassland, there is lots of biomass production, little biodiversity, lots of energy expended, and rapid change. As the ecological system goes through successional change toward a more mature stage, it gains biodiversity and makes use of its biomass to become elegantly free of waste. Hawken likens this contrast to our economic system, which in its early stages did not assign the true costs of waste, inefficiency, and environmental degradation to the market, to encourage mass-production, mass-consumption, and massive waste and destruction. In what he hopes will be our more mature and wiser next stages, Hawken sees economics and development becoming much more aligned with environmental systems to make the reduction and elimination of waste, inefficiency, and environmental degradation profitable (Hawken 1994).

Many of the most basic sustainable landscape elements such as native plants and permeable paving were previously often deemed by project clients as too expensive to implement. This was largely a function of the major markets for plant materials, design and engineering expertise, and skilled construction labor being geared to provide exotic plant palettes and impermeable paving systems. As the extreme inefficiency and cost of building exotic landscapes that require constant infusions of water, fertilizer, and energy becomes increasingly economically unsustainable, and ideologically undesirable, new types of landscape treatments are fueling the rapid retooling and reeducation of our markets and workforce to provide relevant and responsive solutions.

As the economic, social, and health value of landscape becomes more highly documented and quantified—increased values for property located next to protected open space; energy savings, oxygen production, air pollution control, and water purification attributed to urban forests—it is increasingly viewed not as simply an amenity, but as critical infrastructure.

The United States is slowly beginning to connect modern childhood health epidemics such as obesity, allergies, depression, and attention deficit disorder with lifestyles that emphasize sedentary "virtual" activities such as computer use and television viewing, and living environments that offer little access to nature and unstructured play. The "No Child Left Inside" campaign of the Connecticut Department of Environmental Protection is an example of programs that are aimed at addressing what journalist and child advocate Richard Louv has termed "nature-deficit disorder":

> As open space shrinks across America, overuse increases. Meanwhile, the regulatory message is clear: islands of nature that are left by the graders are to be seen, not touched. . . . . The cumulative impact of overdevelopment, multiplying park rules, well-meaning (and usually necessary) environmental regulations, building regulations, community covenants, and fear of litigation sends a chilling message to our children that their free-range play is unwelcome, that organized sports on manicured playing fields is the only officially sanctioned form of outdoor recreation. . . . Countless communities have virtually outlawed unstructured outdoor play, often because of the threat of lawsuits, but also because of a growing obsession with order. . . . These dense donuts of [modern suburban] development offer fewer places for natural play than the earlier suburbs. In some cases, they offer even fewer natural play spaces than the centers of old industrial cities.

In nature-deficit disorder, Louv is talking about "nature" as ecologically functional and biodiverse landscapes in which there are few prescribed uses. He uses examples of both designed and naturally occurring landscapes that offer experiences to children that are open-ended, dynamic, and self-directed, thus stimulating creativity and curiosity, as well as physical challenge and activity—benefits that provide real answers to declining childhood health trends. This phenomenon can easily be extended to the adult population, also plagued by similar health problems. This is both a cultural and an environmental issue in which the landscape offers efficient alternatives to costly and controversial medical treatment.

The concept of "low-impact design" is aimed specifically at the design of stormwater management systems that encourage on-site treatment, thereby creating fewer potentials for negatively impacting downstream sites. Another less pejorative way of thinking about design is to think of the net positive effects that a "high impact" project might have—as in remediating a brownfield, creating improved air quality, or restoring a degraded habitat area.

Multi-Use Landscapes

Another aspect of efficiency is the maximization of landscapes by allowing them to serve multiple functions. Just as we are beginning to realize the efficiencies of mixed-use architecture to reduce travel needs, increase pedestrian-friendly environments, and create new synergies for communities and commerce, we can see the benefits of encouraging landscapes to satisfy more than one focused need. Infrastructure such as water treatment can be satisfied simultaneously with the needs of public open space and of environmental repair. The contemplative landscape of a residential site or a park can also provide biodiverse habitat for wildlife and new understanding of the function and beauty of the natural world. The prescriptive use and identity of landscapes for very specific functions—a detention pond, for instance—limits the possibilities for multiple functions that energy expended on such an element might produce. Detention ponds are typically formed and managed for one single purpose: to temporarily hold stormwater at the low point of the developed site and release it at a controlled rate to prevent flooding downstream. When such ponds are also formed and managed to provide visual beauty, wildlife habitat, or recreational functions this increases the efficiency of the resources being expended on the pond.

The green infrastructure movement is in part a reaction to growing awareness of the negative effects of creating single-purpose, highly technological utilities and infrastructure that are viewed as undesirable neighboring land uses, as described by the NIMBY ("not in my backyard") syndrome. Decreased property values and visual quality, and often dangerous or unhealthful conditions have been associated with highway systems, water treatment facilities, energy and communication grids, and other infrastructure facilities and systems. This is causing us to reconsider both the function and the form of these utilitarian land uses on which we all depend and which are omnipresent in the landscape. Rob Thayer's examination of the perceptual, functional, and symbolic dimensions of technology in the landscape suggests that technologies that are generally perceived to be sustainable (highly productive, renewable, environmentally benign, and safe), such as wind farms, have higher acceptance from the public. He posits that conventional infrastructure utilizes technologies and forms that are typically perceived of with fear or distaste and therefore is approached with disguising strategies in its site design (fencing, screening, hiding). Sustainable technologies, especially when integrated with open space, can be a wonderful neighboring land use to a variety of developed areas, including residential neighborhoods.

This approach extends to nearly all other land use relationships; directing program development and improving landscape character to benefit both the site client and neighboring sites makes for not only "good neighbors," but increased property values through improved neighborhood cohesiveness and identity.

Stewardship

Sustainable site design solutions:

- involve collaborative and participatory design processes
- evoke a sense of long-term responsibility of site users, constituents

One of the standard tag lines of the landscape architecture profession has been "stewardship of the land." Bob Scarfo chronicled the notion of land stewardship through the ages with his seminal article *Stewardship: The Profession's Grand Illusion,* and argued that the profession's claim on this title is generally unsupported by its body of work. As stewards in the more historical sense, subsistence farmers intimately knew their land and understood its limits and capabilities, facing severe and immediate consequences when they did not manage their land sustainably. As stewards who are many steps removed from direct contact with the land, landscape architects have not typically been trained nor do they have the incentive to create designs that are truly sustainable in this sense. In the global era in which we live, the polar forces of interconnectedness and specialization have created an environment for which no one takes specific responsibility and in which narrow dimensions of environmental problems are studied to the exclusion of integrated, holistic thinking.

At the root of the modern stewardship dilemma is the concept of environmental ethics. Aldo Leopold was among the first to articulate a new branch of ethics that would address the relationship of humans to the environment. At

this time, prior to the later revelations of Rachel Carson on the environmental and human health effects of industrial development, Leopold, a forestry scientist with the Soil Conservation Service, was alarmed by recreational exploitation of the natural environment. His concept of the "land ethic" would suggest the later movement of deep ecology in which nature holds intrinsic value of its own, apart from its value to humans. Scarfo and others have argued that ethical training for landscape architects has been focused on professional business ethics and not on the land ethic. Ecological thinking is being addressed in some cases, but less by way of ethics than through technical and scientific training. Of course, this issue only underscores the lack of a land ethic that is espoused by our general population. In an age where ethical lapses on the part of corporate and government leaders is at the fore, sustainability is less linked with a land ethic than it is with economic survival and national security.

In *Grey World, Green Heart* Thayer examines the "cognitive dissonance" that results when we are aware that something—such as landscapes that are dominated by the car culture—is bad for our health and the environment, yet that same something is permeating our world in a seemingly intractable cycle of continuation. The *ideal landscape* of our personal, controllable environments (which subtly accommodate our cars) is out of sync with the *real landscape* of the uncontrollable and chaotic wide world. Making sense of this dissonance and bringing the two landscapes into better balance requires a willingness to work toward and recognize the nature and value of incremental improvements in the larger landscape, as well as coming to terms with the real impacts of our personal ideals and lifestyles (Thayer 1994). Promoting public and professional adherence to a land ethic can be aided by the creation of places that reveal the connections between ideal and real landscapes.

Participatory Design

The need to effectively, appropriately, and meaningfully involve clients, users, and constituents in both developing the design goals and crafting a design solution for a site is a well-recognized component of sustainable design outcomes. Users who have been involved in the process can offer valuable first-hand knowledge of the design site and its history, as well as commitment to manage and care for the site into its future. Randy Hester in his book *Community Design Primer* distinguishes between community design—designing *with* people, and professional placemaking—designing *for* people. Originally associated with aiding underprivileged populations in overcoming environmental injustice and anomie through the empowerment of design decision-making, the community design movement has been widely applied to sustainable design efforts to create better ecological outcomes and public stewardship. The art of involving stakeholders in the design process is a delicate one, requiring a balance of the need for professional expertise with the sensibility and insight of the user. But it yields outcomes in which stakeholders are invested and which reflect the values and spirit of cooperation that make for sustainable sites.

Long-Term Care and Responsibility

In addition to stakeholder involvement during the design process, stewardship is derived from the involvement of stakeholders in the long-term management of the landscape site. This means both the physical maintenance of the site, as well as the general sense of ownership and responsibility for the site, that stems from the combined impact of clients, site neighbors, and maintenance providers. For many public landscapes the client may be the technical owner, but the neighbors who surround the site are the eyes and ears who watch over the site and inhabit it most directly, while the maintenance provider controls the actual care given to the landscape.

The care of sustainable sites typically involves unconventional and relatively new maintenance regimes that revolve around more naturalized types of landscape process. While this is greatly aided by the explicit specification of site management guidelines provided by the designer, adjustment and monitoring of the management regime as the landscape establishes, changes, and matures is critical.