SECOND EDITION

SITE ANALYSIS

A CONTEXTUAL APPROACH TO SUSTAINABLE LAND PLANNING AND SITE DESIGN

James A. LaGro Jr.

Site Analysis

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A Contextual Approach to Sustainable Land Planning and Site Design

Second Edition

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Preface

CONTEXT

A context-sensitive approach to sustainable planning and development helps to protect public health, safety, and welfare. By avoiding inherent site problems, or constraints, and by capitalizing on inherent site assets, or opportunities, site planners can limit long-term maintenance costs and, more important, reduce the risks to life and property from natural hazards. The careful analysis of sites—and the site's context—can lead to better development proposals and, ultimately, to higher-quality built environments.

Qualified site planners and designers are vital to this process. Proposals for carefully sited projects may receive faster approvals and permitting, improved marketability, and rent and sales premiums (Bookout, 1994). The emphasis of the second edition, like the first, is on the site planning process and the organization, analysis, and communication of information throughout this process. This second edition keeps the same structure and format as the first but delves into greater depth within each phase of the site planning process.

WHAT'S NEW

New content has been added to every chapter of this second edition. Substantial revisions were made to Chapter 1 (Shaping the Built Environment), Chapter 2 (Visualization of Spatial Information), Chapter 3 (Site Selection), Chapter 6 (Site Inventory: Biological Attributes), Chapter 7 (Site Inventory: Cultural Attributes), Chapter 8 (Site Analysis: Integration and Synthesis), Chapter 9 (Conceptual Design), Chapter 10 (Design Development), and Chapter 11 (Project Implementation). Chapter 10 from the first edition was divided and expanded to create Chapters 10 and 11 in the second edition. This revised edition explores in more detail the linkages between site conditions and ecologically sustainable development—and redevelopment—of the built environment. More attention is also given to finer-scale site and building design issues and to the development regulations and design review processes that influence the shaping of the built environment.

ORGANIZATION OF THE BOOK

This book is divided into four parts. Part I, Process and Tools, contains Chapter 1 (Shaping the Built Environment) and Chapter 2 (Visualization of Spatial Information). The first chapter summarizes the site planning and design process and places site planning and design in the broader context of sustainable planning and development. The second chapter addresses the basic principles of mapping and graphic communication in site planning and design.

Part II, Site Selection and Programming, also has two chapters. Chapter 3 (Site Selection) examines the goals and methods of site suitability analysis leading to the comparison and selection of sites. Chapter 4 (Programming) focuses on programming methods such as user surveys, focus groups, and market analyses.

Part III, Site Inventory and Analysis, is the core of the book. Chapter 5 (Site Inventory: Physical Attributes) and Chapter 6 (Site Inventory: Biological Attributes) cover a wide array of physical and biological attributes that, depending on the unique features of the site and the program, may be analyzed during the site planning and design process. Chapter 7 (Site Inventory: Cultural Attributes) concentrates on documenting relevant cultural, historic, and regulatory attributes. Chapter 8 (Site Analysis: Integration and Synthesis) describes how site opportunities and constraints for specific project programs are identified and documented in support of the subsequent phases of the site planning and design process.

The last three chapters of the book are in Part IV, Design and Implementation. Chapter 9 (Conceptual Design) addresses the spatial organization of the programmed uses and activities on the site. Chapter 10 (Design Development) addresses the spatial articulation of the organizational framework established in the conceptual design phase. This chapter explores design theory and "form-based" development regulations, which communities are increasingly employing to guide development and shape changes to the built environment. Chapter 11 (Project Implementation), the book's final chapter, addresses the permitting and approval processes, techniques for mitigating development impacts, and construction documentation and contract administration. The book concludes with an Appendix and a Glossary. The Appendix lists both commercial, non-profit, and government resources for data and other relevant planning and design information.

EDUCATIONAL USES

The Council of Landscape Architectural Registration Boards (CLARB) conducted a task analysis of the profession of landscape architecture in North America in 1998. One goal of the survey was to document the types of work performed by practicing landscape architects. The respondents were asked to identify their work tasks and rank them in terms of each

TABLE I-1 Partial results of a survey of more than 2000 landscape architects. Self-assessment of work tasks (by rank) that affect public health, safety, and welfare.

Rank	*Task*
2	Identify relevant laws, rules, and regulations governing the project.
3	Evaluate natural site conditions and ecosystems (for example, slopes, wetlands, soils, vegetation, climate).
6	Identify required regulatory approvals.
10	Evaluate the capability of the site and the existing infrastructure to support the program requirements.
11	Elicit user's intentions and determine needs.
15	Determine the opportunities and constraints of the site.

Source: CLARB, 1998, p. 7.

activity's perceived contribution to the protection of public health, safety, and welfare. This is an important question because state licensing laws for landscape architects, architects, and other professions are explicitly intended to protect public health, safety, and welfare. Completed surveys were received from a randomly selected sample of more than 2000 landscape architects. Six of the fifteen most important tasks listed in the CLARB survey—including two of the top three—involve either site selection or site analysis (Table I-1).

This second edition of *Site Analysis* is intended for students in introductory design studios and site inventory/analysis courses in landscape architecture and students in site planning courses in architecture and urban planning. These include both graduate and undergraduate courses taught in universities throughout North America and, to a more limited extent, in Europe, Central and South America, Africa, and Asia. This book is also intended for practitioners studying for professional licensing exams in landscape architecture, architecture, or planning. Although the book is most relevant to professional practice in North America, the text also should have utility in Europe, Asia, and other developed and developing areas. Finally, this book also can serve as a resource to elected local officials and citizens in the United States who serve on local boards and commissions charged with reviewing site plans and land development proposals.

Acknowledgments

Maps and other project graphics for the first edition were generously provided by: Paul Kissinger (Edward D. Stone, Jr., and Associates); Jim Fetterman (The HOK Planning Group); Jack Scholl (Environmental Planning & Design); Fran Hegeler (Wallace, Roberts & Todd, LLC); Meg Connolley (Land Design); and Bob Thorpe (R. J. Thorpe and Associates).

Several educators provided insightful reviews of an early outline and synopsis of the book's first edition. Constructive critiques were received from Jack Ahern (University of Massachusetts); Gary Clay (California Polytechnic State University, San Luis Obispo); Randy Gimblett (Arizona State University); Paul Hsu (Oklahoma State University); David Hulse (University of Oregon); Nate Perkins (University of Guelph); Rob Ribe (University of Oregon); and Peter Trowbridge (Cornell University). Additional assistance was provided by Rosi LaGro and David LaGro.

For the second edition, generous contributions of additional maps and project graphics were made by Jim Fetterman (The HOK Planning Group); Fran Hegeler and Jim Stickley (Wallace, Roberts & Todd); and Paul Moyer (EDAW, Alexandria). The revision process was aided by several published reviews of the first edition and by constructive suggestions from three anonymous reviewers of the author's second edition proposal to the publisher. David LaGro also provided helpful comments on the proposal. Bridget Lang advised, cajoled, and offered thoughtful and constructive reviews of the entire draft manuscript.

Margaret Cummins, acquisitions editor at John Wiley and Sons, facilitated the production of both the first and second editions. Additional assistance from the publisher was provided by Jennifer Mazurkie, James Harper, Kim Aleski, Lauren Poplawski, Amy Zarkos, and copyeditor Elizabeth Marotta.

part I

Process and Tools

Site planning occurs within an environmental and cultural context. As human populations have grown, society's impacts on the earth's ecosystems have increased. Sustainable approaches to site planning attempt to minimize development impacts both on the site and off-site. Vital environmental processes must be protected and, where feasible, degraded ecosystems restored.

Part I of this book summarizes a contextual approach to site planning and design. The first chapter addresses important design goals that can help shape better, and more sustainable, built environments. The second chapter addresses the important role of mapping and other forms of graphic communication in the site planning and design process.

chapter 1

Shaping the Built Environment

Sustainable design balances human needs (rather than human wants) with the carrying capacity of the natural and cultural environments. It minimizes environmental impacts, and it minimizes importation of goods and energy as well as the generation of waste.

U.S. National Park Service

1.1 INTRODUCTION

1.1.1 Functions of Nature

Landscapes have long been settled, cultivated, and in other ways modified by humans. Yet our ability to alter the earth's atmosphere, oceans, and landscapes has exceeded our current capacity to mitigate the impacts of these changes to our environment. Advances in telecommunications technologies, combined with extensive transportation networks and sprawl-inducing land use regulations, continue to loosen the geographic constraints on land development spatial patterns.

"Economic constraints on locational behavior are relaxing rapidly, and, as they do, the geography of necessity gives way to a geography of choice. Transportation costs, markets, and raw materials no longer determine the location of economic activities. We have developed an information-based economy in which dominant economic activities and the people engaged in them enjoy unparalleled locational flexibility. In this spatial context, amenity and ecological considerations are more important locational factors than in the past.

TABLE 1-1 Landscapes encompass natural environmental systems that directly benefit humans.

Function	*Goods or Services*
Production	Oxygen Water Food and fiber Fuel and energy Medicinal resources
Regulation	Storage and recycling of organic matter Decomposition and recycling of human waste Regulation of local and global climate
Carrier	Space for settlements Space for agriculture Space for recreation
Information	Aesthetic resources Historic (heritage) information Scientific and educational information

Source: Adapted from deGroot, 1992, Table 2.0–1.

Cities located in amenity regions of North America are growing more rapidly than others and such trends will intensify as society becomes more footloose" (Abler et al., 1975, p. 301).

The earth's environmental systems perform a wide array of functions that are essential to human health and welfare. For example, nature's "infrastructure" helps protect the quality of the air we breathe and the water we drink, and it provides many other environmental "goods and services." In *Functions of Nature*, deGroot (1992) organizes nature's beneficial services into four functional categories: production, regulation, carrier, and information (Table 1-1). These services sustain life on the planet.

The following indicators reveal, however, that human activities are degrading the environment and imposing serious impacts on the earth's capacity to sustain life:

- Tropical forests are shrinking
- Topsoil losses exceed new soil formation
- New deserts are formed annually
- Lakes are dying or drying up
- Groundwater tables are falling as water demand exceeds aquifer recharge rates
- Rates of plant and animal species extinction are increasing
- Groundwater continues to be contaminated with pesticides and other contaminants
- Global climate change and warming (mean temperature is projected to rise)

- Sea level is projected to rise between 1.4 meter and 2.2 meters by 2100
- Growing hole in the ozone layer over Antarctica

Source: http://earthtrends.wri.org/

Additionally, hurricanes, floods, and other natural hazards increasingly threaten human health, safety, and welfare. According to the National Science Foundation (NSF), since 1989 natural hazards have accounted for an average of about $1 billion in losses per week in the United States. Many disasters causing the loss of life and property can be prevented, or at least mitigated, by proactive decisions to reduce these risks (H. John Heinz, III, Center for Science, Economics, and the Environment, 2000). Mileti (1999), who led the 132 experts, concludes the following:

> The really big catastrophes are getting large and will continue to get larger, partly because of things we've done in the past to reduce risk . . . . Many of the accepted methods for coping with hazards have been based on the idea that people can use technology to control nature to make them safe.

There are, in fact, practical limits to growth, and some locations are far more suitable for development than others. For example, loss of life and property from natural hazards can be avoided, or at least minimized, if the development of the built environment respects nature's patterns and processes.

1.2 TOWARD SUSTAINABLE BUILT ENVIRONMENTS

1.2.1 Community Sustainability

The United Nations Environment Programme (2003) defines *sustainability* as "meeting the needs of current and future generations through integration of environmental protection, social advancement, and economic prosperity." In Ottawa, Canada, as part of the process for developing the city's Official Plan ("A Vision for Ottawa"), citizens agreed to the following set of community sustainability principles. A sustainable community

- minimizes harm to the natural environment, recognizes that growth occurs within some limits, and is ultimately limited by the environment's carrying capacity;
- respects other life forms and supports biodiversity;
- uses renewable and reliable sources of energy and fosters activities that use materials in continuous cycles;
- does not compromise either the sustainability of other communities by its activities (a geographic perspective) or the sustainability of future generations (a temporal perspective);
- values cultural diversity;

- employs ecological decision making (for example, integration of environmental criteria into all municipal government, business, and personal decision-making processes);
- makes decisions and plans in a balanced, open, and flexible manner that includes the perspectives from the community's social, health, economic, and environmental sectors;
- has shared values within the community (promoted through sustainability education) and makes the best use of local efforts and resources (nurtures solutions at the local level).

Source: www.web.net/ortee/scrp/20/23vision.html

Public policy plays a significant role in shaping the built environment (Ben-Joseph and Szold, 2005). For example, zoning codes in the United States emerged in the early twentieth century to protect public health, safety, and welfare (Platt, 2004). These land use controls were effective in separating new residential areas from polluting industries and ensuring that new housing construction met basic health and safety standards. Separating incompatible land uses has long been justified in the United States as a legitimate "police power" of local government (Platt, 2004). Some land use combinations, such as heavy industry and housing, are inherently incompatible. However, zoning codes routinely separate residential development from shops, restaurants, and other commercial uses, often with detrimental consequences for the built environment and public health.

This approach to land use planning typically weakens community identity by facilitating low-density suburban sprawl. In combination with transportation policy and planning decisions, many zoning codes in the United States not only encourage sprawl but also inhibit more sustainable forms of development. Although some communities have made significant strides toward sustainable growth and pedestrian-friendly development, there is a significant need in the United States for land use planning and regulatory reforms (Schilling and Linton, 2005).

1.2.2 Community Resources

A vital step toward developing a sustainable community is to first identify the community's natural and cultural assets. The conservation of natural and cultural resources is a fundamental site planning concern (Figure 1-1). Diamond and Noonan (1996, p. xix) call for recognition of a broad set of community resources:

> A constituency for better land use is needed based on new partnerships that reach beyond traditional alliances to bring together conservationists, social justice advocates, and economic development interests. These partnerships can be mobilized around natural and cultural resources that people value.

According to Arendt (1999), there are nine fundamental types of natural and cultural resources that should be inventoried at the community level:

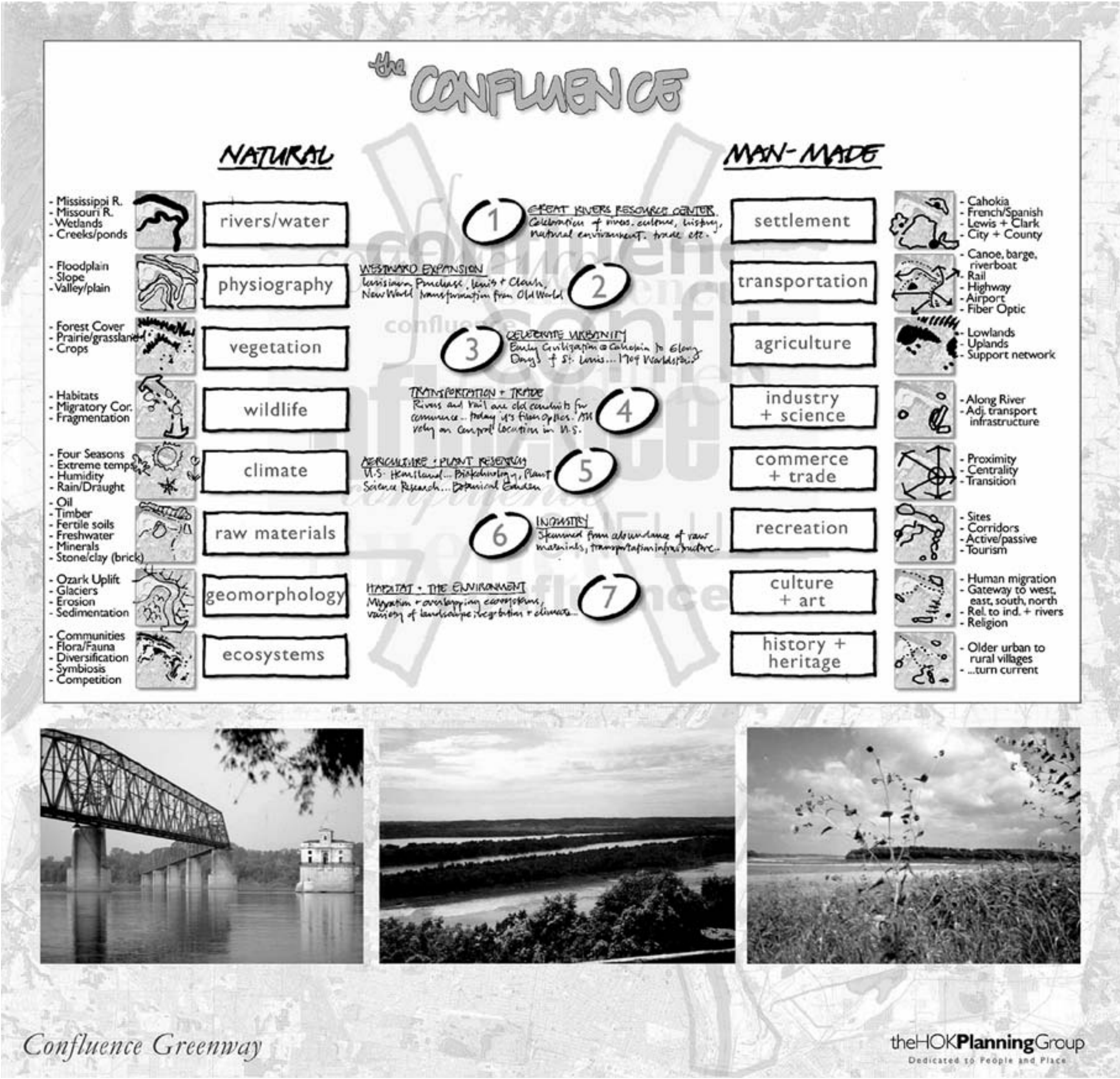

Figure 1-1 Natural and man-made factors influencing a greenway planning project along the Mississippi River in St. Louis, Missouri, USA. Source: The HOK Planning Group.

- Wetlands and wetland buffers
- Floodways and floodplains
- Moderate and steep slopes
- Groundwater resources and aquifer recharge areas

- Woodlands
- Productive farmland
- Significant wildlife habitats
- Historic, archaeological, and cultural features
- Scenic viewsheds from public roads

Collectively, these resources form a unique mosaic or "signature" that defines a community's sense of place to residents and visitors alike. Given their ecological, economic, and psychological importance within the built environment, these natural and cultural resources should be primary determinants of urban form, from the regional to the site scale (Figure 1-2).

1.2.3 Planning Better Communities

The City of Portland, Oregon, has an Office of Sustainable Development whose mission is "to provide leadership and contribute practical solutions to ensure a prosperous community where people and nature thrive, now and in the future" (www.portlandonline.com/osd).

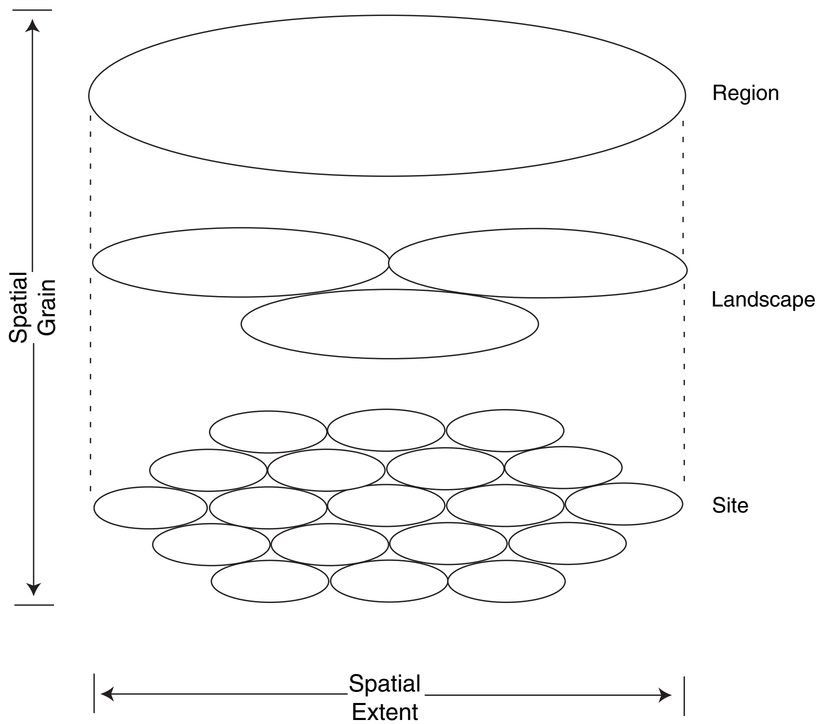

Figure 1-2 Spatial hierarchy—regions, landscapes, sites.

Through outreach, technical assistance, policy and research, the Office of Sustainable Development works to do the following:

- Increase the use of renewable energy and resources
- Reduce solid waste and conserve energy and natural resources
- Prevent pollution and improve personal and community health

Making the built environment more sustainable involves creating more transportation options, more housing choices, and more pedestrian-friendly, mixed-use neighborhoods. Smart Growth principles, endorsed by the American Planning Association and the U.S. Environmental Protection Agency, are practical goals for shaping—and reshaping—the built environment. These principles, guiding both public and private sector decision making, are summarized below.

Smart Growth Planning Goals

- Foster distinctive, attractive communities with a strong sense of place
- Preserve open space, farmland, natural beauty, and critical environmental areas
- Strengthen and direct development toward existing communities
- Mix land uses
- Foster compact building design
- Create a range of housing opportunities and choices
- Create walkable neighborhoods
- Provide a variety of transportation choices

Smart Growth Process Goals

- Make development decisions predictable, fair, and cost effective
- Encourage community and stakeholder collaboration in development decisions

Source: www.smartgrowth.org

Smart growth and sustainable design are complementary paradigms for shaping the built environment. Both approaches encourage the development of pedestrian-friendly communities that not only conserve but celebrate local cultural and natural resources.

1.2.4 Sustainable Site Design

Most communities grow incrementally through a continual process of development and redevelopment. Typically, most of this growth occurs through projects at the site scale. Each

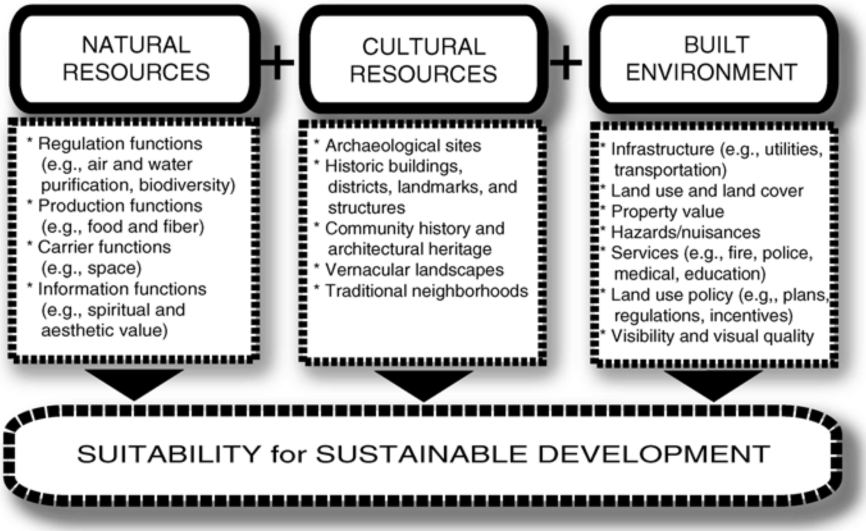

Figure 1-3 Suitability for sustainable development is determined by existing patterns of natural and cultural resources, as well as by the patterns of physical and socioeconomic attributes.

site's carrying capacity is a measure of the type and density of development that can be supported without detrimental effects to society, the economy, or the environment (Figure 1-3). The development of unsuitable sites—or poorly designed development on otherwise suitable sites—can have many negative impacts.

Development impacts vary widely and affect a broad array of natural and cultural resources (Sanford and Farley, 2004). On-site impacts may diminish visual quality and reduce habitat for native vegetation and wildlife. Off-site impacts may include traffic congestion, flooding, or pollution of local surface waters. In *Guiding Principles of Sustainable Design*, for example, the U.S. National Park Service (1993) assesses the potential environmental impacts of new park facility construction by seeking answers to these questions:

- What inputs (energy, material, labor, products, and so on) are necessary to support a development option and are the required inputs available?
- Can waste outputs (solid waste, sewage effluent, exhaust emissions, and so on) be dealt with at acceptable environmental costs?
- Can development impacts be minimized?

A sustainable approach to site planning pays close attention to development intensity and location and considers the initial benefits and impacts of development, as well as the project's life cycle costs. Site planning that is responsive to inherent environmental constraints reduces construction costs, allows the continuation of critical environmental processes, and protects intrinsic natural and cultural amenities. Sustainable site planning is context-sensitive, therefore, minimizing negative development impacts by respecting the

Figure 1-4 Sustainable planning, design, and management is a holistic approach to creating environmentally sensitive development and mitigating environmental degradation.

landscape's natural patterns and processes (Figure 1-4). In *Fostering Living Landscapes* (1997, p. 275), Carol Franklin writes:

> It is the growing realization of the interconnectedness of development and environmental processes worldwide and within our communities that drives the evolution of sustainable design. At every scale, sustainable design is fundamentally about integrating the natural structure of the site with the built environment.

The U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) rating systems for buildings, sites, and neighborhoods are voluntary guidelines that are incrementally improving the sustainability of the built environment. Green buildings enhance employee job satisfaction and productivity (Rocky Mountain Institute) and cost substantially less to operate and maintain than conventional buildings. Careful choices of construction materials and the use of energy and water conserving technologies also reduce development impacts on the environment. Increased productivity, of course, can enhance business profitability (Russell, 1997, pp. 54–55; Stein, 1997, pp. 54–55). Sustainable development is good for business in other ways as well, such as improving market competitiveness by creating favorable "experiences" that enhance customer satisfaction. According to Pine and Gilmore (1999), customer "experiences" are the foundation for future economic growth. Because unsustainable business practices can reduce profitability and competitiveness, sustainability is an issue that is now commonly addressed in a business school education (Burch, 2001).

1.3 THE POWER OF PLACE, THE ROLE OF DESIGN

1.3.1 Good Design Makes a Difference

Mayors, bankers, real estate developers, and many others involved in urban affairs contribute to the "design" or spatial configuration of the built environment. Some designs, however, are far better than others. The arrangement and articulation of streets, buildings, and all other site elements are "design decisions" that—for better or worse—shape the built environment. Design professionals, such as architects and landscape architects, are trained to base these decisions on fundamental design principles, ethical standards, and a thorough understanding of social and environmental context.

The average citizen may think that good design is a frill, or that it simply costs too much to justify the expense. There are many reasons, however, to justify the expense of investing in competent site planning and design. In *Designing the City: A Guide for Advocates and Public Officials*, interviews with mayors, real estate developers, and other individuals expressed strong opinions about the value of good design in the built environment (Bacow, 1995), as follows:

- "Good design promotes public health, safety, and welfare."
- "Good design makes a city work better, not just look better."
- "Good design attracts people to a city, and those people help pay for essentials that help instill pride and satisfaction in what citizens get for their taxes."
- "Well-designed (real estate) products will succeed in tight markets where poorly designed products will not."

Public investment in physical amenities, including historic districts, parks, and waterfront areas, are important community assets that can spur economic growth and serve as catalysts for additional development. These kinds of amenities may also attract companies and individuals seeking to relocate to areas that can provide a high quality of life.

Quality of life is dependent on many factors, including our safety and sense of security, individual freedom, our physical and mental health, leisure and recreation, and opportunities for self-expression as individuals (Kaplan and Kivy-Rosenberg, 1973). Most, if not all, of these factors are affected by the spatial organization and articulation of the built environment. Single-use, sprawling development patterns tend to reduce people's housing choices and limit opportunities for healthier, active living (Frumkin, 2002; Transportation Research Board, 2005).

TABLE 1-2 Benefits of context-sensitive, sustainable site planning and design.

SOCIETY	Pedestrian/bicyclist safety Opportunities for active living Sense of community Attractive surroundings Safe neighborhoods Proximity to public services Minimizes negative impacts on surrounding properties Protects cultural and historic resources
ECONOMY	Attracts investment Attracts visitors and tourists Adds property value Creates marketable "experiences" Quicker real estate sales and rentals in tight markets Attracts high-skilled employees and employers Less time spent commuting Uses land efficiently
ENVIRONMENT	Conserves energy Protects biodiversity Reduces air and water pollution, and urban heat islands) Protects natural processes and sensitive natural areas

Good design that is *sustainable* can reduce the long-term life-cycle costs of operating and maintaining buildings, infrastructure, and sites within the built environment. According to Joseph Romm (1995), up-front building and design costs may represent only a fraction of the building's life-cycle costs. When just 1 percent of a project's up-front costs are spent, up to 70 percent of its life-cycle costs may already be committed; when 7 percent of project costs are spent, up to 85 percent of life-cycle costs have been committed. Consequently, sustainable design benefits society, the economy, and the environment (Table 1-2).

1.4 SITE-PLANNING PROCESS

Site planning is a multiphased process (Figure 1-5). Kevin Lynch (1971, pp.3–4) defined site planning as follows:

> Site planning is the art of arranging the external physical environment to support human behavior. It lies along the boundaries of architecture, engineering, landscape architecture, and city planning, and it is practiced by members of all these professions. Site plans locate structures and activities in three-dimensional space and, when appropriate, in time.

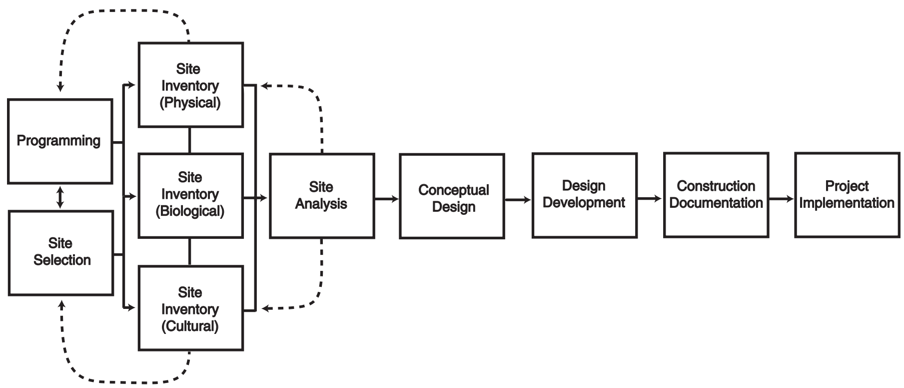

Figure 1-5 Site planning and design process.

Equally important, site planning also involves choices about where not to build. Site planning must be informed, therefore, by a thorough understanding of the site's character and context. Sustainable site planning protects and restores degraded natural and cultural resources and minimizes detrimental impacts of development on the environment.

1.4.1 Preproject (or Predesign) Phases

Clients initiate site-planning projects. Clients may be private individuals; partnerships; corporations; nonprofit organizations; or federal, state, or local governments. In some cases, a client may simply choose a firm that it has worked with in the past. Or the firm may be chosen for its reputation, specializations, or proximity to the client or site. In other cases, a client—especially if it is a government agency—may solicit firms with a Request for Qualifications (RFQ) or a Request for Proposals (RFP). Once the firm is selected, a contract for professional services typically defines the work that will be completed on the project. This contract includes a scope of services, a schedule for delivering the services, and a budget and payment schedule.

Programming

Site-planning projects vary not only in site areas and locations within the urban–rural continuum but also in prospective site uses. One project might involve the construction of roads, buildings, and other infrastructure. Another project might not have any new construction but focuses instead on the conservation, restoration, and management of natural areas or cultural resources. Programming defines the project's objectives and functional requirements, including the proposed activities, area allocated for each activity, and the functional or spatial relationships among those activities.

TABLE 1-3 Example of program elements for an affordable housing project.

Building height	*Unit Density*	*Number of units (by type)*			
Three-story	20 DU/AC	Studio 10	1BR 30	2BR 50	3BR 10
Five-story	30 DU/AC	Studio 15	1BR 45	2BR 75	3BR 15

Source: Adapted from Affordable Housing Design Advisor. (www.designadvisor.org)

The program focuses the subsequent analysis and design activities. The program for a multifamily housing project, for example, might include the number, type, and density of housing units that will be constructed on the site (Table 1-3).

The program may be developed by the client alone, or with the assistance of consultants with programming expertise. Programming often includes market analyses, or user demand studies, and the analysis of relevant precedents. Client objectives and preferences for the project are also considered, including the desired uses, special features, design styles, budgets for various project components, and maintenance concerns. An in-depth discussion of programming can be found in Chapter 4.

1.4.2 Site Assessment Phases

Site Selection

Land development typically occurs in one of two ways: clients have a site and choose a program to develop on that site, or clients have a program of intended uses and need a site for those uses. Across the urban–rural continuum, parcels of land vary greatly in size, shape, character, and context. Site selection involves identifying and evaluating alternative sites and selecting the best location for the intended program. More details on the site selection process can be found in Chapter 3.

Site Inventory

Collectively, the features of the site and its surroundings, in conjunction with the project's program, determine the attribute data that are collected for the site inventory. Site inventories map important physical, biological, and social or cultural attributes (Table 1-4). These may include circulation patterns and traffic volumes, existing utility systems, or architectural character within the surrounding built environment. On large projects, attribute mapping and analysis are particularly well suited for applications of geographic information systems. Ecologists, hydrologists, anthropologists, and other experts may participate in collecting, mapping, and analyzing site and contextual attribute data. Yet for any given program and site, there are always attributes that can be ignored to make the process more efficient. The project's program—or intended uses of the site—helps limit the scope of this data collection effort. Chapters 5, 6, and 7 examine the site inventory processes in greater detail.

TABLE 1-4 Examples of physical, biological, and cultural attributes that may be mapped at the site scale.

Categories	*Subcategories*	*Attributes*
Physical	Soils	Bearing capacity Porosity Stability Erodibility Fertility Acidity (pH)
	Topography	Elevation Slope Aspect
	Hydrology	Surface drainage Water chemistry (e.g., salinity nitrates or phosphates) Depth to seasonal water table Aquifer recharge areas Seeps and springs
	Geology	Landforms Seismic hazards Depth to bedrock
	Climate	Solar access Winds (i.e., prevailing or winter) Fog pockets
Biological	Vegetation	Plant communities Specimen trees Exotic invasive species
	Wildlife	Habitats for endangered or threatened species
Cultural	Land use	Prior land use Land use on adjoining properties
	Legal	Political boundaries Land ownership Land use regulations Easements and deed restrictions
	Utilities	Sanitary sewer Storm sewer Electric Gas Water Telecommunications
	Circulation	Street function (e.g., arterial or collector) Traffic volume
	Historic	Buildings and landmarks Archaeological sites
	Sensory	Visibility Visual quality Noise Odors