



THIRD EDITION

# Site Analysis

Informing Context-Sensitive and Sustainable Site Planning and Design

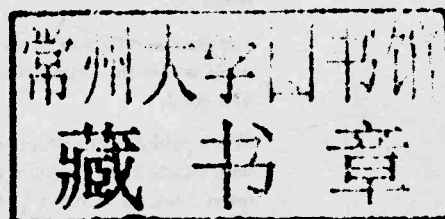
James A. LaGro Jr.

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Informing Context-Sensitive  
and Sustainable Site  
Planning and Design

Third Edition

James A. LaGro, Jr.



WILEY



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*For David and Kyle*

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# Preface

Designing with nature—and with sensitivity to pertinent cultural, historic, and legal factors—is the land use ethic that has guided the writing of this book. This third edition of *Site Analysis* retains the basic structure of earlier editions by devoting one or more chapters to individual phases of the site planning process and by arranging these chapters in the sequence in which they typically occur.

This edition's nine chapters examine the linkages between contextual conditions and the design and development—and redevelopment—of the built environment. A variety of project types, scales, and geographic settings are considered, although greater attention is given in this extensively revised edition to urban sites.

This book is written primarily for a multidisciplinary audience of university students and early-career practitioners. Like previous editions, this book can be a resource for landscape architecture students taking introductory design studios and site analysis courses, and for architecture, urban planning, and civil engineering students taking site planning courses.

Working effectively across disciplines has never been more important. Advances in urban sustainability will require more effective and synergistic collaborations among the planning and design professions, especially architecture, engineering, landscape architecture, and urban planning. Meaningful collaboration among these professions' educational programs can also strengthen relationships between universities and their broader communities.

More than two decades ago, Boyer (1990) argued that universities should place greater value on engaged scholarship (i.e., applying one's academic expertise to solve consequential societal problems). Problem-based learning, characterized by small teams of students focusing on solving real-world problems, is particularly relevant in professional planning and design programs, where students strive to develop their problem-solving knowledge and skills (Barrows, 1996).

Within a few years after graduation, many design and planning practitioners study for professional competency exams. This edition, therefore, can serve as a resource for early-career practitioners studying for licensing exams in landscape architecture or architecture and for certification exams in urban planning. My hope is that this book is also useful to public sector planning staff, elected officials, and appointed citizens who serve on local boards or commissions that formally review land development proposals.

# Acknowledgments

Many illustrations in this edition were generously provided by professional planning and design firms. I especially wish to thank Paul Kissinger (Edward D. Stone, Jr., and Associates); Jim Fetterman (The HOK Planning Group, St. Louis); Jack Scholl (Environmental Planning & Design, Pittsburgh); Fran Hegeler and Jim Stickley (Wallace, Roberts & Todd, San Francisco); Meg Connolley (Land Design, Charlotte); Bob Thorpe (R. J. Thorpe and Associates); Brian Peterson (SmithGroup JJR, Madison); Paul Moyer (EDAW, Alexandria); and Bill Fruhling (Department of Planning and Development, City of Madison, Wisconsin). Several newer illustrations were created by David LaGro, a recent graduate of Cornell University's Master's in Landscape Architecture program.

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Margaret Cummins, executive editor at John Wiley & Sons, oversaw the production of all three editions. On this third edition, additional editorial assistance was provided by Lauren Poplawski and Michael New, and the production process was led by Donna Conte.

Bridget and David LaGro provided unstinting support and encouragement.

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## part I

# Context and Approach

Part I of this book presents the rationale for a context-sensitive approach to site planning and design. Chapter 1, “Shaping the Built Environment,” addresses the sustainability imperative and design strategies to create healthier, resilient, and more livable built environments. The chapter also presents a systematic, multiphased approach to place-making at the site scale.



## 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.*

—United States. National Park Service (1993, p. 55)

## 1.1 INTRODUCTION

About 82 percent of the 312 million U.S. residents—and 50 percent of the planet's 7 billion inhabitants—now live in urbanized areas (United Nations, 2010). Cities and their suburbs today import vast quantities of both raw and processed resources (for example, energy, water, food) and they export—often to rural areas—massive quantities of wastes (for example, plastics, paper, metals).

Yet, the global economy—with its 12,000-mile supply chains—increases international dependencies and, potentially, reduces the resilience of communities to distant political disturbances and natural disasters (for example, Japan's 2011 earthquake and tsunami). Sustainability is a global challenge requiring context-specific changes in the structure and function of our built environments. Urban population growth heightens the need for comprehensive interdisciplinary solutions to this contemporary challenge.

## 1.2 ECOSYSTEM SERVICES

Advances in telecommunications technologies, combined with extensive highway networks and sprawl-inducing land use regulations and subsidies, have greatly loosened the geographic constraints on population distribution and land development spatial patterns.

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. 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 ecosystems perform functions that are essential to human health and welfare. In *Functions of Nature*, deGroot (1992) classified nature's functions into four life-supporting categories: production, regulation, carrier, and information services (Table 1-1). Nature's "infrastructure" helps protect the quality of the air we breathe and the water we drink, and it provides an abundance of other "goods and services." These include food, fiber, water, biodiversity, and energy production as well as the provision of cultural, recreational, and spiritual experiences (Daily et al., 1999; Reid et al., 2005).

The value of nature's services to human well-being, and the implications of different management approaches over space and time, are not widely appreciated or even well understood. Consequently, environmental management practice has suffered from an incorrect assumption (Folke et al., 2002, p. 437): that "*human and natural systems can be treated independently*" [emphasis added]. Many human activities, however, impose detrimental impacts on the earth's capacity to sustain life. The World Resources Institute (WRI) tracks global environmental trends, and the following findings—among many others—reinforce the global sustainability imperative:

**TABLE 1-1** Ecosystem services support human civilization by providing a broad range of "goods and services."

| <i>Function</i> | <i>Goods or Services</i>                   |
|-----------------|--|
| 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, in part, from deGroot (1992, Table 2.0-1).

- Tropical forests are shrinking, and the rates of plant and animal species extinction are increasing.
- Groundwater tables are falling as water demand exceeds aquifer recharge rates, and groundwater continues to be contaminated with pesticides and other contaminants.
- Global climate change and warming are occurring, and the sea level is projected to rise by as much as 3 feet (0.91 meter) by 2100.

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

Hurricanes, floods, and other natural hazards continually threaten human health, safety, and welfare. Yet, many disasters causing the loss of life and property can be prevented, or at least mitigated, by better land use decisions that reduce these risks (H. John Heinz Center for Science, Economics, and the Environment, 2000; Mileti, 1999). Dennis Mileti, who led the Heinz Center's natural hazards risk analysis, concludes in a press release from the National Science Foundation (1999, p.1):

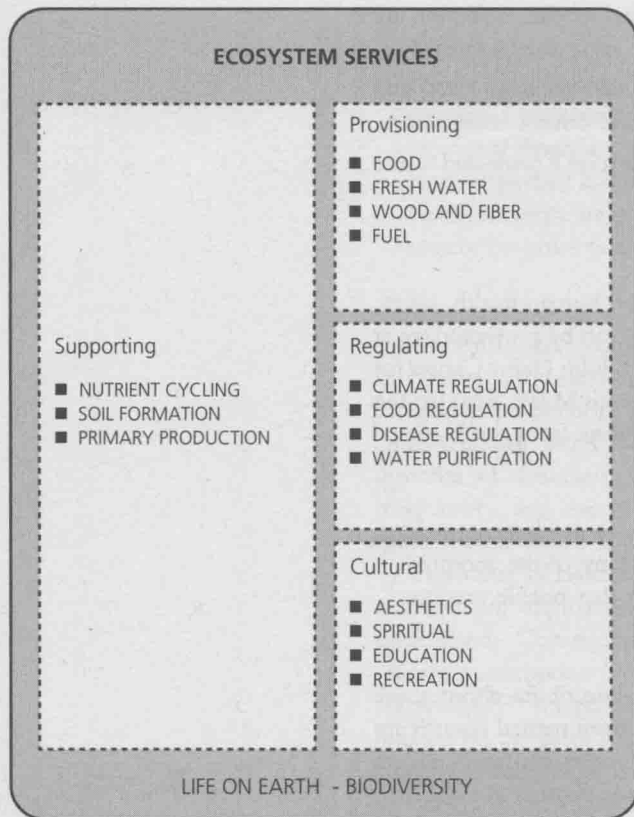
The really big catastrophes are getting large and will continue to get larger, partly because of things we've done in the past to reduce risk. . . . Many of the accepted methods for coping with hazards have been based on the idea that people can use technology to control nature to make them safe.

In the United States, hurricanes, flooding, and severe storms contribute about three quarters of the total damages from natural hazards. Per capita losses from natural hazards are outpacing population growth, and if the trend of the past two decades continues, direct losses of \$300 to \$400 billion are probable within the current decade (Gall et al., 2011).

### 1.3 PLACE-BASED STEWARDSHIP

The World Commission on Environment and Development (1987, p. 40) suggests that "sustainable development seeks to meet the needs and aspirations of the present without compromising the ability of those to meet those of the future." Concern over climate change, in particular, has precipitated advances in "sustainability science"—which seeks to understand the complex dynamics of interconnected human and environmental systems. Actions to reduce greenhouse gas emissions (climate mitigation) and increase cities' resilience to extreme weather events (climate adaptation) are applications of sustainability science. Yet, the most ambitious application of sustainability science, is *"the integrative task of managing particular places where multiple efforts to meet multiple human needs interact with multiple life-support systems in highly complex and often unexpected ways"* [emphasis added] (Clark, 2007, p. 1737).

The built environment—the three-dimensional arrangement of buildings, transportation and utility networks, and green spaces—influences community health and sustainability across the urban-to-rural continuum. As the theoretical concepts guiding sustainability science are translated into actions, the built environment's transformation will require closer collaboration of architects, landscape architects, urban planners, engineers, and other allied professionals. There is a critical need for planning and design professionals who can bridge



**Figure 1-1** Ecosystem services support a hierarchy of human needs. Source: Adapted, in part, from Millennium Ecosystem Assessment (2005).

States has been planned, financed, and constructed while largely ignoring the associated social, economic, and environmental externalities (Soule, 2006). Since World War II, the interplay of local land use planning and federal and state policies has produced abundant “driveable suburban” landscapes but far fewer “walkable urban” neighborhoods (Leinberger, 2008). Besides diminishing the nation’s energy security, the consequences of this land development paradigm include a litany of public health impacts (Frumkin and Jackson, 2004), economic impacts (Burchell et al., 2005), and environmental impacts (Johnson, 2001).

Public policy plays a significant role in shaping the built environment (Ben-Joseph and Szold, 2005). In the United States, local development regulations have not only encouraged low-density sprawl but also have inhibited other, more sustainable forms of development. Zoning codes, for example, 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. But zoning codes also routinely separated residential development from shops, restaurants, and other commercial uses, often with detrimental consequences for community health and well-being. There is an urgent need in the United States for land use planning and regulatory reforms (Schilling and Linton, 2005).

Because public policies play significant, yet often hidden, roles in shaping the built environment, planning and design professionals should be leaders in formulating better

professional “silos” and lead multidisciplinary teams in creating policy, design, and technology solutions to local, regional, and global sustainability challenges.

Sustainability initiatives at the federal level currently include the *Partnership for Sustainable Communities*—an inter-agency initiative of the U.S. Environmental Protection Agency (EPA), the U.S. Department of Transportation (DOT), and the Department of Housing and Urban Development (HUD). This collaboration has been a catalyst for integrated sustainability planning at the local and regional scale ([www.sustainablecommunities.gov/](http://www.sustainablecommunities.gov/)). Along with efforts by the U.S. Centers for Disease Control and Prevention (CDC), this partnership explicitly recognizes that the spatial structure of the built environment—the location and design of buildings, transportation systems, and green spaces—influences not only economic prosperity and environmental quality, but also public health (Figure 1-1).

Our quality of life is dependent on many factors, including our safety and sense of security, our individual freedom and physical and mental health, and our opportunities for self-expression as individuals (Kaplan and Kivy-Rosenberg, 1973). Most, if not all, of these factors are affected by the design of the built environment. Sprawling development patterns, for example, tend to reduce people’s housing choices and limit their opportunities for healthy, active living (Frumkin et al., 2004).

Over the past six decades, suburban sprawl in the United

public policy. Professional associations are, in fact, taking a greater advocacy role. These changes are reflected in recently launched sustainability initiatives by the American Society of Landscape Architects (ASLA) *Sustainable Sites Initiative*<sup>TM</sup>, the American Institute of Architects (AIA) *SustAIAnability 2030 Toolkit*, the American Planning Association (APA) *Sustaining Places Initiative*, and the American Society of Civil Engineers (ASCE) *Institute for Sustainable Infrastructure*. These sustainability initiatives express strong values and advocacy positions—concerning social equity, for example—that are reflected in each profession’s continuing professional education programs and competency exams.

The ASCE, for example, defines “sustainability” as follows:

A set of environmental, economic and social conditions in which all of society has the capacity and opportunity to maintain and improve its quality of life indefinitely without degrading the quantity, quality or availability of natural, economic, and social resources. (<http://www.asce.org/Sustainability/ASCE-and-Sustainability/ASCE—Sustainability/>)

The ASLA’s Sustainable Sites Initiative defines “site sustainability” as

design, construction, operations and maintenance practices that meet the needs of the present without compromising the ability of future generations to meet their own needs. <http://www.sustainablesites.org/>

Suburban sprawl has not only degraded environmental quality in the United States, but has also produced low-density, auto-oriented communities that contribute to sedentary lifestyles and diminished public health (Frumkin et al., 2004). Communities aspiring to become more prosperous, livable—and sustainable—are taking steps to retrofit their built environments in several important ways (Dunham-Jones and Williamson, 2011). “Smart Growth,” “New Urbanism,” and “sustainable design” are three related development paradigms that focus attention on the physical configuration, or design, of the built environment. Key attributes are the following:

- Mixed and integrated uses (i.e., diverse housing, shops, workplaces, schools, parks, and civic facilities encompassing interconnected indoor and outdoor environments)
- Clustered, compact buildings (i.e., architecture that enriches public open spaces, especially streetscapes, and creates neighborhoods and urban districts with a strong sense of place)
- Open space systems (i.e., connected natural areas and other outdoor places that provide linear recreational opportunities)
- Transportation networks (i.e., integrated systems safely serving pedestrians, bicycle riders, public transit, and automobiles)

Achieving these objectives involves coordination on a community-wide, and even regional, scale. Yet, these efforts must also be coupled with good design at the site, or parcel, level. Site-scale development—usually on privately owned property—is the primary way in which most communities change, for better or worse. And there are significant consequences of poor site planning. Detrimental impacts range from exposing people to safety and property risks to making people endure an unhealthy—even ugly—public realm. For