

Green Infrastructure:

Smart Conservation for the 21st Century



“Infrastructure – the substructure or underlying foundation...on which the continuance and growth of a community or state depends”

– WEBSTER’S NEW WORLD DICTIONARY

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The Conservation Fund

Acknowledgements

This monograph is derived from Modules 2 and 4 of the Participants Manual for the May 2001 pilot offering of the Conservation Leadership Network course, *Green Infrastructure: A Strategic Approach to Land Conservation*. Mark Benedict and Lydia Bjornlund drafted these pilot course modules in spring, 2001. The authors would like to acknowledge Ms Bjornlund as well as the members of the "Green Infrastructure 101" design team who contributed to the development of these modules. The authors would also like to acknowledge the following previously published articles that preceded and contributed to Modules 2 and 4 and therefore to the content of this monograph:

- ✿ Edward T. McMahon, "Green Infrastructure," *Planning Commissioners Journal*, Number 37, Winter 2000
- ✿ Mark A. Benedict, "Green Infrastructure: A Strategic Approach to Land Conservation," *American Planning Association PAS Memo*, October 2000

Finally, the authors would like to thank the Surdna Foundation and the USDA Forest Service who have supported The Conservation Fund's Green Infrastructure Program. The Sprawl Watch Clearinghouse would like to thank The Educational Foundation of America and the Surdna Foundation whose support made this report possible.

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About Sprawl Watch Clearinghouse

The Sprawl Watch Clearinghouse is a nonprofit organization based in Washington, DC. The Sprawl Watch Clearinghouse mission is to make the tools, techniques, and strategies developed to manage growth, accessible to citizens, grassroots organizations, environmentalists, public officials, planners, architects, the media and business leaders. At the Clearinghouse, we identify, collect, compile, and disseminate information on the best land use practices, for those listed above.

This report and many other sources of information on sprawl and smart growth are available on the World Wide Web at www.sprawlwatch.org.

About The Conservation Fund

The Conservation Fund is a national, non-profit land conservation organization headquartered in Arlington, Virginia, that forges partnerships to protect America's legacy of land and water resources. Through land acquisition, community planning, and leadership training, the Fund and its partners demonstrate sustainable conservation solutions emphasizing the integration of economic and environmental goals. Since 1985 The Fund has protected more than 3 million acres of open space, wildlife habitat and historic sites across America. To learn more about The Conservation Fund, please visit their website at www.conservationfund.org.

Front cover photo: Cooper/USFWS

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Preface

Oliver Wendall Holmes said that “to live fully is to be engaged in the passions of one’s time.” Clearly land conservation is one of the passions of our time. Over the past few years, poll after poll and ballot measure after ballot measure have demonstrated Americans’ support for land conservation. However, we need new approaches to land conservation to address the accelerating rate at which land is being developed.

In the 1970s, when we began working in the conservation movement, conservation organizations worked to protect *individual* parcels of land. Today we realize that we must protect *networks* of open space. Still, too many land conservation efforts are haphazard and reactive in nature. They deal with whatever comes over the transom. The result is haphazard conservation and haphazard development.

From our perspective, successful land conservation in the future will have to be:

- ✿ More proactive and less reactive
- ✿ More systematic and less haphazard
- ✿ Multifunctional, not single purpose
- ✿ Large scale, not small scale, and
- ✿ Better integrated with other efforts to manage growth and development.

The key to accomplishing this, we believe, is “*green infrastructure*”, a new framework that provides a strategic approach to land conservation.

Just as growing communities need to upgrade and expand their built infrastructure (roads, sewers, utilities, etc.), so too they need to upgrade and expand their green infrastructure—the network of open space, woodlands, wildlife habitat, parks and other natural areas that sustains clean air, water and natural resources and enriches our quality of life. The concept of green infrastructure repositions open space protection from a community amenity to a community necessity.

Green infrastructure can even help reduce opposition to development. When citizens think all land is up for grabs, they oppose development everywhere. On the other hand, when people have some assurance that special places will be saved, they become more amenable to accommodating new development.

One of the biggest challenges, of course, is MONEY. We need a lot more of it. Every state and local government in America needs not only a green infrastructure plan, but also the financial resources to implement the plan. Over the past three years, over \$17.5 billion in state and local government funding has been directed towards open space preservation.

This is an important step in the right direction, but we must do more. The total funding devoted to land conservation is just a small fraction of what we spend on transportation and other infrastructure needs. We need new sources of conservation capital, both public and private.

The final challenge is PEOPLE. We need to broaden our movement to include more people of color and young people. We also need to remember that our work is fundamentally about people — our children and grandchildren. It’s about the future and planning for it.

When we started in conservation many of us were winging it. We hadn't been educated or trained for what we were doing. There wasn't much science and even less thinking about economic development, and there were few opportunities for professional development. By almost every measure, the work of conservation is becoming more complex. Conservationists need to understand marketing, business planning, real estate and tax law, as well as ecology and geographic information systems. We need to build the capacity of our movement embracing the concepts of training, education and lifelong learning. We also need to educate the public about the benefits derived from green infrastructure.

We believe that now is the time for a more strategic and comprehensive approach to land conservation. This monograph sets out that approach.

Mark A. Benedict & Edward T. McMahon
The Conservation Fund

Introduction

“Green infrastructure” is a term that is appearing more and more frequently in land conservation and development discussions across the country and around the world. Green infrastructure means different things to different people depending on the context in which it is used. For example, some people refer to trees in urban areas as green infrastructure because of the “green” benefits they provide, while others use green infrastructure to refer to engineered structures (such water treatment facilities or green roofs) that are designed to be environmentally friendly.



For the purposes of this *Sprawl Watch Clearinghouse*

Monograph, green infrastructure is defined as *an interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations*. In our view, green infrastructure is the

ecological framework needed for environmental, social and economic sustainability—in short it is our nation’s *natural life sustaining system*. Green infrastructure differs from conventional approaches to open space planning because it looks at conservation values and actions in concert with land development, growth management and built infrastructure planning. Other conservation approaches typically are undertaken in isolation from — or even in opposition to — development.

This monograph introduces green infrastructure as a strategic approach to land conservation that is critical to the success of smart growth initiatives. Green infrastructure is “smart” conservation that addresses the ecological and social impacts of sprawl and the accelerated consumption and fragmentation of open land. This monograph describes the concept and values of green infrastructure and presents seven principles and associated strategies for successful green infrastructure initiatives.

What Is Green Infrastructure?

Webster's *New World Dictionary* defines infrastructure as "the substructure or underlying foundation, especially the basic installations and facilities on which the continuance and growth of a community depends." When they hear the term infrastructure, most people think of roads, sewers, utility lines, and other *gray infrastructure*; or hospitals, schools, prisons, and other *social infrastructure*. Taken together, these types of facilities are often referred to as *built infrastructure*. Today, many people and organizations are talking about another type of infrastructure that is critical to the "continuance and growth of a community": *green infrastructure*.

In August 1999 under the leadership of The Conservation Fund and the USDA Forest Service, a working group of local, state and federal agencies and non-governmental organizations came together to develop a

training program that would help communities and their partners make green infrastructure an integral part of local, regional and state plans and policies. This Green Infrastructure Work Group developed the following definition for green infrastructure:

"Green infrastructure is our nation's natural life support system – an interconnected network of waterways, wetlands, woodlands, wildlife habitats, and other natural areas; greenways, parks and other conservation lands; working farms, ranches and forests; and wilderness and other open spaces that support native species, maintain natural ecological processes, sustain air and water resources and contribute to the health and quality of life for America's communities and people."

The elements of a green infrastructure network need to be protected over the long term. This requires long-range planning and management, as well as an ongoing commitment.

"Just as we must carefully plan for and invest in our capital infrastructure – our roads, bridges and waterlines, we must invest in our environmental or green infrastructure – our forests, wetlands, stream and rivers . . . Just as we must carefully plan for and invest in our human infrastructure – education, health service, care for the elderly and disabled – we must also invest in our green infrastructure."

– Maryland Governor Paris Glendening
January 1999



Credit: Hagerly/USFWS

A Community Green Infrastructure Plan?

Does your community have a long-range transportation plan? How about a plan to upgrade and expand the airport, sewage treatment plant, storm water facilities, fiber optic cables, or other community utilities?

Most growing communities have such plans, but many of these same communities have no plan to preserve their essential, life sustaining, natural infrastructure.¹

What Does Green Infrastructure Look Like?

Green infrastructure encompasses a wide variety of natural and restored native ecosystems and landscape features that make up a system of “hubs” and “links.”

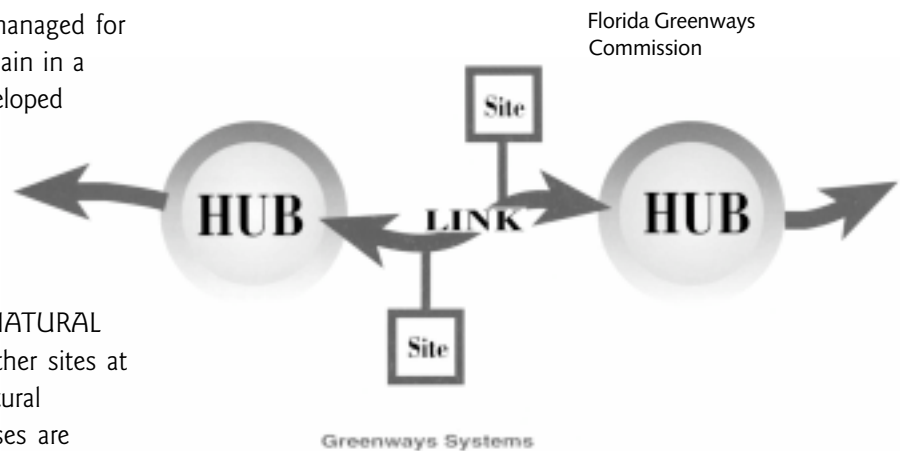
HUBS anchor green infrastructure networks and provide an origin or destination for wildlife and ecological processes moving to or through it. Hubs come in all shapes and sizes, including:

- ✱ RESERVES – Large protected areas, such as national and state parks and wildlife refuges;
- ✱ MANAGED NATIVE LANDSCAPES – Large publicly owned lands, such as national and state forests, managed for resource extraction as well as natural and recreational values;
- ✱ WORKING LANDS – Private farms, forests, and ranches that are managed for commodity production yet remain in a predominantly open and undeveloped state;
- ✱ REGIONAL PARKS AND PRESERVES – Less extensive hubs of regional ecological significance; and
- ✱ COMMUNITY PARKS AND NATURAL AREAS – Smaller parks and other sites at the community level where natural features and ecological processes are protected and/or restored.

What's in a Name?

The term green infrastructure was selected to emphasize its difference from traditional conservation practices and the need to change several popular perceptions about green space planning and protection.

- ✱ Where-as green space is often viewed as something that is nice to have, the term green infrastructure implies something that we must have. Protecting and restoring our nation's natural life support system is a necessity, not an amenity.
- ✱ Where-as green space is often thought of as isolated parks, recreation sites or natural areas, the term green infrastructure emphasizes inter-connected systems of natural areas and other open spaces that are protected and managed for the ecological benefits they provide to people and the environment.
- ✱ Where-as green space is often viewed as self-sustaining, the term green infrastructure implies something that must be actively maintained and at times restored.



LINKS are the connections that tie the system together and enable green infrastructure networks to work. They range in size, function and ownership, including:

- ✱ **LANDSCAPE LINKAGES** – Large protected natural areas that connect existing parks, preserves, or natural areas and provide sufficient space for native plants and animals to flourish while serving as corridors connecting ecosystems and landscapes. Landscape linkages may also provide space for the protection of historic sites and opportunities for recreational use;
- ✱ **CONSERVATION CORRIDORS** – Less extensive linear protected areas, such as river and stream corridors that serve as biological conduits for wildlife and may provide recreational opportunities;
- ✱ **GREENWAYS** – Protected corridors of land managed for resource conservation and/or recreational use;
- ✱ **GREENBELTS** – Protected natural lands or working lands that serve as a framework for development while also preserving native ecosystems and/or farms or ranchland; and
- ✱ **ECOBELTS** – Linear woody buffers that can ease the zone of tension between urban and rural land uses while providing ecological and social benefits for urban and rural residents.

What Are the Origins of Green Infrastructure?

Green infrastructure is a new term, but it's not a new idea. It has roots in planning and conservation efforts that started a hundred and fifty years ago. Green infrastructure has its origin in two important concepts: (1) linking parks and other green spaces for the benefit of people, and (2) preserving and linking natural areas to benefit biodiversity and counter habitat fragmentation.

In his work in public parks in the late eighteenth and early nineteenth centuries, land-

scape architect Frederick Law Olmsted believed that “no single park, no matter how large and how well designed, would provide the citizens with the beneficial influences of nature.” Instead parks need “to be linked to one another and to surrounding residential neighborhoods.”² This idea of linking parks for the benefit of people (e.g. with a focus on recreation, pedestrian and bicycle trails and public health) has evolved into the modern greenways movement.

“A connected system of parks and parkways is manifestly far more complete and useful than a series of isolated parks”

– John Olmsted
and Frederick Law Olmsted Jr. 1903³

Second, wildlife biologists and ecologists have long recognized that the best way to preserve native plants, animals and ecological processes is to create an interconnected conservation system to counter habitat fragmentation. Protecting and restoring connections between parks, preserves and other important ecological areas is a key concept for the science of conservation biology and the practice of ecosystem management.

In the 1990's, Florida, Maryland and several other states and communities initiated programs to strategically identify, protect and restore interconnected systems of conservation land and other sites of ecological value. These states and communities recognized that these interconnected green space systems represent their green infrastructure. They further recognized that the protection and maintenance of green infrastructure is vital to their sustainable future because it provides a way to link land use planning to the preservation of biodiversity.

In its May 1999 report, “Towards a Sustainable America,” the President's Council on Sustainable Development identified Green Infrastructure as one of five strategic areas

that provide a comprehensive approach for sustainable community development. The report stated that “green infrastructure strategies actively seek to understand, leverage, and value the different ecological, social, and economic functions provided by natural systems in order to guide more efficient and sustainable land use and development patterns as well as protect ecosystems.”⁴ Statewide projects in Florida and Maryland; recognition by the President’s Council on Sustainable Development; and other innovative initiatives at the state, regional and local levels have led to a rapid increase nationwide in the use of the term green infrastructure and the application of its concepts and values to meeting today’s conservation and land use challenges.

The modern-day greenways movement also has influenced green infrastructure planning and implementation. It has brought together many important players who had not previously considered the impact of development on the landscape. Although green infrastructure and greenways share a common origin, green infrastructure differs from greenways in at least three major ways:

✿ ECOLOGY VS. RECREATION — Green

infrastructure emphasizes ecology not recreation, although trails and other recreational amenities can provide substantial human benefits and should be part of any integrated system of open space;

✿ BIGGER VS. SMALLER — Green infrastructure includes large ecologically important hubs, as well as key landscape linkages. Greenways, on the other hand, typically focus on trails, narrow conservation corridors and other linear features;

✿ FRAMEWORK FOR GROWTH — Green infrastructure can be designed to shape urban form and provide a framework for growth. It works best when the framework pre-identifies both ecologically significant lands and suitable development areas.

Green infrastructure as we know it today has been influenced by these four factors: linking parks for people; linking natural areas to counter fragmentation and preserve biodiversity; identifying and protecting interconnected open spaces systems to benefit wildlife and ensure a sustainable future; and building upon the excitement and appeal of the modern-day greenways movement.

Benton MacKaye’s Prescription for Urban Sprawl

Benton MacKaye, the founder of the Appalachian Trail, was also concerned about urban sprawl. In 1928, he explained in *“The New Exploration – A Philosophy of Regional Planning”* how green space could be used to curb development in a hypothetical community: “The outstanding topographic feature consists of the range of hills and mountains encircling the locality, together with the four ridges reaching toward the central city. This could be reserved as a common public ground, serving the double purpose of a public forest and a public playground . . . It would form a linear area, or belt around and through the locality,

well adapted for camping and primitive travel (by foot or horseback)

. . . This series of open areas and ways would form a distinct realm: it would be a primeval realm (or near-primeval) – the opposite realm from the metropolitan. These open ways (along the crestlines) mark the lines for developing the primitive environment, while the motor ways mark the lines for extending the metropolitan environment. The motor ways form the channels of the metropolitan flood, while the open ways (crossing and flanking the motor ways) form ‘dams’ and ‘levees’ for controlling the flood.”⁵



Why Do We Need to Plan and Protect Green Infrastructure?

Land is being developed faster today than ever before. This accelerated consumption and the resulting fragmentation of open land are the primary conservation challenges facing our nation today. The following statistics illustrate the problem:

- ✱ According to the December 2000 update of the Natural Resource Conservation Service's National Resources Inventory, over the 15-year period from 1982 to 1997, the total acreage of developed land in the United States increased by 34 percent (25 million acres). From 1982 to 1992, land was converted at 1.4 million acres per year; from 1992 to 1997, land was converted at 2.2 million acres a year. This rate is more than 1.5 times the previous 10-year rate.⁶
- ✱ The 1997 American Housing Survey conducted by the Census Bureau and HUD found that, between 1993 and 1997, 2.3 million acres of open space were converted to new single-family homes each year. Almost 90 percent of this land conversion occurred with lots of one acre or larger. These lots were purchased by only 33 percent of new homebuyers.⁷
- ✱ According to a July 2001 report by the Center on Urban & Metropolitan Policy at

The Brookings Institution, "between 1982 and 1997, the amount of urbanized land in the United States increased by 47 percent ...During this same period, the nation's population grew by only 17 percent."⁸

- ✱ The amount of working lands in the United States has declined by nearly 20 percent – more than 200 million acres over the last half-century. Further, the rate of conversion has doubled over the last five years. We are now developing almost 2 million acres of farmland and half a million acres of private forest land each year.

In many major metropolitan areas, green space is rapidly disappearing. For example, the Atlanta metropolitan area has lost 25 percent of its tree cover since 1973; the 350,000 acres that have been developed translates to nearly 50 acres of trees lost every day.⁹ From 1970 to 1990, Cook County and the five other counties closest to Chicago experienced a 35 percent increase in developed land, but an increase in population of only 4 percent. Over 450 square miles of agricultural land was suburbanized during this time.¹⁰ Some of our most threatened lands are in rapidly urbanizing counties where we produce nearly 80 percent of our fruit and vegetables and more than half of our dairy products. Rural communities are also affected by development: 60 percent of new homes built from 1994–1997 were built in communities of less than 40,000 people.¹¹

Population Growth Versus Land Development: 1982–1997¹²

U.S. Regions	Change in Population	Change in Urbanized Land
Midwest	7.06%	32.23%
Northeast	6.91%	39.10%
South	22.23%	59.61%
West	32.21%	48.94%
United States	17.02%	47.14%



Photo: USDA NRCS

Consequences of Haphazard Development

Over the past several decades, growth has leapfrogged beyond cities and older suburbs into many areas that were once rural. Today development is converting farms and forests to other uses at an increasingly rapid rate. Too often, this is done without firm land-use plans in place to guide development. The result is urban sprawl.

Human modifications of the land have created fragmented development patterns that threaten native plant and wildlife communities and associated ecological functions and processes. This has led to:

- ☼ LOSS OF NATURAL AREAS — Developing land for houses, roads and other human needs reduces the amount of natural areas. For example, about 25,000 acres of wetlands continue to be lost each year to sprawl. As natural areas diminish, so does habitat diversity. The result is both a decline in the number of species and fewer individuals of those species that survive.

- ☼ FRAGMENTATION OF NATURAL SPACES — As we convert land, we fragment it into smaller and more isolated patches of open space, which greatly alters the way in which natural systems function. Fragmentation increases edge habitat and the isolation between patches while reducing the number and diversity of natural plant and animal species.
- ☼ DEGRADATION OF WATER RESOURCES — Developing wetlands and riparian zones reduces their capacity to control floods, trap sediments, filter out toxins and excess nutrients, and support wildlife and plant species, and it threatens the health of the environment.
- ☼ DECREASED ABILITY FOR NATURE TO RESPOND TO CHANGE — Development has hindered nature’s ability to respond to climatic changes and has reduced population viability for wildlife by reducing genetic diversity and limiting wildlife movement.

In addition to these ecological effects, there are also social and economic consequences of the consumption of open lands and the resulting loss of green space. These include:

- ✿ LOSS OF “FREE” NATURAL SERVICES — Natural systems provide important services, such as flood control, stormwater management and the filtration of pollutants. The loss of natural systems increases the risk of flooding and natural disasters. This, in turn, costs communities billions in mitigation efforts and in disaster relief and recovery.
- ✿ INCREASED COSTS OF PUBLIC SERVICES — Haphazard development often increases the cost of public services by requiring huge investments in new roads, sewers, schools and other public infrastructure.

In addition, the loss of farm and forestlands affects a community’s bottom line. Many studies show that farming and forestry generate considerably higher revenue than the amount of public services they require. Residential development has the opposite effect. Urban sprawl and the inefficient use of land and resources require communities to provide services across a larger geographic area. Because developments and buildings are spread further apart, sprawl stretches municipal services, resulting in scarcer water and higher taxes.

Cost of Service Analysis


Numerous studies across the nation show that farmland, forests and open space generate taxes but require few services. For example, a 1992 American Farmland Trust study of three Massachusetts towns found that residential development costs more in services than it earns in tax revenue, while open space generates more in taxes than it costs to service. Sometimes it makes more economic sense to purchase and preserve open space than it does to allow it to be developed. In the early 1990’s, for example, the city of Huntsville, Alabama purchased a 547-acre tract on Mount Sano for \$3.3 million. The annual maintenance costs for the land were about \$75 an acre. Residential development would have cost about \$5 million for roads, sewers and other infrastructure — or about \$2,500 an acre per year. 



Photo: Gentry/USFWS

Smart Growth

The United States grows by 2.7 million people every year requiring at least 1 million new units of housing each year. As a result, the real question is not whether we will grow, but how and where.

In recent years, an increasing number of communities have attempted to better plan development through smart growth initiatives. Smart growth has been defined as development that is economically sound, environmentally friendly and supportive of community livability — growth that enhances our quality of life. Certainly the sprawl that has resulted from our growing dependence on the automobile and the haphazard spread of strip malls and nondescript subdivisions is not smart growth. Smart growth advocates point out that we can have development that is more attractive, more efficient, more affordable and more environmentally sensitive than much of what has been built since World War II. In fact, a recent study of New Jersey by the Center for Urban Studies at Rutgers University found that the annual operating and maintenance costs for roads, sidewalks, and water and sewer facilities could be reduced by \$400 million a year by developing in a more compact, less land-consuming manner.

What's more, studies by the Brookings Institution and others show that the pace of land development far exceeds the rate of population growth in America. This suggests that the problem is not growth itself, but the pattern of growth; in other words, where we put it, how we arrange it, and how growth impacts natural and cultural resources.

Simply put, some places are better for development than other places. The first principle of better development is figuring out where we should not develop. Green infrastructure planning can help communities figure this out. Taken together, smart growth initiatives and green infrastructure planning are

two sides of the same coin. Communities need to make better use of existing infra-structure and to encourage more compact, walkable, mixed use communities; they also need a framework for shaping where growth will go. This can be provided by green infrastructure.

Smart Conservation

Smart growth programs are designed to address the problems of haphazard development and sprawl. Likewise, we also need smart conservation programs to strategically direct conservation practices. Smart conservation promotes resource planning, protection, and management in a way that is:

- ✱ proactive not reactive;
- ✱ systematic not haphazard;
- ✱ holistic not piecemeal;
- ✱ multi-jurisdictional not single jurisdictional;
- ✱ multifunctional not single purpose; and
- ✱ multiple scales not single scale.

Green infrastructure offers a smart solution to our land conservation challenges because it seeks to plan land development and land conservation *together* in a way that is consistent with natural environmental patterns. In doing this, green infrastructure promotes both smart growth and smart conservation.

Green Infrastructure Functions and Benefits

Green infrastructure systems help protect and restore naturally functioning ecosystems and provide a framework for future development. In doing so, they provide a diversity of ecological, social, and economic functions and benefits: enriched habitat and biodiversity; maintenance of natural landscape processes; cleaner air and water; increased recreational opportunities; improved health; and better connection to nature and sense of place. Well-planned green space has also been shown to increase property values and decrease the costs

CASE STUDY

Smart Growth & Smart Conservation in the State of Maryland

In 1997, Maryland launched its Smart Growth and Neighborhood Conservation initiative, which is designed to rejuvenate existing communities while preserving farms, forests and other open spaces. Central to the success of this initiative are two related ideas. First, the state would no longer provide financial support for haphazard development, but would instead redirect all of its financial resources to existing communities and areas approved for growth. Second, Maryland would take a much more aggressive and strategic approach to preserving open space.

The new strategic approach to land conservation manifested itself in two separate programs. Maryland's Rural Legacy Program seeks to protect large, contiguous blocks of farmland and other rural open spaces by working with local governments and non-profit organizations to define preservation boundaries and then concentrating preservation efforts and funding in these areas. The state's new

GreenPrint Program aims to identify and protect the state's most ecologically sensitive lands.

Although the State of Maryland has worked diligently to conserve its finest natural areas for decades, until the creation of GreenPrint, the efforts were not part of an overall long-term strategy. GreenPrint identifies the state's green infrastructure – a statewide network of large ecologically significant hubs bound together by greenway corridors or links. The state has allotted \$145 million over five years to protect these hubs and links. 🌿



Maryland's Green Infrastructure. Source: Maryland DNR

of public infrastructure and public services, including the costs for stormwater management and water treatment systems.

Investing in green infrastructure can often be more cost effective than conventional public works projects. For example, in the 1990s New York City avoided the need to spend \$6–\$8 billion on new water filtration and treatment plants by instead purchasing and protecting watershed land in the Catskill Mountains for about \$1.5 billion. Likewise Arnold, Missouri, has dramatically reduced the cost to taxpayers of disaster relief and flood damage repair by purchasing threatened properties and creating a greenway in the flood plain.

Two nonprofit organizations, the Center for Neighborhood Technology and Urban Logic, believe a shift in governmental accounting rules may help standardize these examples. In 1999, the Government Accounting Standards Board (GASB) issued comprehensive changes in state and local government financial reporting. The standards, known as "GASB-34," require governments to develop, maintain and present capital accounts in their balance sheets. The two organizations are working with economists, accountants, bond financiers and others to explore using GASB-34 to help capture our natural environment's inherent capital.

Green Infrastructure Planning

Trends Influencing the Shift to Green Infrastructure

In the past, many communities considered open space to be land that has not yet been developed. The legal and philosophical framework of our land use system assumed that land was a commodity to be consumed. Communities that did plan for open space focused almost exclusively on preserving land for parks, which were viewed as a community amenity. Most open space preservation efforts were site-specific and were not undertaken in conjunction with local land use planning. However, in recent years, there has been a dramatic shift in the way government officials think about green space and a growing awareness among local and state governments of the need to plan for green infrastructure.

Trends influencing a shift to a systematic, green infrastructure approach to open space planning include:

- ✱ Increasing recognition of the problems associated with urban sprawl and landscape fragmentation, particularly on the fringe of major metropolitan areas;
- ✱ Federal water quality mandates;
- ✱ Endangered species protection, particularly the emphasis on habitat conservation plans that protect multiple species and link isolated preserves;
- ✱ Public health concerns, including obesity, that have resulted from inactive lifestyles;
- ✱ An increase in the marketability and resale value of homes near protected green space, such as parks and greenways;
- ✱ Urban revitalization, emphasizing the value of natural areas within the city;
- ✱ Smart growth policies and programs at the state, regional and community levels;
- ✱ Development practices designed to promote environmental, social and economic sustainability.

Green Infrastructure Planning Approaches

Just like our built infrastructure, our green infrastructure should be carefully planned, designed, and invested in far in advance of development. Green infrastructure planning should be the first step in the land-use planning and design process. Green infrastructure planning should also be coordinated with planning for gray infrastructure — roads, bike trails, water, electric, telecommunication and other essential community support systems. Integrated planning and design should connect the two in a more effective, economic and sustainable network.

Green infrastructure initiatives should use approaches similar to those used for the planning, design and financing of built infrastructure. Green infrastructure should be:



Photo: Nebel/USFWS

- ✱ DESIGNED HOLISTICALLY – Like our transportation system, green infrastructure should be designed to link diverse green space elements into a system that functions as a whole, rather than as separate, unrelated parts.
- ✱ PLANNED COMPREHENSIVELY – Like our electric power and telecommunication systems, our green space systems need to be planned comprehensively to provide ecological, social and economic benefits, functions, and values.
- ✱ LAID OUT STRATEGICALLY – Like our roads and water systems, our green space systems need to be laid out strategically to cross multiple jurisdictions and incorporate green space elements at each level of government.
- ✱ PLANNED AND IMPLEMENTED PUBLICLY – Like our built infrastructure systems, our green infrastructure systems should be planned and implemented with input from and involvement of the public, including community organizations and private landowners.
- ✱ GROUNDED IN THE PRINCIPLES AND PRACTICES OF DIVERSE PROFESSIONS – Like the design and planning of our transportation, water, electrical and phone systems, green space systems should be based on sound science and should build on the knowledge of professional disciplines such as landscape ecology, urban and regional planning, and landscape architecture.
- ✱ FUNDED UP-FRONT – Like other infrastructure systems, our green space systems need to be funded as a primary public investment. In other words, green infrastructure should be funded up front with other essential services, rather than with money that is left over after all other services have been provided.

Green infrastructure planning should take place at all scales: from the individual parcel, to the

local, regional and statewide scales. At the parcel level this could mean designing homes and businesses around green space. At the community level this could mean creating greenways to link existing parks. And at the statewide level this could mean protecting broad wildlife movement corridors to connect state and national forests.

Benefits of Integrating Green Infrastructure Into the Land Planning Process

Just as there are many benefits to green infrastructure, there are many benefits to utilizing a green infrastructure approach to conservation and development planning. Green infrastructure planning:

- ✱ Recognizes and addresses the needs of both people and nature;
- ✱ Provides a mechanism to balance environmental and economic factors;
- ✱ Provides a framework for integrating diverse natural resource and growth management activities in a holistic, ecosystem-based approach;
- ✱ Ensures that both green space and development are placed where most needed and most appropriate;
- ✱ Identifies vital ecological areas and linkages prior to development in suburban and rural landscapes;
- ✱ Identifies opportunities for the restoration and enhancement of naturally functioning systems in already developed areas;
- ✱ Provides a broad, unifying vision for the future that diverse people and organizations can buy into;
- ✱ Enables communities to create a system that is greater than the sum of its parts;
- ✱ Helps provide both communities and developers with predictability and certainty; and
- ✱ Enables conservation and development to be planned in harmony, not in opposition to one another.

Green Infrastructure Principles

All across America states, regions, communities, private landowners, public agencies, and conservation organizations are working to conserve and restore our country's natural life sustaining system. Although these projects go by many different names (greenway planning and design, ecosystem management, watershed protection, conservation development, habitat restoration, stream improvement, greenprints), successful initiatives are based on common principles and share similar strategies.

What follows are six guiding principles and strategies that have been identified as critical to the success of green infrastructure initiatives. Taken together, these principles provide a strategic approach and framework for conservation that can advance the sustainable use of land while providing an interconnected system of green spaces that

benefit people, wildlife and the economy. They are intended to help provide design, planning, acquisition and other decision-making guidance for community-based sustainable development. It is our hope that planners, developers, landowners, state and local officials, and others will use these principles as benchmarks for incorporating a green infrastructure approach into existing and future plans and policies as well as future land conservation and land development projects.

PRINCIPLE 1: Green infrastructure should be the framework for conservation and development.

Most of our nation's land conservation programs over the last century have focused on the protection of individual parks, preserves, or other isolated areas that have important natural or cultural resources. Today, conservation biology teaches us that these "wilderness" islands are unlikely to meet their conservation objectives. This is because wildlife



Photo: Hollingworth/USFWS

populations cannot flourish if they are isolated and ecological processes cannot function if natural connections are severed. By contrast, roads and other forms of gray infrastructure upon which America's communities depend — and that provide the framework for future growth and development — are planned, built and maintained as a system of inter-connected parts.

By making green infrastructure the framework for conservation, communities can plan for and protect interconnected, green space systems. And where isolated “islands” of nature already exist, green infrastructure planning can help them identify opportunities to restore the vital ecological connections that are necessary for the survival of those protected areas.

Having a green infrastructure strategy also helps planners and developers minimize the adverse impacts that rapid growth can have on ecosystem functions and services, such as the loss of wildlife habitat and migration corridors and the loss of riparian and other natural areas that absorb nutrients, recharge ground and surface water supplies, slow and absorb stormwater runoff, and replenish soils. Protecting green infrastructure up front ensures that existing open space and working lands are seen as part of the community's essential assets and not left vulnerable to development pressures that would leave green infrastructure further reduced and fragmented.

PRINCIPLE 2: Design and plan green infrastructure *before* development.


Restoration of natural systems is far more expensive than protection and preservation of existing landscapes. Because green infrastructure provides the ecological framework for the sustainable use of land, it is essential to identify and protect critical ecological sites and linkages in advance of the planning and construction of roads, houses, stores and other development.

Because restoration is expensive and because man-made wetlands and other restoration projects can cease to function over the long term, planning for and protecting green space systems should come *before* development whenever possible. But in situations in which development has already occurred, it is still important to assess where restoring green infrastructure would benefit people and natural systems. A green infrastructure plan will focus acquisition and restoration priorities and help communities take advantage of opportunities to reconnect isolated habitat islands as existing developed areas and built infrastructure age or other redevelopment opportunities occur.

CASE STUDY

**Protecting Green Infrastructure
Before Development**

MONTGOMERY COUNTY, MARYLAND

Montgomery County (population 800,000) initiated green infrastructure planning for its stream valley park system in advance of the county's rapid growth. The county began buying land along all of its major stream corridors in the 1940s and 1950s — well before land development and population growth had made it impossible to preserve these ecologically important areas. Today the county has a system of stream valley parks encompassing over 25,000 acres. The county has begun adding to this system with a 10-year, \$100 million initiative to complete a county-wide network of open space comprised of protected farmland, stream valley parks, ecological reserves, trail corridors, and green space preserves. 

PRINCIPLE 3: Linkage is key.

The desired outcome for all green infrastructure initiatives is the creation of a green space network that functions as an ecological whole, not as a random assemblage of separate, unrelated parts. The strategic connection of different system components — parks, preserves, riparian areas, wetlands, and other green spaces — is critical to maintaining vital ecological processes and services (e.g., carrying and filtering stormwater runoff, storing and cleaning fresh water, cleaning urban air) and to maintaining the health and biodiversity of wildlife populations. In addition, green infrastructure requires linkages to be made among different agencies, nongovernmental organizations, and the private sector. The Ecological Network of Florida's Statewide Greenways System and the State of Maryland's Green Infrastructure Assessment are examples of green infrastructure network design that is based on this principle.¹³

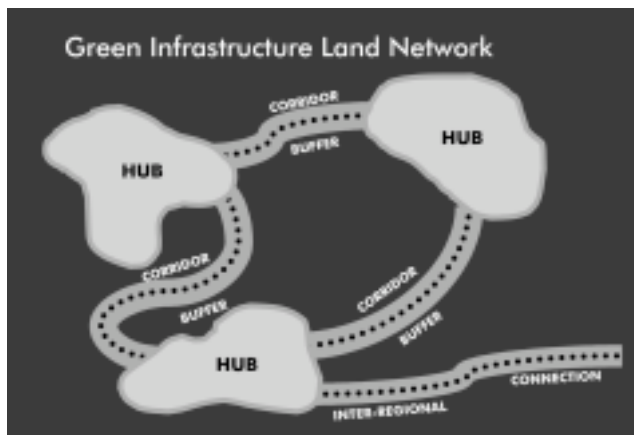
Designing and building the nation's interstate, state, and local highway networks holistically creates a single, functional transportation system that is funded and supported by several different levels of government. Why not design green infrastructure in the same way, taking advantage of natural stream networks and terrain features to create physically connected green space systems that protect and restore vital ecological functions and linkages?



Photo: Gentry/USFWS

STRATEGY: Make connections between green infrastructure initiatives and other activities within and beyond the community.

Linking green infrastructure efforts to statewide, regional and local smart growth programs provides a useful and satisfying framework for development. Integrating green infrastructure with programs that focus on growth and development will aid state and community efforts to protect vital agricultural and other working lands. Partnerships also should be forged among foundations, regional councils, government agencies, universities, non-profits, and other organizations that are already funding projects and initiatives with similar goals to protect, restore, connect, or improve management of natural areas, parks, trails, and greenways.



Source: Maryland DNR

CASE STUDY

Metro Greenways Program

Linking Partners and Programs for
Resource Conservation and Restoration

TWIN CITIES REGION, MINNESOTA

In the past 150 years, urban development in the Twin Cities region has consumed nearly 96 percent of the pre-settlement habitat. Emphasizing the important role of natural resources, in 1998 the Minnesota Legislature established the Metro Greenways program and provided \$4.3 million to plan, protect, and improve significant natural areas in the seven-county metropolitan region.

Administered and coordinated by the Minnesota Department of Natural Resources, Metro Greenways relies on unprecedented partnerships with a wide range of nonprofit conservation organizations, government agencies, institutions, and private businesses and landowners. By assisting local government with planning grants and project funding, the program empowers communities to protect and improve the natural resources that are important to them in a way that earns local support. At the same time, the seven-county scope assures that the individual projects contribute to the existing local and regional park systems as elements of a regional network of green spaces and naturally functioning ecosystems.



PRINCIPLE 4: Green infrastructure functions across multiple jurisdictions and at different scales.

Our nation's transportation, power, telecommunication and other gray infrastructure systems are designed to connect across multiple jurisdictions and incorporate facilities that function at different scales. Likewise, we need to design green infrastructure systems strategically to connect across urban, suburban, rural and wilderness landscapes and incorporate green space elements and functions at the state, regional, community and parcel scales.

Green infrastructure strategies can be used for initiatives of any size or scale, including:

- ✿ The project scale, involving individual parcels and within single real estate developments (e.g., the Fields of St. Croix in St. Elmo, Minnesota or Prairie Crossing in Grays Lake, Illinois);
- ✿ The community scale, supporting local resource conservation and restoration efforts and including park, recreation and other open-space projects (e.g., the Northern Illinois Regional Greenway Plan, which involves six counties in and around the Chicago metropolitan region);
- ✿ The landscape scale, encompassing statewide and national conservation and open space resources (e.g., the Florida Statewide Greenway System for wildlife habitat, water quality, and recreation).

Green infrastructure may be most successful when it functions at multiple scales in tandem. For example, Toronto's "Greening the Portlands" project in Ontario, Canada focuses on major parks, minor parks, wide corridors, narrow corridors, and development parcel landscapes.

CASE STUDY

A Conservation Development Incorporating Green Infrastructure Concepts and Values

PRAIRIE CROSSING, GRAYSLAKE, ILLINOIS

Located 40 miles northwest of Chicago in Grayslake, Illinois, Prairie Crossing is a unique conservation development that shows how green infrastructure can add value to residential development. Prairie Crossing's 362 homes are located on a small portion of the site's 667 acres. The majority of the land is left in open space to protect environmental resources and the site's rural character. The 350 acres of open space include 160 acres of restored prairie, 158 acres of active farmland, 13 acres of wetlands, a 22 acre lake, three ponds, a village green and recreational parks. Prairie Crossing's open space network is the western anchor of a 2500-acre preserved area – the Liberty Prairie Reserve – making it part of a larger protected and functioning ecosystem. The project's design features have generated an estimated 15 percent premium over the local market and competition.



STRATEGY: Work with all levels of government and private landowners at various scales to plan and implement green infrastructure.

Our state and local governments would never fund and construct highway systems without a multi-year transportation plan and an associated public communication plan that lays out all the implementation steps in a logical and orderly fashion. State and local transportation agencies even provide for volunteers to “adopt” highways. The funding, protection and management of our green infrastructure systems deserve the same level of foresight and commitment on behalf of the community. It is important to note that green infrastructure systems do not require or even imply public ownership of all the land in the system. Clearly privately owned land, particularly working farms and forests, can play an important role in any green space system.



Photo: Hollingsworth/USFWS

PRINCIPLE 5: Green infrastructure is grounded in sound science and land-use planning theories and practices.

No single science or planning discipline can lay claim to the evolution of green infrastructure. Instead, theories and practices of many scientific and land planning professions – including conservation biology, landscape ecology, urban and regional planning, landscape architecture, geography, and civil engineering – all contribute to the successful design and planning of green infrastructure systems.

The twentieth century included experimentation with different approaches to protecting our natural resources and environment. Scientists, engineers, and land use planners have come to recognize that natural systems already function efficiently when it comes to protecting our water supply and air resources. With strategic use of environmental design, professionals and laypersons alike are finding that networks of linked natural areas and habitats managed for biodiversity purposes also can protect developed urban and rural areas from natural disasters, can improve the general health of the human community, and can provide recreation opportunities and other public amenities.

STRATEGY: Draw from the theories and practices of a variety of disciplines in designing green infrastructure systems.

A green infrastructure approach employs theories and practices from a diversity of disciplines including conservation biology and landscape ecology, urban and regional planning, and geographic analysis and information systems. Green infrastructure initiatives should therefore engage and incorporate the expertise of professionals from all relevant disciplines.

CASE STUDY

EPA's Southeastern Ecological Framework

Using Conservation GIS to Identify Green Infrastructure in a Multi-State Region

The Southeastern Ecological Framework Project is a geographic information systems (GIS) analysis to identify ecological significant areas and connectivity in the southeast region of the United States. The states included in the project are Florida, Georgia, Alabama, Mississippi, South Carolina, North Carolina, Tennessee, and Kentucky. The project was conducted in 1999-2000 by the University of Florida GeoPlan Center and sponsored by the US Environmental Protection Agency Region 4. Project goals and objectives include:

1. Identifying primary ecological areas that are protected by some type of conservation or ecosystem management program;
2. Identifying a green infrastructure network that connects these primary ecological areas;
3. Identifying the important ecological characteristics of the ecological areas and connecting green infrastructure;
4. Developing an understanding of the spatial scale issues involved in analyzing the ecological connectivity at local, state and regional scales; and
5. Developing protocol for dissemination of the information.

This analysis was conducted using landscape ecology principles and GIS tools. The product of the study can be used by local, state and federal agencies to develop a regional atlas of environmental issues and threats to the natural ecosystems caused by human environmental impacts. State, local and private entities can utilize the information to address various environmental resource allocation areas.¹⁴



PRINCIPLE 6: Green infrastructure is a critical public investment.

The functions, values and benefits of green infrastructure are available for everyone. Creating interconnected green space systems benefits communities by providing land for resource protection and restoration, recreation and other public values. More important, strategic placement of green infrastructure reduces the need for some gray infrastructure, freeing up public funds for other community needs. For example, one third of weekday trail users are commuting in major urban areas with trail systems such as Washington, D.C., Seattle, Wash., and Tampa, Fl., greatly reducing the need for road construction and other expensive transportation infrastructure. Green infrastructure also reduces a community's susceptibility to risk of floods, fires, and other natural disasters. Recognizing the public benefits of green infrastructure is an important first step in providing adequate funding. For all of these reasons, green infrastructure is an appropriate and necessary use of public funds.

STRATEGY: Make green infrastructure a primary budgetary item.

Our nation's gray infrastructure — transportation, water, electric, telecommunication and other essential community support systems — are publicly financed as primary budgetary items, in part to spread the costs of development and upkeep across a large pool of users and to ensure that all parts connect to one another to achieve the design function. State and local governments use dedicated taxes and other public funding mechanisms to pay for the planning, acquisition, construction, maintenance and improvement of our highway systems.

Green infrastructure should be included in the annual budget, as are roads, sewers, and other public works. While not yet on the same funding level as public works, states and communities have begun using conventional

CASE STUDY

Green Topeka

Using Green Infrastructure to Reduce Stormwater Management Costs

TOPEKA, KANSAS

Topeka, Kansas is one of an increasing number of municipalities that are using green infrastructure to enhance the livability of their community with open spaces that work for people and water quality throughout the watershed. One inch of rain over the city of Topeka translates to 940 million gallons of stormwater. As the city became concerned about runoff, it looked to surrounding communities to find solutions. Green Topeka is a partnership between state agencies, local government, nonprofit organizations and other stakeholders that was created in November 2000 to address water quality and quantity concerns. Rather than using expensive concrete channels and underground pipes, the Soldier Creek Watershed, a Green Topeka pilot planning project in North Topeka, is exploring the use of vegetated swales, constructed wetlands and other practices to contain and treat stormwater.¹⁵



mechanisms to finance green infrastructure projects — including bond referenda, real estate transfer taxes, dedicated development fees and direct budgetary line items. The new accounting standard, GASB-34, may be one method to incorporate green infrastructure into a city or state's budget, by highlighting the economic trade-offs between built and natural infrastructure. It is also important to tap resources in state and federal agencies for planning and management activities, including protected public lands that can serve as building blocks for a viable green infrastructure.

STRATEGY: Document and promote the benefits of green infrastructure.


Green infrastructure provides a diversity of public and private functions and values that address both natural and human needs and benefit the environment and communities. These benefits need to be documented, both in terms of their ecological values for people and the environment and their economic values to society. Just as all forms of built infrastructure are promoted for the wide range of public and private benefits they provide, we need to promote green infrastructure systems actively for the wide range of essential ecological, economic and social functions, values and benefits that accrue to people and nature.

Green infrastructure initiatives describe and define the values and functions of interconnected networks of open space in a context that enables citizens to understand the ecological, human, and economic benefits.

CASE STUDY

A Greenprint that Makes Fiscal Sense

PITTSFORD, NEW YORK

In 1993, Pittsford, N.Y. commissioned a fiscal analysis of the revenues and expenses associated with existing and potential land uses. The analysis showed that it would be less expensive to implement a new land use plan rather than continue the current zoning policy. The proposed plan targeted 2,000 acres of land for permanent protection while also creating several enhanced economic development sites for commercial and light industrial expansion. The community supported the plan, recognizing that protection of open space, including purchase of development rights, would cost taxpayers less per year than full build out of the town. Landowners supported the plan because they were compensated for the loss of their development rights. Today, Pittsford has a network of preserved open space that is a regional model.¹⁶ 

PRINCIPLE 7: Green infrastructure involves diverse stakeholders.

The stakeholders of green infrastructure initiatives have diverse backgrounds and needs. Successful green infrastructure efforts forge alliances and interrelationships among various organizations — both public and private. A few examples of how diverse organizations have been brought together for a single purpose:

- ✿ The Chicago Wilderness is a grassroots collaboration of over 100 organizations representing all sectors with an interest in the region.
- ✿ Keep America Growing is designed to create partnerships to balance the demands for growth and development with the protection of vital working lands
- ✿ The Cooper River Wildlife Corridor Initiative in South Carolina uses an agreement for common land management practices with DuPont, Amoco, Medway Plantations, Cypress Gardens, and the Francis Marion National Forest.

Community buy-in is better than mandates or regulations, because community support is lasting and sensitive to the economic value of the land, private property rights and responsibilities, and local home rule.

STRATEGY: Engage key partners and the general public.

By necessity, green infrastructure projects incorporate the experiences and programs of diverse public, private and nonprofit partners. For this reason, it is critical to provide open forums that bring together key individuals, organizations and agencies to coordinate and help guide the activities that will make green infrastructure a reality. To be successful, green infrastructure initiatives must excite people, engage them at the start, and keep them involved.

It is important to involve participants in the

creation of a shared vision that can help drive the process and forge consensus. The community should be engaged in seeking ways to build on its history and existing assets and to extend the benefits into underserved and growing areas.

Successful citizen involvement programs go beyond traditional methods of engaging citizens to find informal and creative ways to get their attention. Among the strategies that might be effective are placing greenspace maps in post offices, libraries, schools, city hall, etc., to invite input, and working with the media to get out the message, as was done in Anne Arundel County, MD. In creating its wetlands plan, the city of West Eugene, OR, used a variety of techniques from the beginning to the end of the project to involve citizens; the city's techniques included direct mailings to landowners, marketing posters, news releases and newspaper stories, public surveys, public hearings.

CASE STUDY

Chicago Wilderness

In 1996, a coalition of organizations launched Chicago Wilderness. Their vision: a thriving mosaic of natural areas (200,000 acres of private, local, state, and federal protected lands connected by greenways and wildlife corridors) embedded within the Nation's third largest metropolitan area. On its sixth anniversary, Chicago Wilderness – once seen as a contradiction in terms – is becoming a reality, mobilizing human diversity on behalf of biological diversity. The partnership now includes over 100 agencies at all levels of government, centers of research and education, community groups, landowners, and conservation organizations that have joined forces and pooled resources to protect, restore and manage Chicago Wilderness.



Photo: McCabe/USDA NRCS

CASE STUDY

The Florida Greenways Commission

A New Vision of the Future

The 40-member, Governor-appointed Florida Greenways Commission engaged representatives of public agencies, conservation nonprofits and the private sector in planning an interconnected, statewide system of greenways and greenspaces that would benefit Florida's people and wildlife. The following statements and graphic portray their concept of Florida's green infrastructure.

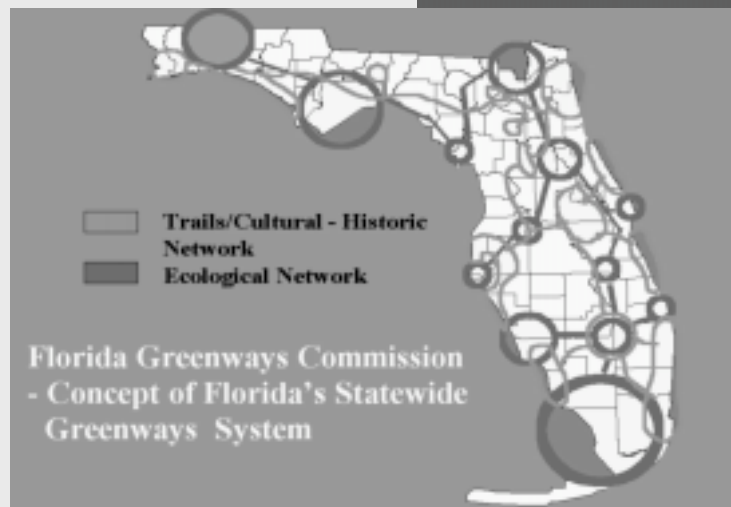
"The Commission's vision for Florida represents a new way of looking at conservation, an approach that emphasizes the interconnected-ness of both our natural systems and our common goals and recognizes that the state's "green infrastructure" is just as important to conserve and manage as our built infrastructure...We believe the recommendations in our report offer Florida an incredible opportunity to create a statewide greenways system that connects

fragmented or isolated elements of the state's green infrastructure, and that connects people with their natural, historic and cultural heritage...A healthy and diverse green infrastructure is the underlying basis of our state's sustainable future...."¹⁷

The Commission's vision statement and graphic guided the subsequent design of the statewide system and the development of its plan for implementation.



Source: University of Florida GeoPlan Center



Source: Florida Greenways Commission

Green Infrastructure Examples

Numerous conservation initiatives are occurring across the United States that embody green infrastructure concepts and approaches. These projects (some of which have been described in this monograph's case studies) encompass a diversity of scales and landscape types. The following are a few examples.

Continental Scale and Multi-State Initiatives

- ✿ Sky Islands Network: a continental scale conservation initiative linking wilderness areas, parks and reserves and crossing the U.S. Mexico border (www.skyislandalliance.org/siwn.htm)
- ✿ Yellowstone to Yukon: a continental scale conservation initiative linking wilderness areas, parks and reserves and crossing the

U.S. Canada border (www.rockies.ca/y2y/)

- ✿ Southeastern Ecological Framework: a regional conservation assessment identifying diverse ecological green space elements throughout the Southeast¹⁸ (www.geoplan.ufl.edu/epa/index.html)

Statewide Initiatives

- ✿ State of Maryland GreenPrint Program: a statewide scale conservation initiative protecting forests, wetlands, river corridors and other critical ecological areas as a part of the state's Smart Growth initiative (www.dnr.state.md.us/greenways/greenprint/)
- ✿ State of Florida Statewide Greenways System: a statewide scale conservation and recreation system that incorporates a linked ecological network designed to benefit Florida's wildlife and people (www.geoplan.ufl.edu/projects/greenways/greenwayindex.html)



Credit: Menke/USFWS

Regional Initiatives

- ✿ Chicago Wilderness Biodiversity Conservation Plan — a regional biodiversity conservation initiative developed by a public, private and nonprofit alliance and incorporating green infrastructure concepts and principles (www.chiwild.org/biodiversity.html)
- ✿ Twin Cities Minnesota Metro Greenways — a regional green infrastructure network design that identifies, protects and restores important ecological resource features in a multi-county metropolitan area (www.dnr.state.mn.us/greenprint/metro-green.html)
- ✿ Portland, Oregon Metro Greenspace Program — a regional conservation initiative that protects and restores natural areas and recreational open spaces through a partnership of state, regional and local government agencies and nongovernmental community organizations (www.metro-region.org/parks/parkfuture.html)

Local and Community Initiatives

- ✿ Montgomery County, Maryland, Legacy Open Space — a comprehensive open space initiative that will target and protect exceptional resource lands over a 10 year period (www.mc-mncppc.org/legacy/index.html).
- ✿ Palm Beach County, Florida, Linked Open Space Network — Conservation Greenways/Wildlife Corridors — a community open space and land conservation effort that incorporates a system of conservation greenways, wildlife corridors, trails and other conservation and recreational spaces that benefit both the environment and the community (www.pbcgov.com/pzb/).
- ✿ Kinston/Lenoir County, North Carolina, Green Infrastructure Plan — a community green infrastructure plan encompassing conservation and recreation objectives as

CASE STUDY

Metropolitan Greenspaces Program

Natural Resource Conservation
in Urban Environments

PORTLAND, OREGON

In the late 1980's, a group of representatives from the metropolitan regional government (Metro), non-profit organizations, local governments and citizens formed to collaborate on greenspace protection in the region around Portland, Oregon and Vancouver, Washington. As a result of their efforts, Federal funding was allocated to establish a formal partnership between the U.S. Fish and Wildlife Service and Metro to initiate the Metropolitan Greenspaces Program. The program focuses on environmental education, habitat restoration, public outreach and regional planning throughout the bi-state, four-county metropolitan area. This partnership serves as one of only two national demonstration programs involving the Fish and Wildlife Service as a partner in local natural resource conservation efforts in urban environments.

Initially, the Metropolitan Greenspaces Program supported natural area inventories and mapping to develop a strategic conservation plan for the Metropolitan region. In 1995, voters approved a \$135.6 million bond measure to implement the plan by publicly acquiring an extensive network of trails and greenspaces. Continued program funding of \$300,000 annually has supported three grant programs and enabled the Fish and Wildlife Service to participate in regional planning and policy development efforts. Under the auspices of the program, a variety of integrated regulatory and non-regulatory tools are being used to protect greenspaces, water quality, floodplains, and fish and wildlife habitat.¹⁹



well as hazard mitigation (<http://www.greeninfrastructure.net/kinston-lenoir.htm>).

Conservation Developments

- ☼ Prairie Crossing, Liberty Prairie Preserve, Gray's Lake, Illinois – A conservation development that incorporates green infrastructure design principles and is linked to a local open space preserve that conserves diverse ecological resources and provides recreational trail opportunities (<http://www.prairiecrossing.com/>).

Other Examples

- ☼ Other project examples as well as additional information about green infrastructure concepts and approaches can be viewed at <http://www.greeninfrastructure.net>



Photo: Cooper/USFWS

CASE STUDY

Green Infrastructure Plan

Linking Hazard Mitigation to Community Conservation and Recreation Objectives

KINSTON/LENOIR COUNTY, NORTH CAROLINA

Developed by graduate students at the University of North Carolina, the Kinston/Lenoir County Green Infrastructure Plan for the Neuse River Floodplain seeks to identify opportunities to maintain, restore, and provide new green infrastructure along the Neuse River floodplain and adjacent areas in Lenoir County and the city of Kinston. The area suffered considerable damage from flooding caused by Hurricanes Fran and Floyd. The local governments have used Federal Emergency Management Agency (FEMA) disaster relief funds to purchase many damaged properties lying in the floodplain.

The plan uses green infrastructure planning principles and complements existing community projects and goals such as the Kinston-Lenoir County Parks and Recreation Master Plan and the Greater Kinston Urban Area Growth Plan. The components of the Green Infrastructure Plan present ideas for how the Neuse River and its floodplain can provide Lenoir County and Kinston with additional recreational and environmental amenities. The governments can use the plan as a way to continue their flood mitigation work by turning vacant buyout areas into a network of parks, trails and habitats along the Neuse River and the Adkin Branch stream that connects downtown Kinston and others areas in the community.²⁰

Green Infrastructure Versus Traditional Conservation

Many people believe that green infrastructure represents the next generation of conservation action because it forges an important connection between land conservation and land use planning. Traditional land conservation and green infrastructure planning both focus on environmental restoration and preservation, but green infrastructure also concentrates on the pace, shape, and location of development and its relationship to important natural resources and amenities. Unlike more conventional conservation approaches, green infrastructure strategies actively seek to promote more efficient and sustainable land use and development patterns, as well as protect natural ecosystems.

As described in the principles and strategies section, green infrastructure differs from traditional conservation efforts in the following ways:

- ✿ It focuses on the protection of connected

natural ecosystems as the framework for both conservation and development.

- ✿ It recognizes that physical linkage between green space elements is key to sustaining natural ecosystems and landscape processes.
- ✿ It emphasizes the importance of planning and protecting green infrastructure before development.
- ✿ It recognizes the need to connect green space elements across multiple jurisdictions, scales and landscape types.
- ✿ It focuses on the creation of a green space vision that excites and engages people and guides implementation actions.
- ✿ It considers the needs of both nature *and* humans – addressing both the environmental effects of proposed development and the economic well-being of a community.

In doing all of these things, green infrastructure also helps provide a framework for development, ensuring that developers, citizens and communities capture the cost advantages of location and create and protect community amenities.



Photo: Alexander/USDA NRCS

Conclusion

Every state and local government has a long-range transportation plan. Growing communities also have detailed plans for improving their airports, sewage treatment plants, telecommunications facilities and other public infrastructure. Just as these communities need to upgrade and expand their gray infrastructure, so too they need plans to upgrade and expand their green infrastructure.

Green infrastructure plans provide a blueprint for conservation in the same way that long-range transportation plans provide a blueprint for future roads or transit lines. Green infrastructure plans can create a framework for future growth while also ensuring that significant natural resources will be preserved for future generations. Green infrastructure plans can even reduce opposition to new development by assuring civic groups and environmental organizations that growth will occur only within a framework of expanded conservation and open space lands.

Savvy states and communities are starting to think about green space in a more thoughtful and systematic way. They realize that green infrastructure is not a frill – it is smart conservation for the twenty-first century.



Photo: Hollingworth/USFWS

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