


Green Infrastructure

by Edward T. McMahon

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 optics 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.

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."

Just as growing communities need to upgrade and expand their gray infrastructure (i.e. roads, sewers, utilities), so too, they need to upgrade and expand their "green" infrastructure – the network of open space, woodlands, wildlife habitat, parks and other natural areas, which sustain clean air, water, and natural resources and enrich their citizens' quality of life.

According to Charles Little, author of *Greenways for America*, the concept of green infrastructure began 130 years ago with Frederick Law Olmsted, Sr., the designer of New York's Central Park as well as Boston's Emerald Necklace.  "No single park," Olmsted believed, "would provide people with all the beneficial influences of nature." Instead, parks should be linked to one another and to surrounding residential neighborhoods.

Likewise, more than 60 years ago the South African Wildlife Society recognized the importance of connections to maintaining the continent's wildlife. By the 1960's, U.S. ecologists had become believers in the need to create an "integrated conservation system" that protects wildlife while maintaining natural landscape processes.

Both of these concepts – Olmsted's linking chains of parks, and ecologists' linking conservation areas to counter

habitat fragmentation – have come together in planning for systems of green space.

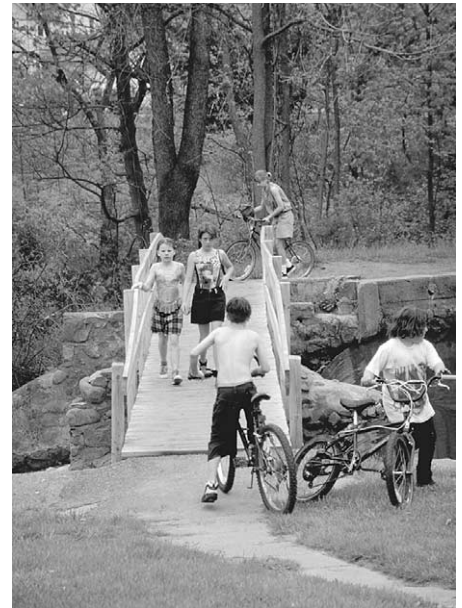
In recent years, there has been a growing awareness by local and state governments of the need to plan for green infrastructure. In his Inaugural Address in January 1999, Maryland Governor Paris Glendening said, "Just as we must carefully plan for and invest in our capital infrastructure – our roads, bridges and waterlines, we must also invest in our environmental or green infrastructure – our forests, woodlands, streams and rivers. Just as we must carefully plan for and invest in our human infrastructure – education, health services, care for the elderly and disabled – we must also invest in our green infrastructure."

The concept of green infrastructure represents a dramatic shift in the way local and state governments think about green space. In the past, many communities assumed that open space was land that had simply not been developed yet, because no one had filed a subdivision plan for it. This view was reinforced by the legal and philosophical framework of our land use system which assumed that land was a commodity to be consumed.

Communities that planned for open space primarily thought about preserving land for parks. And these parks were often viewed as a community amenity, an extra, even a frill. Likewise, until recent years, most open space preservation efforts were site-specific in their orientation: develop a park here, protect a natural area there. Today, however, a growing number of communities are recognizing not just that green space is a basic community necessity, but that it should be planned and developed as an integrated system.¹

TRENDS INFLUENCING THE PROCESS

What are some of the trends that are causing this shift to a systematic, green infrastructure approach to open space planning?



Greenways can give kids a safe place to walk or ride a bike.

- **Landscape Fragmentation** – Increased urban sprawl has caused the rapid fragmentation of land, particularly on the fringes of major metropolitan areas. Citizens have reacted to this trend by demanding that policymakers take steps to preserve open space and channel growth.²

- **Federal Water Quality Mandates** – Clean water standards mean that natural drainage systems have become more important as urban waterways and wetlands are protected.

¹ In 1991, the National Recreation and Park Association joined forces with the American Academy for Park and Recreation Administration to publish *Park, Recreation, Open Space and Greenway Guidelines*. The report noted that economic, demographic, technological and development trends over the past decade had profound implications for open space planning – and required a change in "our entire philosophy of planning for parks and open space" to encompass a "systems approach."

² According to the U.S. Department of Agriculture's recently released *1997 National Resources Inventory*, the loss of farmland and other open space to development has more than doubled in recent years. Between 1992 and 1997, the rate of loss grew to 3.2 million acres a year.

- **Endangered Species Protection** – Conservationists originally focused on preserving individual species and their habitat. Today, there is an emphasis on habitat conservation areas that protect multiple species and link isolated preserves.

- **Public Health Concerns** – More than 50 percent of U.S. adults are overweight and nearly 18 percent are obese. The Centers for Disease Control and Prevention have recommended more places to walk and bicycle as an antidote to inactive lifestyles.³

- **“Close-to-Home” Green Space** – More homebuyers today favor housing developments that include green space, biking and pedestrian paths, and natural areas. *Editor’s Note: For more on this, see the section on green space as a residential amenity in McMahon’s “Smart Growth Trends” column in PCJ #33 (Winter 1999).*

- **Urban Revitalization** – Strategies for revitalizing urban cores are increasingly emphasizing the value of natural areas within the city such as waterways, parks, and other green corridors.

- **Sustainable Development** – Growing public interest in so-called “green” or sustainable development is reflected in emphasis on multi-modal transportation planning, support for bicycle and pedestrian facilities, and other policies aimed at reducing fossil fuel consumption.

The systems planning approach focuses on creating a comprehensive and interrelated system of parks, recreation areas, open spaces, and greenways that: respond to locally-based needs, values, and conditions; provide an appealing and harmonious environment; and protect the integrity and quality of surrounding natural systems.

³ Centers for Disease Control research, published in the Oct. 13 1999 issue of the Journal of the American Medical Association, found that obesity (defined as being over 30 percent above ideal body weight) accounts for more than 300,000 premature deaths each year in the U.S., second only to tobacco-related deaths. The proportion of the population classified as obese increased from 12 percent in 1991 to 17.9 percent in 1998. According to Jeffrey P. Koplan, Director of the CDC, “obesity is an epidemic and should be taken seriously ... urban policymakers must provide more sidewalks, bike paths, and other alternatives to cars [as] restoring physical activity to our daily routines is critical.”

This approach is now being considered by local governments all over the country. For example, Montgomery County, Maryland has just proposed 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 greenspace preserves. Likewise, Cleveland Metroparks is composed of 14 largely undeveloped woodland reservations totaling almost 20,000 acres, linked by a network of parkways, bike trails, and stream corridors. This system accommodates over 40 million visitors a year and is often referred to as Cleveland’s Emerald Necklace. Similar open space systems are being developed in big and small communities nationwide.

WHAT DOES GREEN INFRASTRUCTURE LOOK LIKE?

Dr. Mark Benedict of the National Conservation Training Center in Shepherdstown, West Virginia (and former Director of the Florida Greenways Program) says 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

Green infrastructure hubs come in all shapes and sizes and serve different purposes. For example:

- **Reserves** – Large protected areas, such as national wildlife refuges or state parks, serve as primary sites for conserving biological diversity and natural

resources such as fisheries and fresh water. Reserves can also protect important historical and cultural sites, and provide nature-based recreation opportunities.

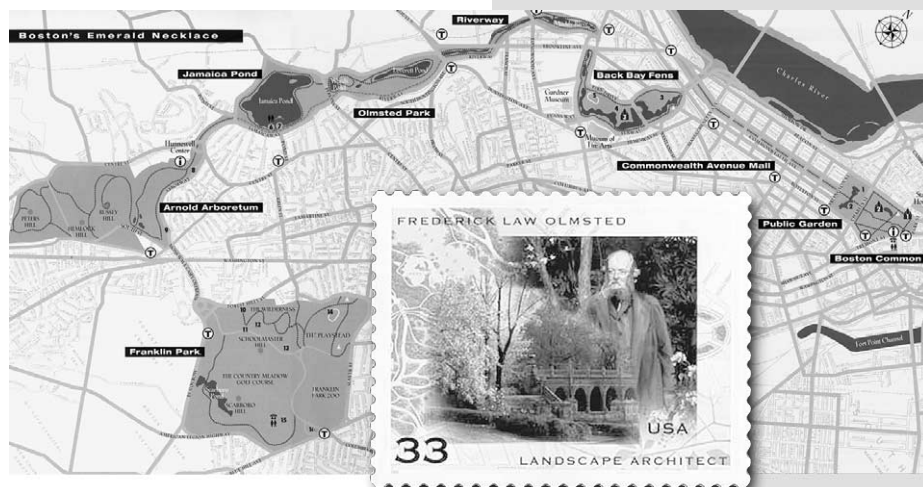
- **Managed Native Landscapes** – Large publicly owned lands, such as our system of National and State Forests, managed for resource extraction as well as natural and recreational values.

- **Agricultural Preservation Districts** – A number of states have recognized the importance of protecting large blocks of contiguous working farmland. This minimizes conflicts between farmers and suburban homeowners while providing farm machinery and seed dealers with the critical mass of farmland they need to stay in business.

continued on page 6



Boston’s “Emerald Necklace,” a system of interconnected parks, natural areas, drives, and promenades, was designed by Frederick Law Olmsted, one of America’s earliest, and most prominent, landscape architects. The greenbelt extends in a nine-mile long semi-circle around the heart of Boston. For over one hundred years it has provided residents and visitors relief from the pollution, noise, and stress of city life. The Emerald Necklace, and its cousins in other cities across the country, continue to demonstrate the long-term benefits that planned green infrastructure can provide for metropolitan areas.



Green Infrastructure

continued from page 5

- **Regional Parks and Preserves** – Less extensive hubs of regional significance, like the forest preserve system in Cook County, Illinois, provide ecological benefits and conserve biological diversity as well as offer important compatible resource-based recreational opportunities.

- **Cultural/Historic/Recreational Sites** – Community parks or cultural/historical sites that provide recreational opportunities, help protect and interpret a community's heritage, and can often serve as an origin or destination for a recreational trail.

- **Trailheads** – Selected ecological, recreational, or cultural/historical sites with appropriate visitor services that serve as points of origin or destination linked by trail corridors. Trailheads can occur within rural natural areas and working landscapes or within urban areas ranging from large metropolitan areas to small communities. Trailheads serve as human hubs within greenways systems.

Links

Many different types of landscape links can go into creating a system of green space. For example:

- **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 can also provide space for the protection of historic sites and opportunities for human use like hunting, fishing, canoeing, and hiking.

- **Conservation Corridors** – Less extensive linear protected areas, such as river and stream corridors, serve as biological conduits for wildlife and, in many cases, also provide opportunities for compatible outdoor, resource-based recreational activities.

- **Greenbelts** – Protected natural lands or working landscapes, such as the one around Boulder Colorado, serve as a framework for development while also preserving native ecosystems and/or productive farms or ranchland and directing urban and suburban growth.

- **Trail Corridors** – Designated routes, such as rail-trails and greenways, provide access to and appreciation of the values of natural areas and other green spaces, present diverse resource-based outdoor recreational opportunities, and enhance the understanding of historical sites and

cultural diversity. Trail corridors include linear urban open spaces that accommodate moderate to intense recreational use for residents and visitors.

- **Utilitarian Corridors** – Linear features, such as powerline and pipeline rights-of-way and canals, can provide a way of connecting recreational, cultural or natural system features. Addison Texas, for example, has created an outstanding park system using utility rights of way, while communities in New York have used the Erie Canal as the backbone for a series of linear park and recreation areas.

WHAT ARE THE BENEFITS OF A GREEN INFRASTRUCTURE PLAN?

Green infrastructure initiatives provide a blueprint for conservation the same way 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 and cultural 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 open space and conservation lands.

Investing in green infrastructure can also be much more cost effective than building conventional public works projects. Consider flood control. The U.S. Army Corps of Engineers estimates that flood damage in the United States averages more than \$4 billion a year. Despite massive investments in dike and levee systems, many communities have learned the limitations of structural approaches to flood control. In fact, it is far less expensive to buy or otherwise protect floodplain land. Arnold, Missouri, for example, has dramatically reduced the cost to taxpayers of disaster relief and repairing flood damage by purchasing threatened properties and creating a greenway in the flood plain.

Similarly, green infrastructure can provide a less costly way of assuring safe drinking water. New York City, for example, avoided the need to spend between \$6 and \$8 billion on new water filtration and treatment plants by instead purchasing



Built between 1828 and 1850, the 185 mile long C&O Canal runs from Washington, D.C. to Cumberland, Maryland.

and protecting watershed land in the Catskill Mountains for about \$1.5 billion.

HOW CAN A COMMUNITY CREATE GREEN INFRASTRUCTURE?

Green infrastructure is being created at all scales: state, regional, metropolitan area, and local community. Green infrastructure networks can be divided into three separate but interrelated components: ecological networks, working landscapes, and outdoor recreation and trail networks. Florida's statewide greenways plan uses an integrated landscape approach to identify an ecological network of natural hubs, linkages, river corridors, and coastlines – as well as a recreational/trail system connecting parks, urban areas, and cultural sites.

Maryland, the state which the Sierra Club ranks first in open space protection, has developed a "green infrastructure assessment system" to help identify and prioritize areas for conservation and restoration. The goal of this system is to target areas of greatest statewide ecological importance as well as areas under the most intense development pressure. The state has also established a Rural Legacy Program that is working to create strategic open space reserves with an emphasis on greenways, greenbelts, and agricultural preservation districts.

At the local level, different communities have taken different approaches to green space protection. The town of Pittsford, New York, population 25,000, provides a good illustration of how a small community can create a network of green space. Pittsford, a 24 square mile suburb of Rochester, has implemented an award winning green infrastructure plan that grew out of a concern with the loss of its agricultural and green space resources.

Pittsford's "Greenprint" plan began with a community visioning process that identified the working agricultural and natural landscapes that were an essential part of the town's character. In 1993, Pittsford commissioned a fiscal analysis of the revenues and expenses associated with existing and potential land uses. The analysis demonstrated that it would be less expensive to implement a new land use plan rather than continue the



Building a greenway in Georgia's Amicalola Falls State Park off the Appalachian Trail.

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.

Pittsford's plan is one model for small communities on the metropolitan fringe. But savvy communities of all sizes are starting to think systematically and long term about green space. They realize that green space is not a frill – it is a basic community building block. ♦

Edward McMahon is a land use planner, attorney, and director of The Conservation Fund's "American Greenways Program." He is former president of Scenic America, a national non-profit organization devoted to protecting America's scenic landscapes. McMahon's column appears regularly in the PCJ.



Resources:

Greenways for America by Charles Little. John Hopkins Press, 1990, 1995. The first comprehensive book on greenways. Discusses their origins and history. Details their benefits. Describes model projects from coast-to-coast: riparian greenways, paths and trails, wildlife movement corridors, heritage corridors, and metropolitan greenway systems.

Greenways: A Guide to Planning Design, Design, and Development by Chuck Flink, Loring Schwarz, and Robert Searns. Island Press, 1993. A "soup-to-nuts" guide to the practical issues involved in planning and designing greenways and trails. Offers guidance on the overall process of greenway creation while detailing each step along the way.

How Greenways Work: A Handbook on Ecology by Jonathan Labaree. National Park Service and the Atlantic Center for the Environment, 1993. This handbook introduces readers to the ecological dimensions of green infrastructure. Discusses the ecological impacts of land development and the functions of corridors.

Landscape Ecology Principles in Landscape Architecture and Land Use Planning, by Wenche Dramstead, James Olson, and Richard Forman. Island Press, 1996. This book summarizes principles of landscape ecology and planning over a range of spatial scales.

All of these publications are available from The Conservation Fund's, American Greenway's Program, 1800 N. Kent Street, Suite 1120, Arlington, VA 22209, 703-525-6300. The Fund, in partnership with the U.S. Forest Service, is also developing a pilot course on Green Infrastructure for elected officials and natural resource professionals to be offered at the National Conservation Training Center (NCTC) in Shepherdstown, West Virginia next Winter. For more information contact Dr. Mark Benedict at the NCTC, 304-876-7461.

Green Infrastructure is a concept originating in the United States in the mid-1990s that highlights the importance of the natural environment in decisions about land use planning. In particular there is an emphasis on the "life support" functions provided by a network of natural ecosystems, with an emphasis on interconnectivity to support long term sustainability. Examples include clean water and healthy soils, as well as the more anthropocentric functions such as recreation and providing shade and Green infrastructure is a cost-effective, resilient approach to managing wet weather impacts that provides many community benefits. While single-purpose gray stormwater infrastructure—conventional piped drainage and water treatment systems—is designed to move urban stormwater away from the built environment, green infrastructure reduces and treats stormwater at its source while delivering environmental, social, and economic benefits.