

CHAPTER 4

GREEN SERVICES: LETTING NATURE DO THE WORK

Nature's ecosystems have 3.85 billion years of experience in creating efficient, adaptive, resilient, sustainable systems. Why reinvent the wheel, when the R&D has already been done?
Gil Friend, CEO of Natural Logic¹

When Beth Dowdle, an urban planner and environmentalist, arrived in Florida in the 1990s to work on the future of the Loxahatchee River watershed, a 500,000-acre basin critical to the Palm Beach area, she went to the headquarters of the South Florida Water Management District, the government agency responsible for the region's water system. "It's something out of a science fiction movie," she recalls, "a big command center, a huge, very modern building in the suburbs, adjacent to the airport. I was in a room full of TV monitors watching the weather—lots of buttons, bells and whistles. You have to be cleared to go inside. When big storms come through, they hunker down in there to manage the water system."

Dowdle spent some time looking at a large map of south Florida, talking with one of the district's hydrological engineers. "Their maps are exquisite—satellite imagery maps. I'm seeing a beautiful wetlands mosaic: the river, canals, the whole Loxahatchee watershed." After a while, she turned to the engineer. "Which way is the water flowing?" she asked.

The engineer laughed. "We can make it move any way you want it to."

Here was a classic example of the human urge to control nature—to engineer and harness it—for human ends. For most of the 20th century engineers had directed the slow flow of water in Florida's huge Everglades, draining and damming to make dry land for development of housing and entire communities. Nowhere has this man-over-nature mindset been more apparent than in the case of the City of New Orleans. Nearly 300 years ago the first levees, four to six feet high, were built along the Mississippi River to protect the city from floods.

But, as John Barry recounts in *Rising Tide*, "levee building never stopped. Levees were extended above and below New Orleans, then to the opposite bank. Those levees increased the pressure on old ones. The reason is simple: when the river was leveed on only one bank, in flood it simply overflowed the opposite bank. But with both banks leveed, the river could not spread out. Therefore, it rose up. Thus, the levees, by holding the water in, forced the river higher. In turn, men tried to contain the flood height by building levees still higher. By 1812, levees in Louisiana began just below New Orleans and extended 155 miles north on the east bank of the river and 180 miles on the west bank. By 1858, levees on the two sides of the river totaled well over 1,000 miles."²

To control the Mississippi River, Barry continues, "was the perfect task for the nineteenth century. This was the century of iron and steel, certainty and progress, and the belief that physical laws as solid and rigid as iron and steel governed nature, possibly even man's nature, and that man had only to discover these laws to truly rule the world. It was the century of Euclidean geometry, linear logic, magnificent accomplishments, and brilliant mechanics. It was the century of the engineer."³

At the beginning of the 21st century, however, a new approach—green services—rejects engineered solutions in favor of "letting natural systems do the work."

Defining Nature's Services

On a sunny spring morning in 1999, biologist and writer Daniel Botkin attended a riverside ceremony in Augusta, Maine, to watch something that had never happened before in the United States. A hydropower dam, built across the Kennebec River in 1837, was to be removed—the first intentional elimination in American history.

“Just after 9:00 am,” Botkin reports, “a bell, tolling along the shore, was answered by a big bell in the Augusta church, announcing the time to breach the dam. The diesel shovel dug deeper and deeper into the temporary earth dam until a shout went up from the crowd and water began to spill through. The thin trickle breached the dam and eroded rapidly downward, moving ever faster. A frothy-brown mud-laden torrent began to run down the far side of the Kennebec, tumbling against an old mill building and spreading its color into the main channel. The river began to clean itself of a century and a half deposits behind the old dam.”⁴

Destroying the 917-foot-long, 23-foot-high Edwards Dam and restoring the river’s natural system—17 miles had been underwater—was not an act of generosity toward nature. It was a calculation of human self-interest arising out of a new analysis, call it a “green cost-benefit equation,” which replaces the logic that led to blocking the river. Originally built to support lumber mills upriver, by the end of the 20th century the dam’s affect on the river had destroyed rich fish spawning grounds. Yet it produced little electricity and made no contribution to irrigation or flood control. In 1997, the federal government refused to renew the dam owners’ license, ordering the company to take it down or spend nearly \$10 million to repair the environmental problems. Removing the dam would save migrating fish, restore the river’s habitat, and improve fishing and boating. The calculation, says Botkin, was based on “a matter of a change in our society’s needs and desires. . . . The dam and its mills no longer provided prosperity for Augusta, but threatened migrating fish like shad, which are in trouble along the coast. The majority of people wanted the river back. We could, one hopes, depend on other sources for energy. The river could return as a renewable resource for living things.”⁵

It’s obvious that communities depend on nature, but we tend not to see the many ways that the natural *ecosystems* within which communities are nested create benefits by their very existence,⁶ rather than because we engineer them into something useful. Ecosystems “maintain biodiversity and the production of *ecosystem goods*, such as seafood, forage, timber, biomass fuels, natural fiber, and many pharmaceuticals, industrial products,” explains biologist Gretchen Daily in her introduction to the groundbreaking *Nature’s Services*. An initial list of ecosystem services, she continues, includes: purification of air and water; mitigation of floods and droughts; detoxification and decomposition of wastes; generation and renewal of soil and soil fertility; pollination of crops and natural vegetation; control of the vast majority of potential agricultural pests; maintenance of biodiversity; protection from the sun’s harmful ultraviolet rays; and moderation of temperature extremes.⁷

More specifically, the Kennebec River, unplugged, produces fish. Riverside land along rivers sucks up floodwater, while watersheds—forests, rivers, lakes, wetlands—clean the water for consumption downstream. “Wetlands are nature’s sponges, soaking up floodwaters, reducing flood heights, and protecting water quality,” says Brett Hulsey of the Sierra Club. “It just makes sense to restore our wetlands and streams rather than pay billions for dirty water, flood and crop damage, and moving people out of floodplains.”⁸

Imagine a forest around a rural community or an “urban forest” spread throughout a city. We usually perceive the value of the forest as the wood it produces or the land that can be converted for development or farming. But, points out Constance Best, cofounder of the Pacific Forest Trust, forests also provide habitat for species; pollination for agriculture; carbon sequestration for climate stabilization; and soil formation; in addition to water for consumption, power generation, and flood protection.⁹

The idea of ecosystem services, first raised prominently in the 1970s, took decades to evolve through experimentation and analysis into a set of innovative practices whose environmental and financial value could be estimated.¹⁰ These innovations fall into three categories:

Green Infrastructure uses natural systems instead of “gray infrastructure”—dams and sewers, for instance—to provide essential, large-scale “utility” services such as stormwater control. Jeff Olson and Gary Moll, in an article for *Livable Communities*, summarize the indictment of gray infrastructure: “Gray infrastructure is impervious and inert. When impervious surfaces dominate a city’s structure... their interaction with natural cycles of air and water become a costly problem. Impervious surfaces repel water quickly, causing flooding, expensive stormwater management problems, and lowering water quality. The gray infrastructure also heats up on hot summer days and holds its heat late into the evening. The added heat causes people to use air conditioning longer during the day straining local utility capacity.”¹¹

“Green infrastructure,” says Steve Wise, natural resources program manager for the Center for Neighborhood Technology (CNT), “is the interconnected network of open spaces and natural areas—greenways, wetlands, parks, forest preserves, and native plant vegetation—that naturally manages storm water, reduces the risk of floods, captures pollution, and improves water quality. In cities and other urbanized areas, that network can be extended by means of rain gardens, green roofs, tree planting, permeable pavement, and other landscape-based drainage features. They restore, protect, and mimic natural hydrologic functions within the built environment.”¹²

Green Building invents and uses building materials and methods that take advantage of natural services to reduce energy consumption and generate environmental benefits. From green roofs above to organic fertilizers on the lawns below, and windows that increase natural lighting in between, green-building innovations are gaining appeal in markets and a place in communities’ building codes.

Green Production designates and manages large-scale “working landscapes” (forests and farmland, in particular) to generate products and services in ways that sustain natural systems rather than erode or set aside their productive capacity. For instance, in chapter 2 we saw the town of Canterbury, New Hampshire, vote to increase its property taxes so it could buy and maintain the agricultural use of hundreds of acres in the community. This prevented the landscape from being developed for housing, which would reduce its environmental benefits and capacity. But it also kept the land in productive economic use, rather than setting it aside for preservation.

From Gray to Green (Infrastructure)

Sometimes greening the infrastructure starts by dismantling gray infrastructure, as with the Edwards Dam removal in Augusta. In 2001, four decades after the U.S. Army Corps of Engineers dammed Florida’s Kissimmee River for flood

control, destroying 30,000 acres of wetland, it reversed course and removed the last dam as part of restoring 43 miles of the river back to its original bed.¹³ More recently, in May 2009, the biggest levee-busting effort in the U.S.—16,000 acres in northern Louisiana—commenced when the Ouachita River broke through the man-made barrier, before bulldozers could do the job, and spread across a floodplain newly planted with thousands of trees. Crews with heavy-equipment were to finish the job a few months later. Then, says George Chandler, a federal Fish and Wildlife Service official in North Louisiana, “whenever the river comes back up we will have normal flows of water that will return to these bottomlands out there. It will rise and fall with the rhythm of the river.” Planners expect that the green infrastructure will absorb river overflows in the floodplain, thereby reducing flood threats for communities downstream.¹⁴

Dismantling infrastructure isn’t just about restoring natural water systems. Communities in the west, for instance, are removing rusting fences that prevent wildlife migration. Milwaukee tore down the one-mile Park East Freeway along the Milwaukee River to give residents and developers better access to the riverfront.¹⁵

But water is the main arena in which green infrastructure replaces gray. Communities across the nation are using green infrastructure to get the clean water they need. New York City, for instance, has spent \$170 million since 1997 to buy 70,000 acres abutting streams and rivers in the Catskill Mountains that feed into city-owned reservoirs. It also reached agreement with 70 upstate communities to invest in improving the capacity of the 1-million acre watershed that provides the city’s water. The alternative was an engineering solution, the construction of a water treatment plant mandated by the federal Environmental Protection Agency, with a \$6 billion price tag. “Many cities,” reports *The Wall Street Journal*, “are finding that it is cheaper to buy land to help keep water supplies clean than to build expensive treatment plants.” In Texas, Austin and San Antonio paid more than \$125 million for 27,000 acres of land atop the Edwards Aquifer, which is susceptible to contamination that could come from development of the land. The cities planned to spend at least that amount again to snatch up more land. In Massachusetts, the state government spent \$120 million to buy 20,000 acres around two reservoirs that supply greater Boston. In a similar acknowledgment of the value of existing “environmental services,” the federal government provides incentives and financial resources for state and local governments to set aside “conservation reserve” land to minimize both sprawl and excessive construction of storm water management facilities.

In other places, green infrastructure protects the community from potential water damage. After the Mississippi River drowned Davenport, Iowa, a community of 100,000, in 1993, again in 1997, and once more in 2001, the city refused to build a permanent flood wall to keep the water out. “We’re trying to work with the river and not trying to tame it,” declares Mayor Bill Gluba. Since the 1960s, federal officials had pushed Davenport to construct a levee, which would cost tens of millions of dollars. But Davenport and other cities are learning to live with the river’s natural cycles: instead of building levees and other barriers, they are moving houses and other facilities out of the flood plain and prohibiting new construction. Grafton, Illinois, for instance, used federal funds to buy out homeowners near the river and build homes on a bluff; most of the riverfront has been turned into parkland. Grand Forks, North Dakota, pursued a similar strategy after it was flooded catastrophically by the Red River, building a 2,200-acre greenway of dikes and flood walls along both sides of the river, disguised as a wooded, open space with a trail, picnic shelters, and campgrounds—

instead of allowing riverside homes to be rebuilt.¹⁶ Around St. Louis, after the historic Mississippi flood of 1993, the federal government bought low-lying land and bought out thousands of homeowners to turn the flood-prone land into parks and undeveloped areas.¹⁷

Davenport remains vulnerable to the Mississippi, of course. In April 2008, the river flooded a city park and shut down a freight-rail line. But few other structures are within reach of rising waters, and the city plans to develop more of the waterfront with special landscaping to make cleaning up after floods easier.¹⁸

In the Great Lakes region, just a few years ago, more than 120 cities were legally required by the federal Environmental Protection Agency to redo their combined sewer infrastructure for capturing and handling storm water and sewage. Detroit faced a \$3.2 billion cost for the new infrastructure, Cincinnati \$1 billion, Fort Wayne, Indiana, \$350 million. Fort Wayne was under court order to upgrade and replace its combined sewers and treatment plant. These and other communities are looking to use green infrastructure approaches—for example, reducing water runoff by redesigning street and other surfaces, using different paving materials, and changing landscaping design—to meet their goals for environmental performance at lower cost.

“In cities and other urbanized areas,” explains CNT’s Steve Wise, green infrastructure—rain gardens, green roofs, tree planting, permeable pavement, and other landscape-based drainage features—works “by intercepting rainfall before it reaches sewers.” He adds that it usually costs less to install and maintain than gray forms of water infrastructure that relies on concrete gutters, sewers, and end-of-pipe treatment.¹⁹

Many communities have established green infrastructure projects at large scale. In Pittsburgh, where a rain downpour can cause aging sewers to overflow into creeks and rivers, resulting in fish kills and public health warnings, homeowners working with environmental organizations are creating 150 native-plant gardens, each to as much as 500 gallons of water funneled from roofs and driveways.²⁰ In Maplewood, Minnesota, the city built some 400 rain gardens on private and public property as part of street redevelopment projects. For homeowners willing to have a rain garden in the right-of-way in front of their houses, the city provides excavation, amended soil, plants, and technical assistance. Fort Wayne, Indiana, is seeking to build 1,000 rain gardens as part of its stormwater overflow-prevention effort.

In Chicago, seven years after the city turned the roof of its 11-story city hall into a 20,000-square-foot garden with 100 plant species, which cools the building and reduces its energy bills, more than 4-million square feet of public and private rooftops are greening the community.²¹ As a result, Chicago has become North America’s leading “green roofs” city.²² Although living roofs aren’t new—recall sod houses on the prairie—the potential for energy savings and reduced water runoff is driving a revival of the practice. In 2007, *BioScience* reported green roofs can cut heat loss from a building by 50 percent and reduce air-conditioning costs by 25 percent.²³ Meanwhile, the use of technologies such as water-proof membranes has made it easier to design and install green roofs, and some communities offer financial incentives and lower fees for building owners adding topside gardens. In some communities chains of rooftop islands provide a growing amount habitat for birds and insects along with plants.

Trees and shrubs and even saltwater bivalve molluscs are part of the green infrastructure tool kit communities are deploying. In Portland, Oregon, a proposed five-year initiative includes planting 88,000 trees, creating 43 acres of green roofs, and establishing 350 acres of natural area plantings—to improve stormwater flow and

wildlife habitats. Many cities are planting more trees, whose roots to leaf “canopy” help to manage water flows, and also clean and cool the air—environmental services that reduce the need for and cost of infrastructure. American Forests, a nonprofit that has analyzed the loss of tree cover in more than 40 metropolitan areas, has helped Atlanta, Charlotte, North Carolina, and San Antonio develop strategies to increase tree cover.²⁴

Other places promote the use by landowners of plants that require very little water (no lawns) and organic compost rather than chemical pesticides or fertilizers. New York City’s plan for environmental sustainability, unveiled in early 2007, includes the cultivation of mussels to suck pollution out of rivers.²⁵ Chicago promotes “permeable alley” redesign for the city’s 1,900 miles of alleys, using porous concrete and asphalt mixes to replace surfaces that block rain seepage.²⁶

Green infrastructure may also be part of strategies to “right size” cities that have lost much of their population and have large tracts of vacant and abandoned property. In proposals for Buffalo, Joseph Schilling, associate director of the Green Regions Initiative at Virginia Polytechnic University, argues that “Green infrastructure initiatives, in combination with land banking and community-driven planning, can together form the nucleus of any effort to right-size a shrinking city... Green infrastructure initiatives”—mainly involving networks of open space, parks, and greenways—“would make these places once again attractive for reinvestment and rebuilding.”²⁷

The many small changes involved in green infrastructure enhance a community’s natural landscape, but may barely be recognized as such. Gary Belan and Katherine Baer, staffers for the American Rivers environmental advocacy organization, report they were driving to a meeting when “we were forced to brake suddenly as we approached a curb extension that jutted into the street, narrowing the road. Filled with shrubs and grasses, the extension had an attractive landscaped look to it.” The extension “calmed” traffic and protected a nearby stream by slowing stormwater heading to it and filtering out pollutants. “We had just ‘run into’ an example of green infrastructure.”²⁸

Building Green

Members of the Urban Sustainability Directors Network—roughly 60 people who guide their cities’ initiatives for energy efficiency and environmental quality—are very picky about where they meet and stay: it has to be in “green” buildings. Just a few years ago, that would have meant meeting nowhere at all, but not anymore. In September 2009, the network convened in Chicago at the Hyatt Center, opened just four years earlier and “LEED” certified (standing for Leadership for Energy and Environmental Design) by the Green Building Council, one of several available green certificates.

The Hyatt Center counts as one of at least nine LEED certified office facilities in downtown Chicago.²⁹ Citywide the number tops 29 LEED buildings, placing Chicago third in the nation behind Seattle and Portland.³⁰ Of course, that number only covers a small fraction of the 300,000 buildings in the city, but the growth of green real estate has been rapid. By mid-2006, there were enough green developments that *USA Today* reported a “green building boom... What has been a patchwork of green buildings in many cities is expanding to whole communities, whole neighborhoods... The green ethic—energy-efficient, water-stingy buildings full of features that stress the natural

over the chemical, the recycled over the new and the renewable over the finite—is firmly mainstream.”³¹ In 2008, the number of LEED-certified projects doubled over the previous year and commercial real estate analysts predicted continued growth in sustainable development. New projects around the U.S., reported the CoStar Group in early 2009, included prominent office towers, retail stores, hospitals and even a basketball arena and an FBI field office.³²

Green building certification is one of the most successful innovations in the past 10 years. As we recounted earlier, a small group of professionals started in 1994 to conceptualize energy and environmental standards for new construction, and eventually created the nonprofit U.S. Green Building Council. The Council has endorsed thousands of projects and has a backlog of many thousands more undergoing review.

Gradually, communities have also gotten into the act: adopting LEED and other new standards as part of their local building codes. In August 2008, for instance, San Francisco adopted a green building ordinance, described by its mayor, Gavin Newsom, as the nation’s strictest code, which requires *all* new construction and renovation of commercial space to meet energy and water conservation standards. The Tarkington School of Excellence became Chicago’s first public school built to meet LEED standards—with a living roof and use of recycled steel and construction waste. Now all new Chicago schools will have to meet the green test.³³ In 2008 alone, six states—Florida, Indiana, Maryland, New Jersey, Oklahoma and South Dakota—and more than a dozen cities and counties—including El Paso, Tampa, and Fairfax County, Virginia—required that new, large public buildings meet LEED standards. Aspen, Colorado, writes environmental activist and downhill skier William Shutkin, is “known for being more glitzy than green,” but it became the nation’s first ski resort community with a green building policy.³⁴

In addition to mandates, some communities provide commercial builders of green projects with tax breaks and expedited permit approval.³⁵

The greenness of a green building depends on many factors. A good many of them are based on technologies and supplies, such as waterless toilets, recycled building materials, lighting that won’t distract birds into smashing into the building, and high-efficiency energy-delivery systems. But some of the elements of greenness involve letting nature do the work, including:

- Use of renewable energy sources such as solar, wind, and geothermal energy.
- Use of natural fertilizers for surrounding landscapes and rooftop gardens. In some communities, this is stimulated by a ban on the use of chemical pesticides to manage lawns and backyards. About 20 U.S. communities have pesticide-free parks and several hundred school districts have policies to minimize students’ exposure to pesticides.³⁶
- Use of large windows to reduce the need for artificial lighting that consumes energy and optimizing the location of windows to maximize capture of sunlight without overheating. Even the angle of a building’s windows can affect energy usage. A planned 26-story condominium in Chicago included tilted windows facing south—a way to decrease the impact of midday sun and reduce need for air conditioning.³⁷
- Use of native grasses of the region, rather than sod.
- *More here?*

Green Production (Working Landscapes)

When *Yankee* magazine celebrated nine New Englanders in 2005 as “defenders of the forest,” the roll call of heroes included a surprise. Seven of them championed forest preservation, as you’d expect. But the list also included two men who cut down trees for a living. Mel Ames had harvested his 600-acre tree farm in central Maine for 45 years and Starling Childs II similarly worked the seven-square-miles of woods in Connecticut his grandfather assembled and his father harvested before him. In what environmentalist universe could Ames and Childs be considered “defenders” of the forest? One in which, as *Yankee* proclaimed, protecting forestland from “unwarranted development and unwise forestry practices” is as good as preserving the trees.

Ames cut trees, but he practiced “low impact” or “sustainable” forestry—no clear-cutting the woods, or taking just the most valuable trees, or tearing up the forest floor with heavy machinery, or cutting more wood than the forest grows. “I owned the land, I improved the land, and I made a living from the land,” says Ames. “It looked good when I started, and it looks better now.”

Childs, a professional forester, took a like-minded approach, harvesting saw logs, veneer wood, and Christmas trees from land that a century ago, when his grandfather bought it, had been clear-cut by its business owners. To keep the working forest intact, the Childs family eventually sold development rights to the property to the state, but maintained the right to harvest in sustainable ways.³⁸

Childs and Ames carved out a large-scale space—a “working landscape”—between the outright no-changes preservation of land and the intense development of land. Some communities are doing the same—with forestland and farmland and by revitalizing and repurposing stretches of urban landscapes.

The 298 residents of Errol, a town in northern New Hampshire, borrowed \$400,000 to buy a 5,269-acre tract of forestland—13 Mile Woods—along the Androscoggin River. They wanted to protect the town from real estate speculation and development. “We’d seen landownership change, seen land ‘flipped’ on a very routine basis,” says Errol Selectman Bill Freedman. “We’re trying to preserve the character of the town. We’re trying to have controlled growth.” But Errol needed a way to pay for its land acquisition. The town’s funding was part of a \$4-million total purchase price brokered by the nonprofit Northern Forest Center—the balance coming from financing backed by the federal New Markets Tax Credit program and a combination of state and federal government grants that included a provision for a conservation-based “working forest.” As a result, the project’s loans will be repaid from revenue from timber harvests on the land. And once the loans are paid off, the town can use the continuing revenue stream for whatever it wants.

Northern Forest Center president Rob Riley says that two other New England communities are purchasing a total of 25,400 acres under similar working forest plans.³⁹ One of them, Grand Lake Stream, Maine, a small landlocked community, involves 22,000 acres of forestland. “This may be the largest community-owned forest in the U.S.,” says Peter Stein, a managing partner in Lyme Timber Company, which helped to broker the deal. The \$20-million financing package completed in April 2009 set up a sustainable forestry management regime for the land.

A working forest landscape can support conservation of other lands, even beyond the local landscape—by serving as a buffer for or link between conservation

lands, such as state and national parks and ecological reserves, or as a component in an even larger landscape of contiguous conservation and working lands.

A different version of the working landscape is found in “cluster” real estate development that concentrates new housing on a small portion of a larger tract of land while conserving the rest of environmental and aesthetic reasons. Serenbe, a 900-acre village with 60 homes about 32 miles from Atlanta, formed an alliance of landowners to conserve some 40,000 surrounding acres. In a Virginia community, EcoVillage, developers reduced the lot size and clustered the homes, conserving 85 percent of the land as open space—a mature forest, four creeks, and seven springs instead of a grid matrix of three-acre lots like other subdivisions.⁴⁰ In Grayslake, Illinois, developers planned to build on just 325 of their original 11,500 acres; they sold much of the land to The Nature Conservancy and established a financial trust to support historic preservation and environmental protection.⁴¹

In these and other “green space” developments, rather than production of forest or farm products, the environmental service or “work” involves production of the amenity of natural space—recreational and cultural capacities, as well as increased healthiness and boosts in the value of surrounding property.

Cluster development usually occurs on unbuilt lands, but urban areas can convert their built environments—especially lands spoiled by pollution—into green space for their amenity value. America’s largest urban bottomland hardwood forest, the 6,000-acre Great Trinity Forest, lies within Dallas’s control, connected to the city by the Trinity River and other lands that for decades had been illegal dumping grounds for construction waste and household trash; in 1997, a landfill caught fire and burned for months. But in 1998, city residents approved a \$246-million bond program to revitalize the area, with recreational facilities and a 120-acre Audubon nature interpretive center. When the center opened in October 2008, more than 10,000 local bird watchers and residents turned up for the first weekend.⁴² Irvine, California, launched a \$1.1-billion recreational area that will be 60 percent larger than New York’s Central Park. Pittsburgh developed a 283-acre slag dump along the Monongahela River into a residential complex with 200 acres of green space. New York City decided to invest \$172 million to turn a 1.5-mile ruined viaduct into an elevated “linear” park with an amphitheater, picnic areas, and dramatic views of the city. When the first nine blocks of High Line Park opened in June 2009, 300,000 visitors arrived in the first six weeks.⁴³ And Seattle converted nine acres of an industrial site at the edge of its downtown into Olympic Sculpture Park—keeping the area out of the hands of real estate developers attracted to its waterfront views.⁴⁴

The urban greening trend extended from waterfronts to reclaimed brown-fields and abandoned military bases, and even to inner-city farming. In the two years before June 2007, 29 of the nation’s largest cities added nearly 14,000 acres of new parkland. Urban politicians, reported *The Wall Street Journal*, “are finding that most of the new residents grew up with access to running trails, sports fields and the like—and expect to have the same access in the city.”⁴⁵

The Edge of Innovation for Green Services

Community innovations in green infrastructure, green building, and green production face barriers typical to getting new concepts to mainstream scale: settling on

a common set of standards for products and services and financing the often costly implementation of innovations.

When innovation is driven by new standards, such as the LEED green building model, a period of competing and incomplete standards usually emerges. Competition may be created when multiple innovators follow different approaches to standard-setting. Or it arises when followers of old standards don't want to adopt the new standards because it requires them to make changes in their practice; usually the concern is about the cost of making changes. As an alternative, they create a new standard of their own that requires them to make fewer changes. This triggers conflict with developers of more rigorous standards.

In the case of green building standards, both dynamics have occurred. Multiple standards compete for attention and the LEED standard is the target of substantial criticism—for not being rigorous enough and for being too rigorous—and an ongoing process of revision. At the same time, “green washing”—the practice of presenting a much less rigorous standard—emerged. The National Association of Homebuilders, representing builders of 80 percent of new homes annually, argued that the Green Building Council's criteria were too impractical and costly, and in 2007 started to develop its own easier-to-achieve certification.⁴⁶

At the same time, standard setting involves continuous improvement to “get the standards right.” A number of criticisms have been aimed at green building standards. For instance, Gabriel Works, a Michigan-based activist in historic preservation of buildings and neighborhoods, argues that green-building certification has not fully embraced the potential green effects of preserving and rehabilitating, rather than demolishing, buildings. Others contend that where a building is—its location efficiency—not just what it is made of, is a critical element in its greenness and should be more fully incorporated into green standards. “An old building on an urban site adapted and reused, is greener than any new building on a newly developed site,” explains Witold Rybczynski, professor of urbanism at the University of Pennsylvania.⁴⁷

As greener standards become the desired norm, financing the transition to green buildings, infrastructure, and landscapes becomes more and more of a challenge—and an opportunity for innovation. Putting together the multi-million-dollar financing for working landscapes such as forestlands involves substantial complexity and multi-sector sourcing of funds, often requiring banks, government conservation programs, and nonprofit organizations, not to mention family estate and tax planning, and community approval, as we saw in the Errol and Grand Lake Stream cases. It's a specialized niche that doesn't, for now, rely on a set of standard financial products. “There are so many bells and whistles,” notes Lyme Timber's dealmaker, Peter Stein.

Financing for green infrastructure faces a different set of challenges. Although market forces and regulatory pressures are building on local governments to invest in reliable and low-cost green solutions to their environmental problems, the structure for financing local infrastructure is designed, as it has been for decades, for large-scale, big-ticket gray projects. Governments typically pay for their infrastructure through long-term borrowing in the municipal bond market. Every year, they borrow hundred of billions of dollars this way, and changes in a community's bond rating can cost a government millions, even hundreds of millions, in revenue. Meanwhile, the future bill for infrastructure keeps climbing. The American Society of Civil Engineers estimated several years ago that \$1.3 *trillion* must be invested over five years to reverse declines in the nation's infrastructure capacity.

At the same time and for the first time, every governmental unit in the nation must disclose, value, and justify all of its capital investments. Accounting rule 34 issued by the Government Accounting Standards Board (GASB) requires all state and local governments to reveal regularly the long-term maintenance costs of their infrastructure.⁴⁸ Wall Street firms can use this information to adjust bond ratings for local governments. This creates an incentive for communities to embrace and implement innovations in infrastructure that generate stronger bond ratings and, therefore, lower financing costs. It also creates the potential for far greater public scrutiny of and debate over decisions by local elected officials and administrators involving billions of dollars—yet another driver, perhaps, of interest in “green” and lower-cost alternatives to traditional public infrastructure. Engineers and public works agencies may look to “fix it first” approaches that are often cheaper to maintain an infrastructure asset than to wait until it can no longer be kept in service and must be rebuilt and replaced, and to minimize the life-cycle costs of infrastructure. And advocates of improved environmental performance may be able to use the new public financial information to justify alternative approaches to traditional public infrastructure.⁴⁹

Finally, there are some experiments in new financing for green buildings, at least for increased energy efficiency. Lenders and government agencies now offer mortgages to people who make their homes more energy efficient or buy highly efficient homes. Others factor potential energy-bill savings into the qualifying income for a mortgage, making more people eligible to borrow money. And some offer discounts on loan closing costs if the home meets Energy Star standards. A test program in Maine offers eligible homeowners a second mortgage of as much as \$30,000 at a fixed interest rate for energy-saving costs. This allows homeowners to stretch payments over a long term instead of using short-term loans.⁵⁰

- ¹ Friend quotation at <http://www.natlogic.com/approach/overview/>, the Natural Logic Web site.
- ² John M. Barry, *Rising Tide: The Great Mississippi Flood of 1927 and How It Changed America* (New York: Simon & Schuster, 1997), p. 40.
- ³ John M. Barry, *Rising Tide: The Great Mississippi Flood of 1927 and How It Changed America* (New York: Simon & Schuster, 1997), p. 21.
- ⁴ Daniel Botkin, "The Breaching of Edwards Dam," <http://www.danielbotkin.com/2007/03/18/the-breaching-of-edwards-dam>.
- ⁵ Botkin, "The Breaching of Edwards Dam."
- ⁶ From wikipedia (<http://en.wikipedia.org/wiki/Ecosystem>): An **ecosystem** is a natural unit consisting of all plants, animals and micro-organisms (**biotic** factors) in an area functioning together with all of the non-living physical (**abiotic**) factors of the environment. An ecosystem is a completely independent unit of interdependent organisms which share the same habitat. The term ecosystem was coined in 1930 by [Roy Clapham](#) to denote the combined physical and biological components of an environment. Central to the ecosystem concept is the idea that [living organisms](#) interact with every other element in their local [environment](#). Eugene Odum, a founder of ecology, stated: "Any unit that includes all of the organisms (ie: the "community") in a given area interacting with the physical environment so that a flow of energy leads to clearly defined trophic structure, biotic diversity, and material cycles (ie: exchange of materials between living and nonliving parts) within the system is an ecosystem."
- ⁷ Gretchen C. Daily, "What are Ecosystem Services," in Gretchen C. Daily, ed., *Nature's Services: Societal Dependence on Natural Ecosystems* (Washington, D.C.: Island Press, 1997), pp. 2-4.
- ⁸ Michael Maddox, "Studies Show Wetlands Reduce Floods," *River Monitor*, May/June 2001, Volume II, Number 5, p. 4.
- ⁹ Constance Best, "Values, Markets, and Rights: Rebuilding Forest Ecosystem Assets," in James K. Boyce and Barry G. Shelley, eds. *Natural Assets: Democratizing Environmental Ownership* (Washington, D.C., Island Press; 2003), pp. 209-226.
- ¹⁰ Harold A. Mooney and Paul R. Ehrlich, "Ecosystem Services: A Fragmentary History," in Gretchen C. Daily, ed., *Nature's Services: Societal Dependence on Natural Ecosystems* (Washington, D.C.: Island Press, 1997), pp. 11-19.
- ¹¹ Gary Moll and Jeff Olson, "Urban Forests: New Tools for Growing More Livable Communities," *Livable Communities @ Work*, Volume 2, Number 1, January 2005.
- ¹² Steve Wise, "Green Infrastructure Rising: Best practices in stormwater management," *American Planning Association*, August/September 2008.
- ¹³ "Undamming the Kissimmee," *National Geographic*, July 2001.
- ¹⁴ Cornelia Dean, "Destroying Levees in a State Usually Clamoring for Them," [nytimes.com](http://www.nytimes.com/2009/06/20/science/earth/20levee.html?hpw), June 19, 2009, <http://www.nytimes.com/2009/06/20/science/earth/20levee.html?hpw>.
- ¹⁵ Kris Hudson, "Down by the Riverside, Development Spurs Debate," *The Wall Street Journal*, October 31, 2007, p. B1, B8.
- ¹⁶ Ted Gregory, "Grand Forks cresting after flood of 1997," *Chicago Tribune*, April 22, 2007, p. 4.
- ¹⁷ Douglas Belkin, "Midwest Floods Dredge Up Dispute," *The Wall Street Journal*, June 19, 2008, p. A4.
- ¹⁸ Joe Barrett, "As River Swells, Davenport Resists Flood Wall," *The Wall Street Journal*, April 29, 2008, p. A8.
- ¹⁹ Steve Wise, "Green Infrastructure Rising: Best practices in stormwater management," *American Planning Association*, August/September 2008.
- ²⁰ "Let It Rain," *Audubon*, January-February, 2009, p. 22.
- ²¹ Jim Carlton, "Nine Cities, Nine Ideas," *The Wall Street Journal*, February 11, 2008, p. R1.
- ²² Verlyn Klinkenborg, "Up On The Roof," *National Geographic*, May 2009, pp. 84-103.
- ²³ Jeffrey Kluger, "Need to Weed Your Roof?" *TIME*, November 19, 2007, p. 64.
- ²⁴ See <http://www.americanforests.org/resources/urbanforests/>,
- ²⁵ Thomas J. Lueck, "Bloomberg Draws a Blueprint for a Greener City," *The New York Times*, April 23, 2007.
- ²⁶ Steve Wise, "Green Infrastructure Rising: Best practices in stormwater management," *American Planning Association*, August/September 2008.
- ²⁷ Joseph Schilling, "Blueprint Buffalo—Using Green Infrastructure to Reclaim America's Shrinking Cities," p. 153, available at http://metrostudies.berkeley.edu/publications/proceedings/Shrinking/18Schilling_PA_final.pdf.
- ²⁸ Gary Belan and Katherine Baer, "Green Communities for Clean Water," *Rivers Voices*, Volume 18, Number 1 – 2008, p. 1.
- ²⁹ NAI Hiffman, *Metropolitan Chicago: Green Office Report: Third Quarter 2008*, at www.hiffman.com.
- ³⁰ Blair Kamin, "Chicago's green cred is good, but not platinum," *Chicago Tribune*, October 21, 2007, p. 7-1.
- ³¹ John Ritter, "Building 'green' reaches a new level," *USA Today*, July 27, 2006, p. 1A.

³² Andrew C. Burr, "Sustainability in '09 Reflects Robust '08," January 24, 2009, at www.costar.com/News/Article.aspx?id=922656AF976298910D0A4D1B7E4E0551

³³ "Bright Ideas," *Audubon*, September-October 2009, p. 71.

³⁴ William A. Shutkin, in manuscript, 2008.

³⁵ Wendy Koch, "Green building codes sprout up across USA," *USAToday*, August 13, 2008.

³⁶ Gwendolyn Bounds, "Grass Warfare," *The Wall Street Journal*, July 7-8, 2007, p. P1, P4.

³⁷ Andrew Blum, "Made for Shade," *WIRED*, August 2007, p. 71.

³⁸ Edgar Allen Beem, "Defenders of the Forest," *Yankee magazine*, October 2005, pp. 51-59.

³⁹ Northern Forest Center, *Stories of Success, Focus on the Future: Fiscal Year 2008 Financial Report*, p. 11.

⁴⁰ "Building Character," *Audubon*, September-October 2009, p. 60.

⁴¹ Ben Casselman and Katy McLaughlin, "Politically Correct Developments," *The Wall Street Journal*, November 16, 2007, pp. W1, W10.

⁴² Alexa Schirtzinger, "Making the Grade," *Audubon*, September-October 2009, pp. 48-54.

⁴³ "One Picture," *Audubon*, September-October 2009, p. 106.

⁴⁴ Douglas Gantenbein, "From Toxic Wasteland to Public Garden With View," *The Wall Street Journal*, January 31, 2007, p. D9.

⁴⁵ Jon Weinbach, "The Focus-Grouped Park," *The Wall Street Journal*, June 29, 2007, pp. W1, W3.

⁴⁶ Sara Schaefer Munoz, "Ratings Proliferate for 'Green' Builders," *Wall Street Journal*, November 8, 2007, p. D1.

⁴⁷ Witold Rybczynski, "Home Truths," *The Atlantic*, October 2009, p. 34.

⁴⁸ Governments with over \$100 million in revenues had to begin complying with the new reporting requirements after June 15, 2001. Medium-sized governments started in 2002 and smaller ones, less than \$10 million in revenues, in 2003. Governments had an additional four years to include infrastructure assets retroactively.

⁴⁹ Most of the discussion about green infrastructure financing comes from a concept paper for a National Green Infrastructure Service drafted by Scott Bernstein and Peter Plastrik.

⁵⁰ Anna Prior, "Green for Green," *The Wall Street Journal*, August 24, 2009, p. R6.