Making the Economic Case for Nature-Based Solutions in Climate Projects

Monon Boulevard and Midtown Plaza Phases 1 and 2
Landscape architects with Rundell Ernstberger Associates transformed an industrial area into a trail and plaza with significant amenities, catalyzing private investment. Image credit: (before) Rundell Ernstberger Associates; (after) Rundell Ernstberger Associates, Hadley Fruits

Landscape architects can design nature-based solutions to increase the economic benefits of climate projects. These benefits spread throughout communities. These projects are made possible by good public governance and funding.

This guide provides a high-level overview of ways landscape architects can communicate to public clients about how to increase investment in nature-based solutions to climate change.

Research shows that specific design elements of landscape architecture create additional economic value. Designing with nature creates additive benefits. Each project matters as it contributes to restoring and protecting what people value about natural environments.

When we have a greater understanding of how design elements contribute to climate mitigation and adaptation and biodiversity net gain, we can advocate for more holistic designs that always increase natural features.

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This guide is for landscape architects, educators, and students. It will help you understand the broader economic framework of projects and how nature-based solutions fit into that framework.

This guide enables you to:

- Understand the economic and financial context in which public and private clients operate.
- Become familiar with basic economic language and better communicate with clients about economic benefits.
- Show the benefits of using nature-based solutions in different types and sizes of projects.

Figure 1 A client may be interested in a project's economic impact and calculate that impact in monetary values. When landscape architects make design choices that increase the amount of nature-based elements in a project, they provide additional economic benefits. The Landscape Architecture Foundation's Landscape Performance Series compiles examples of project benefits in a searchable database.

Understanding Your Client's Economic Context

Landscape architects play an important role in development and redevelopment projects. As part of a project team, they assist a range of clients – local, state, and federal governments; private developers; non-profit organizations; universities; and healthcare providers – by providing design services to meet project goals. While project goals may be wide-ranging, the economic and fiscal goals of a project are a bit narrower.

According to a recent ASLA survey, local, state, and federal governments are the primary sources of demand for climate and biodiversity projects. These public sector clients seek to balance economic growth, social well-being, and sustainability when making development and redevelopment decisions. The private sector operates within an economic development framework set by the public sector.

How can landscape architects increase the economic benefits of public projects? To answer this, we can start by understanding government clients' economic goals. These goals are the economic benefits of a project.

Traditional Economic Benefits

Traditional economic benefits for government clients include improving land use (housing, parks, public amenities, and infrastructure) for people living in and around the project.[1] Economic impact determines how the project benefits contribute to the local or regional economy.

Some of the economic benefits, as well as fiscal challenges, of development and redevelopment projects include:

Economic Growth and Efficient Land Use Planning
Growth can be managed to maximize benefits while considering the needs of residents and the environment. Zoning regulations and land use planning choices can change local property tax revenue, impacting local funding streams and infrastructure costs.

Economic Development and Job Creation
Projects can attract new investments that increase revenue through new business or workforce development. Short-term jobs are associated with the design and construction of a project, and long-term jobs that pay a living wage may result from the project.

Infrastructure and Public Services

Public infrastructure improvements may require significant capital expenditures, often covered through state or federal funds, bonds, or public-private partnerships that require new revenue streams. However, funding for capital projects does not include maintenance and operations costs, making maintenance a challenge to cover in the long term.

Housing and Community Cohesion

Affordable housing and improving neighborhoods are challenging to balance with concerns like gentrification and displacement. Growing populations need growing budgets to provide community services like schools, healthcare, and public safety.

Transportation and Mobility

Transportation upgrades and expansion require significant investments and additional funding beyond municipal budget allocations. New projects like multi-modal streets will bring long-term maintenance and operation costs. Congestion, greenhouse gas emissions, accessibility, and equity need to be considered.

How Traditional Economic Benefits Are Calculated

These are some of the challenges in balancing economic development, budget, and funding priorities with sustainable and inclusive growth. Calculating the economic benefits of projects can help decision-makers with this balancing process.

Traditional economic benefits can be calculated by measuring the economic impacts of the project. These impacts may be positive or negative. To measure them, data is collected before and after a project is undertaken.

Landscape architecture projects are shaped by economic decision-makers, including state and local economic development departments, planning and zoning departments, finance or budget offices, and economic consultants.

These players can calculate or predict economic drivers and revenue changes to estimate a project's impact. These include:

- Increased tax revenue from attracting new businesses and residents
- Development choices, such as mixed zoning for commercial and residential developments
- Increased wages and number of jobs

- Consumer spending
- Housing demand

Once these impacts are calculated, the economic benefits of the project to the local or regional economy can be estimated.

These are the ways public sector clients may evaluate the traditional economic benefits of a project's impact. Projects that show these tangible changes include Cortex Commons in St. Louis, Missouri, which established mixed-use zoning that influenced housing demand, and the Chicago Riverwalk in Chicago, Illinois, which increased revenue and attracted new businesses and jobs. (Learn more about these projects in Landscape Architecture: Maximizing the Economic Benefits of Nature-based Solutions Through Design)

However, there are reasons government clients may also consider design options with nature-based solutions or require a change from the way projects are typically implemented.

We will now cover some reasons why public sector clients consider including these solutions and expanding their goals beyond traditional economic benefits.

Why Investment in Nature-based Solutions is Growing

An increasing number of public clients are investing in design choices that restore or protect nature. They are doing this for several reasons.

They may be familiar with the concepts of capital infrastructure and asset management, which traditionally includes infrastructure that provides public services, such as drinking water and wastewater plants and distribution systems.

Natural assets or capital[2]– such as wetlands, forests, salt marshes, and grasslands – are another form of infrastructure. They are frontline ecosystems in reducing the impacts of flooding and erosion, moderating extreme heat and drought, and removing carbon emissions to slow climate change. They are also vital to biodiversity.

Natural assets are important, but elected officials, planners, and developers need an accounting system that realizes their value.[3]The services that nature provides – trees that cool down cities, vegetation that filters stormwater – often go unrecognized in traditional land use, planning, and management of public assets, yet they are crucial for resilient and livable urban environments.[4]

Nature-based solutions offer multiple benefits not only for clients but also for communities. They enhance project outcomes while promoting environmental and social well-being.

We briefly describe several reasons nature-based solutions are gaining traction:

Reduced Risk for Project Finance

The markets that support public and private infrastructure and finance are changing. Emerging financial disclosure frameworks, such as the Taskforce on Nature-related Financial Disclosures (TNFD) and Science Based Targets for Nature (SBTN), view nature-based solutions as increasingly important to mitigate long-term infrastructure and public risk from climate change.[5]

These frameworks are used in states with stringent environmental regulations, such as California, Washington, and New York. They help developers meet investor expectations while aligning project outcomes with state governments' sustainability goals.

One high-profile example of disclosures is Pacific Gas and Electric Company (PG&E)'s adoption of TNFD guidelines to evaluate and disclose its operations in California and exposure to wildfire risks, including assessments of natural capital dependencies and risks, such as impacts on local ecosystems and water resources.

Using TNFD helped PG&E align its sustainability goals with investor expectations and regulatory requirements while fulfilling California's stringent climate action mandates.[6] While this project is a private utility example, the approach addressed risk and natural capital and operated within the California state government's climate requirements.

Another example is the use of SBTN in California to achieve net biodiversity gain for projects. Developers integrate biodiversity metrics to support urban planning that maintains or enhances local biodiversity, meeting investor and regulatory requirements and contributing to the state's environmental goals.[7]

With Wall Street's increasing focus on environmental, social, and governance (ESG) criteria, companies and public and private investors are exploring these frameworks to manage nature-related risks better and align with global sustainability goals.[8]

Aligned Sustainability and Resilience Goals

Design strategies that reduce hardscape, increase green space, and minimize project carbon footprints can meet multiple objectives. Environmental features can support other client goals and initiatives, such as climate action plans, stormwater regulation compliance, public health, and resilience. They can create cost efficiencies by aligning efforts and developing multi-purpose projects.

Positive Financial Returns

Projects designed to integrate nature and expose people to green space can increase the project's economic return on investment. A growing number of case studies document how nature-based solutions produce financial benefits for communities and local businesses, increase property values, and improve the communities' quality of life.[9] Industry leaders and consultants argue for businesses to create nature-positive strategies, and that shapes how they invest and fund projects.

There are many examples of green space catalyzing development and providing new revenue for cities. Brownfield sites and old rail passages have been transformed into parks and greenways, bringing new vitality to urban areas, people, and greater commercial investment.[10]

Discovery Green in Houston, Texas; Gas Works Park in Seattle, Washington; The Highline in New York City; and Mill Ruins Park in Minneapolis are a few examples. In these projects, millions of dollars in public and private investment was spent to remediate the sites and build green spaces, spurring millions, if not billions, of dollars in new development in the form of housing and businesses, and new jobs resulted from the multi-use, public open spaces.[11]

Increased Health Benefits

Extensive scientific evidence demonstrates that spending time in nature:

- Positively influences mental and physical health
- Increases well-being
- Promotes relaxation
- Reduces stress
- Fosters better community interactions

Projects that improve access to nature influence human health through physical and mental states, behaviors, and community-level impacts.

Annual U.S. healthcare expenditures exceed those of most other developed nations, yet the health of many Americans is of lower quality. National healthcare expenditures grew to $4.5 trillion in 2022, or $13,493 per person, and accounted for 17.3 percent of the nation's Gross Domestic Product.[12] Extensive research on nature and health in cities highlights that access to nature is a vital social determinant of health, potentially lowering healthcare costs.[13]

Several recent articles that draw on patient healthcare and Medicare data highlight the economic benefits of nature experiences.[14] These benefits are linked to improved health and longevity and reductions in medication use.

Public, private, and non-profit partnerships to achieve public health goals use the built environment to improve and address the social determinants of health. These partnerships are of growing interest to state and local public health officials and the healthcare industry.[15] [16]

How Landscape Architects Can Take Advantage of this Shift

As noted, public sector clients are increasingly focused on how a project reduces risk, provides positive returns, meets sustainability and resilience goals, and improves health benefits. Landscape architects are seeing this growth in public sector demand. According to a recent ASLA survey, 511 landscape architects stated city and local governments have the highest demand for solutions to climate impacts like intense storms, heat waves, and pollinator loss; more than other kinds of clients.

Landscape architects design nature-based solutions. They integrate nature into development, which supports local and state governments' sustainable urban growth objectives and balances the needs of the economy, environment, and society. This approach supports long-term urban sustainability, reducing reliance on resource-intensive infrastructure while enhancing ecological systems.

More local and state governments see that green infrastructure can meet stormwater regulatory goals and potentially be more cost-effective than gray infrastructure. This infrastructure can also increase biodiversity, sequester greenhouse gas emissions, and enhance urban cooling.[17]

How Environmental Economists Think About Benefits

Landscape architects are familiar with the benefits of designing with nature. However, the total value of projects is often missed when estimating environmental and social benefits for public sector clients. Landscape architects can bolster their case for public climate projects by learning how environmental economists think about benefits.

Environmental economics values an expanded set of project benefits. Total economic value captures how goods and services are viewed. To economists, the term value, which is different from price, has a specific meaning—it's the amount of money people are willing to pay for a good or service.[18] It may also indicate what must be given (willing to accept) to accept a lower-quality good or service.

Value captures the importance of something based on how different people desire it or its usefulness. Economists use the basic ideas of supply and demand to estimate value. They estimate how much producers gain (producer surplus) and how much consumers gain (consumer surplus) from selling and buying a good or service.

Value is measured the same way whether we're talking about a product purchased in a store or the quality of the environment.

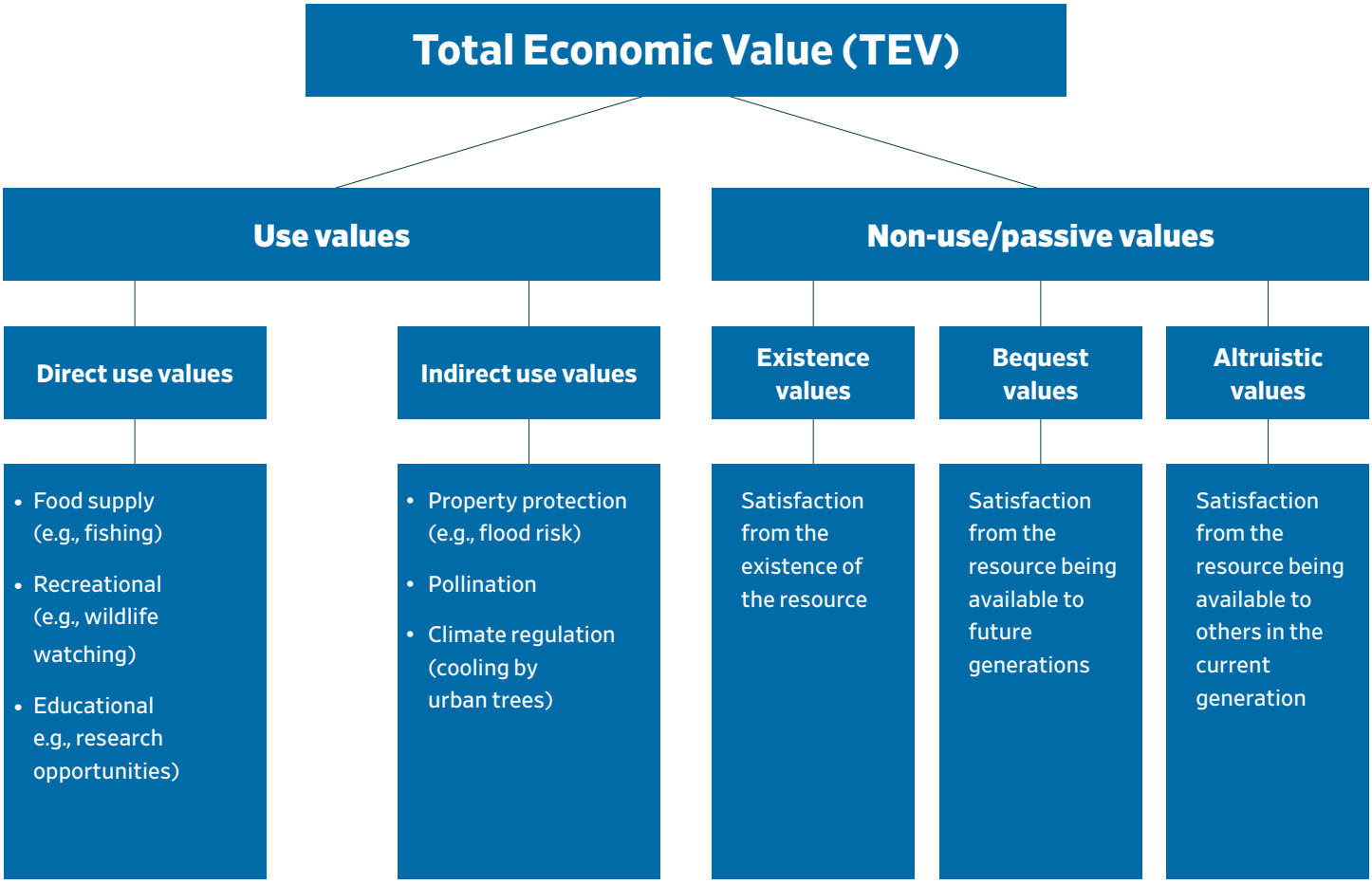

Figure 2 Components of total economic value and relevant valuation methods. National Ecosystem Services Partnership. 2016. Federal Resource Management and Ecosystem Services Guidebook. 2nd ed. Durham: National Ecosystem Services Partnership, Duke University

The economic value of environmental goods and services has several components. Value is based on a spectrum of uses for an item and the corresponding individual desire to obtain the good or service.

The total economic value concept encompasses an environmental good or service's direct uses and potential or future uses. Figure 2, above, shows this spectrum.

Direct use value is obtained through observable market actions, such as sales of goods and services. Indirect use values include observable, quantitative, and modeled methods to estimate benefits.

Non-use or passive uses include existence, bequest, and altruistic values, which have different benefit estimation methods, explained in Appendix A. These methods generally derive resource values from surveys, with hypothetical examples that ask questions about the resource.

How Environmental Economists Value Ecosystem Services

Environmental economics examines what nature provides to people through ecosystem services.[19] The services provided depend on the environmental conditions and the type of environment. Different environments produce different services and benefits to communities.

To measure how people value the benefits of a policy or project, an economist is interested in estimating how much an individual's well-being would change. Aggregating individual well-being can lead to changes in society's *well-being*. Similarly, economists measure how people value a change in environmental conditions by assessing changes in well-being. (See Appendix A for a brief on benefit valuation methods.)

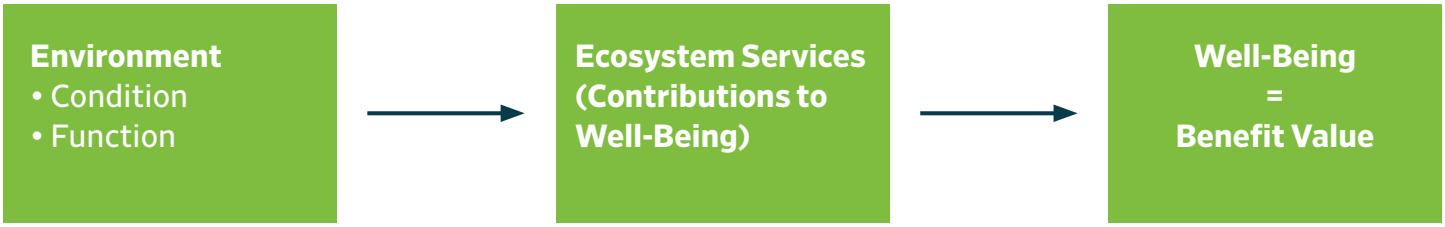

Figure 3 Environmental conditions lead to specific services that people benefit from and place value on.[20]

How Landscape Architects Can Calculate the Environmental Benefit Values of Their Projects

There are different ways to put a value on environmental benefits. This stems from how environmental economists attach monetary benefits to people's use or non-use values. There are ways to describe this to clients that build on our understanding of projects' economic benefits and expand the definition of benefits.[21]

Here are categories of environmental benefits that help clients achieve climate and biodiversity goals. Note the numbers are not meant to be large; they only show how these numbers can be estimated. However, we can imagine the greater value generated when we aggregate all landscape architecture project benefits globally.

Each environmental benefit category has:

- An example of how they are implemented in landscape architecture projects
- A brief description of the valuation type
- A project example
- A description of the benefit that can complement traditional economic benefits

The examples are from small to large urban areas in different U.S. regions.

Benefit: Enhanced Climate Resilience

Taylor 28, Seattle, Washington. Landscape architects at Mithun designed Taylor 28 to infiltrate stormwater in the pedestrian space and reduces water use for landscape irrigation. The landscape now eliminates discharge to the combined sewer system for up to a 25-year storm event. Image credit: Mithun (Juan Hernandez)

Example: Water Conservation

Water conservation design practices reduce water use from municipal water systems and save money on water bills. While dollars saved in potable water reuse may reflect how undervalued water may be, each drop of water conserved has value, especially when considering increasing uncertainty in water availability.

Valuation type
Cost savings. Dollars per gallon of water saved based on a local potable water rate estimate.

Project example
Taylor 28. Seattle, Washington.

Landscape architects
Mithun

Taylor 28[22] is a project in Seattle's dense urban core designed to use the public right-of-way for water conservation and reuse. The captured rainwater is used for irrigation and non-residential toilets.

In Seattle's urban core, more than 35 percent of open space is within the public right-of-way. By restoring more than 30 percent of the site, which was devoid of trees and almost entirely composed of impervious surfaces, this project created a livable, walkable, and ecologically-balanced community that concentrates growth within an urban center.

A holistic approach to rainwater harvesting allowed water from the private roof to be used for irrigation in the public right-of-way. City approval of a hybrid cistern meant the number of residents could increase, but the potable water use remains the same over time.[23]

Benefit Value

Eliminates potable water use for landscape irrigation and uses harvested rainwater in non-residential toilets, saving up to 122,000 gallons annually. This equates to approximately $1,200 per year, using an average rate of $7.70 based on water rate charges for Seattle.

Climate Ready East Boston, Boston, Massachusetts. This project improved East Boston's flood resilience by creating a "network of landscape-based defenses," such as parks and vegetated buffers. The natural strategies include stormwater meadows, tree planting, and porous pavement. Image credit: Stoss

Example: Flood Mitigation

Nature-based solutions, like wetland restoration and urban tree planting, can make properties more resilient to climate impacts, such as increased flooding.

Valuation type
Avoided costs. This is typically modeled for the project using flood damage reduction data.

Project example
Climate Ready East Boston Boston, Massachusetts.

Landscape architects
Stoss

Stoss, along with Kleinfelder and One Architecture and Urbanism (ONE), prepared the first neighborhood-specific plan of the city-wide Climate Ready Boston initiative. The plan offers a network of landscape-based defenses, including parks and natural buffers along the coast in East Boston. These are designed to protect inland homes and businesses from flooding.

Benefit Value

By directing $142 to $262 million in municipal resources towards resilient landscape barriers over the next few decades, Boston will net $644 to $751 million in benefits and provide a model for other coastal cities to follow to prepare for climate impacts. Full implementation of near- and long-term measures will protect against a 100-year flood event with sea-level rise at levels projected for 2050, preventing an estimated $1.3 billion in losses.[24]

Benefit: Improved Air Quality

Millennium Park, Chicago, Illinois. The design of Millennium Park intensified green space, which reduces pollutants in a concentrated urban space. Image credit: ASLA 2020 Landmark Award. Millennium Park—The Fortuitous Masterpiece Landmark Award Chicago, Illinois. Millennium Park Foundation / Millennium Park Foundation

Example: Green roofs and urban forests capture pollutants like particulate matter and absorb pollutants like ground-level ozone

Valuation type
Willingness to pay for better health is captured by stated preference methods (see Appendix A). Models like iTree provide values for trees by calculating the value of removing pollution and reducing health risks using EPA BenMAP.

Project example
Millennium Park, Chicago, Illinois.

Landscape architects
Terry Guen Design Associates, Gustafson Guthrie Nichol, and Ed Uhlir.

Millennium Park was designed by a team of landscape architecture firms to be one of the "world's most extensive green roofs." It is built on top of two multi-level parking garages and a commuter rail line.[25] The project increased green space by about 62 percent, with hundreds of trees and almost ten new acres of gardens and lawn.

Benefit Value

According to estimates from iTree, the 73 acres of trees in three census blocks encompassing the park area reduce harmful air pollutants. The estimated value from iTree for ground ozone reduction is approximately $14,000 annually. For reducing particulate matter of 2.5 microns,[26] the stimated value is $42,000 annually. These benefits estimate the health benefits of having cleaner air.[27]

Benefit: Improved Water Quality

Historic Fourth Ward Park, Phase 1. Atlanta, Georgia. The former brownfield site in the Old Fourth Ward along the Atlanta BeltLine was underused and couldn't manage stormwater. The Historic Fourth Ward Park was designed to include native shade trees and store large quantities of stormwater. Mixed-use and residential developments surround the park's perimeter. Image credit: Preconstruction photo (H4WP preconstruction) / Photo courtesy of HDR. Post construction photo (H4WP 1 SC) / Photo courtesy of HDR; photographer Steve Carrell

Example: Green infrastructure distributed in urban areas, such as rain gardens or ponds with stormwater filtration and retention, reduces pollutants and the frequency of combined sewer overflows to local waterways

Valuation type
Avoided cost of gray infrastructure or wastewater treatment.

Project example
The Historic Fourth Ward Park. Atlanta, Georgia.

Landscape architects
HDR

The site was converted by landscape architects at HDR into a park with stormwater storage to address the U.S. Environmental Protection Agency's consent decree to reduce combined sewer overflows. Stormwater management features include bio-retention swales and rain gardens. The stormwater pond stores 44 million gallons per day and creates an open space for the community.[28]

Benefit Value

Cities with combined sewer overflow problems may use traditional gray infrastructure solutions, such as new sewer tunnels, to help reduce sewer overflows. However, cities like Atlanta have worked with local stakeholders to implement cost-effective solutions that can manage similar quantities of water at a lower construction cost. This project released the city from the U.S. Environmental Protection Agency consent decree and saved approximately $50 million while providing park space and aquatic habitat.[29]

Benefit: Public Health and Well-being

Lafitte Greenway, New Orleans, Louisiana. The Lafitte Greenway, near the historic French Quarter and central business district in New Orleans, Louisiana, contained trash and disconnected and non-functional pathways. Redesigned as a greenway, the park now has a 2.6-mile trail for commuting and recreation. The park comprises basketball, tennis courts, and athletic fields with stadium seating. Image credit: Brandon Huttenlocher/Design Workshop, Inc

Example: Urban parks and green spaces provide opportunities for physical activity, reduce stress, and foster social interaction

Valuation type
Benefit transfer of recreational use values (revealed or stated preference methods).

Project example
Lafitte Greenway, New Orleans, Louisiana

Landscape architects
Design Workshop

Landscapes can be designed to encourage physical activities such as walking, jogging, and cycling. Regular physical activity has numerous health benefits, including reduced risk of obesity, heart disease, stroke, and diabetes.[30] Studies have shown that exposure to nature can reduce symptoms of depression and anxiety, improve mood, and enhance overall psychological well-being.[31] Lafitte Greenway, which was designed by Design Workshop, is an example of how to use underused and disconnected urban spaces to expand opportunities for physical activity.

Benefit Value

The trail has approximately 375,000 users annually.[32] Estimating the value of recreation for individuals is accomplished by benefits transfer of recreational use values. Using conservative estimates and an average value for biking and walking[33] in parks, the recreational value of the Lafitte Greenway trail is estimated at $6 million annually (2024).

Benefit: Greenhouse Gas Emission Reduction

The Bud and Susie Rogers Garden at the Akron Art Museum in Ohio significantly improved its surrounding space by transforming a parking lot into an oasis. The garden, which was designed by landscape architects at OLIN, uses diverse trees and plants to sequester carbon, reduce stormwater, increase biodiversity, and reduce surface temperatures. Image credit: Sahar Coston-Hardy / ESTO

Example: Projects that draw down and store carbon from the atmosphere help mitigate the effects of climate change. The design may include using low-carbon materials (e.g., less concrete), reusing or recycling materials, and planting new trees and vegetation

Valuation type
The Social Cost of Carbon (SCC) measures the economic harm caused by emitting one ton of carbon dioxide (CO2) into the atmosphere and represents the dollar value of the damages caused by a ton of CO2 emissions over its lifetime. Impacts include adverse effects on agriculture, human health, and property damage.[34] The SCC varies from $51 per metric ton – the value used across the U.S. federal government and several states – to $185 per metric ton in published literature.[35]

Project example
Bud and Susie Rogers Garden at the Akron Art Museum

Landscape architects
OLIN

The Bud and Susie Rogers Garden at the Akron Art Museum increases all aspects of environmental benefits and provides space for social interaction. The gardens creatively address design challenges, such as a 13-foot elevation change, while providing accessible walkways. The amount of native trees and plants transformed the site from black to green and provides a beautiful space for museum programs.

Benefit Value

The 83 new trees are estimated to sequester 2,788 pounds annually and 63,474 pounds over the next 20 years.

Using the SCC, the benefits of designing nature-based solutions for carbon mitigation may be approximately $1,480- $5,400 for the one-acre site that previously provided no carbon sequestration.

Additional Economic Benefits of Nature-Based Solutions

Public sector clients may be interested in how nature-based solutions offer other benefits for a project. This section also takes a look at how private sector goals such as financing and competitive advantage can be fulfilled by designing nature–based solutions.

Landscape architects provide innovative ways for projects to generate economic benefits. They can design projects that :

- Increase property values
- Meet regulatory requirements[36] and access different financing options
- Contribute to positive branding and corporate social responsibility goals
- Provide aesthetic appeal, giving these places a competitive advantage

Increase Property Values

Creating well-designed parks, green spaces, and tree-lined streets can increase property values by making areas more attractive to buyers and tenants. Green gentrification and displacement are real concerns. Housing is at an all-time high, creating affordability challenges.

Public investments in affordable housing and homebuyer support programs can reduce those impacts while still providing parks and green space as a general public benefit.

The Trust for Public Land summarized 40 national studies following the "proximate principle." It evaluated the market values of properties near a park, trail, or greenway, and found they are frequently higher than those of comparable properties elsewhere.

The summary study found that nearby green spaces can increase average home prices by 16 percent and average lot prices by 35 percent. Increased property value generally results in increased property tax revenues, which can help cover the initial acquisition and development costs of new green spaces in a few years.

Meet Regulatory Requirements and Access to Different Financing Options

Many cities and states are implementing stricter regulations for stormwater management, heat mitigation, and biodiversity. By incorporating nature-based solutions, projects can open new ways to finance projects, ensure compliance, create win-win solutions like tax/fee breaks, or reduce permitting costs.

Removing EPA Consent Decrees

The Historic Fourth Ward Park in Atlanta, Georgia, which was described earlier, also led to the removal of the U.S. Environmental Protection Agency (EPA) consent decree. Consent decrees are agreements between permittees and the EPA to comply with regulations in a specific timeframe. In the case of Atlanta, the park stored stormwater that would have otherwise entered the combined system. Reducing this runoff reduced the chance of the combined sewer overflowing raw sewage into waterways. The removal of a consent decree is extremely important for a city government and shows water quality regulatory requirements were met.

Leveraging Environmental Impact Bonds (EIBs)

DC Water used proceeds from an Environmental Impact Bond (EIB) to construct 77 green infrastructure projects in the Rock Creek sewershed. Before the DC Clean Rivers Project started, approximately three billion gallons of combined sewer overflows (CSOs) would flow into the Anacostia River, Potomac River, and Rock Creek annually, adversely affecting the water quality of the rivers and tributaries in the region.

The project established the effectiveness of green infrastructure in meeting regulatory compliance in the District of Columbia. It reduced combined sewer and stormwater runoff into Rock Creek, improving the health of waterways in the District. Landscape architects with Rhodeside & Harwell, Incorporated (RHI) contributed to the design of 79 green infrastructure facilities in this large-scale stormwater management project for the District.

Reducing Stormwater Utility Fees

The Philadelphia Water Department's Green Schoolyards program partners with communities and school districts to implement green stormwater infrastructure and provide educational opportunities and enhanced recreational amenities for students and the surrounding community. More than 1,400 acres of schools are in Philadelphia's combined sewer area. Almost 70 percent of these school properties are impervious surfaces such as rooftops and asphalt paving.

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The Philadelphia Water Department is working with the School District of Philadelphia, private schools, charter schools, faith-based schools, parents, and Friends of Schools groups to reduce runoff from the school properties. The projects reduce runoff and the school's stormwater fees to the Philadelphia Water Department.[37]

For example, the Chester Arthur Green Schoolyard is found at a public K-12 school in the densely populated Graduate Hospital neighborhood of Philadelphia, Pennsylvania. The schoolyard was designed by landscape architects at SALT Design Studio to reduce

stormwater by 28,000 gallons annually. The design infiltrated water and transformed the former parking lot into a quieter, greener play space open to community residents.

Contribute to Positive Branding and Corporate Social Responsibility Goals

Companies and developers can use nature-based solutions as part of their brand narrative, demonstrating their commitment to sustainability and corporate social responsibility. This can enhance their public image and attract environmentally-conscious customers or investors.

The Bank of America Tower in Houston, Texas, was designed by landscape architects at OJB to incorporate nature-based solutions, including a green roof and rainwater harvesting.

The building's 31,000-square-foot rooftop collects rainwater stored in four tanks and is used for cooling and flushing toilets. The tower uses 45 percent less water than similar-sized buildings.

The 35-story building's 12th-floor roof is a 24,000-square-foot sky park for tenants. Green roofs collect rainwater and provide insulation. Rainwater is used in toilets and urinals to reduce the facility's water bills by almost 80 percent.

Another example: VF Corporation has teamed with the Trust for Public Land for several years to help create greener parks and schoolyards for kids and families nationwide, targeting urban communities where climate change exacerbates inequities. VF and other corporations fund initiatives like the 28×28 Green Schoolyard Initiative, where landscape architecture firms such as Studio-MLA work with the Los Angeles Unified School District.

Provide Aesthetic Appeal

Nature-based solutions can be designed to enhance a project's aesthetic quality, making it more visually appealing and setting the project apart from less natural projects. In real estate, this provides a competitive advantage for developers.

The Shops at Park Lane in Dallas, Texas, was transformed by landscape architects at TBG Partners from a vacant parking lot into a green space with green roofs, mixed-use restaurants, and civic event space. The small green space has greatly impacted the surrounding area and helped boost occupancy rates of residential and retail spaces. According to reports from national retailers, these stores are in the top ten percent of sales due to customers spending time in the space.

Another example: Scissortail Park in Oklahoma City was designed by HargreavesJones to be a "70-acre urban oasis extending from the core of downtown Oklahoma City to the shore of the Oklahoma River."[38] The park has significant green space and includes

events with other areas designed to reflect a more natural environment. Scissortail Park was seen primarily as an economic development tool to "re-populate the urban core" in order to fight sprawl and bring more people down to the Oklahoma River.[39]

Conclusion

Landscape architects provide economic benefits to public sector clients. These benefits are increasingly essential to livable communities and human health and well-being. This primer introduces the more complex nature of how economics and environmental economics shape projects.

Landscape architects design climate projects, increase access to nature, and help reduce large global deficits like biodiversity loss. However, they will benefit from a cross-sectoral understanding and knowledge of economic disciplines and the economic models and approaches used by developers, insurance companies, and consultancies.

Environmental economics is a deep subject that offers some ways to communicate a wider range of economic benefits to clients. This primer introduces basic ways to communicate these economic benefits to any client while making the case for nature-based solutions.

How we can move economic benefits research forward:

Develop a practical understanding of the overarching project goals from the economic impact perspective. Economic impacts can be both positive and negative. Add to the positive economic benefits of projects by designing through nature-based solutions. Focus on the benefits of nature-based design in the project kick-off and design phases.

Be critical about what design elements you add and why you add them. For example, we now understand that planting trees has actual monetary value and is not just a project cost. Trees provide cost savings in the long run by reducing runoff, which can financially benefit clients. Careful design choices add to positive economic impacts. Describe and quantify or qualify the multiple benefits of a given design choice.

Continue to support the Landscape Architecture Foundation's *Landscape Performance Series* by advocating for the regular use of qualitative and quantitative metrics. Learn which quantitative benefits can be monetized using clear methods. For example, the benefit of potable water use is estimated by gallons saved, and the cost is saved by using local water rates.

Refer to best practices on the equitable distribution of environmental benefits to address social and economic challenges, such as inclusive design based on community and cultural needs. Learn about housing and other public investment strategies to avoid green gentrification and displacement.

Appendix A

Methods for Valuing Ecosystem Goods and Services

Table 1 summarizes approaches, methods, and values obtained for ecosystem goods and services.

Economists use these research approaches to construct total values for specific research questions about changes in ecosystem services. Benefits transfer is not mentioned in the table because values are derived from the methods in the table. Most values seen in non-academic documents use a benefits transfer approach.

Benefit transfer may be defined as the use of research results from pre-existing primary studies at one or more sites or policy contexts (often called study sites) to predict welfare estimates or related information for other, typically unstudied sites or policy contexts (often called policy sites).

Approach		Method	Value
Market valuation	Price-based Cost-based	Market prices	Direct and indirect use
		Avoided cost	Direct and indirect use
		Replacement cost	Direct and indirect use
		Mitigation/Restoration Cost	Direct and indirect use
	Production-based	Production function approach	Indirect use
		Factor income	Indirect use
Revealed preference		Travel cost method	Direct (indirect) use
		Hedonic pricing	Direct and indirect use
Stated preference		Contingent valuation	Use and non-use
		Choice modelling/Conjoint analysis	Use and non-use
		Contingent ranking	Use and non-use
		Deliberative group valuation	Use and non-use

Table 1 Valuation method and valuation types[40]

The approaches, methods, and values in Table 1 describe how economists design research projects to answer questions about the spectrum of values for environmental goods and services.

Market valuation can be performed with three approaches:

- Price-based
- Cost-based
- Production-based

There are also **non-market** approaches, including:

- Revealed Preference
- Stated Preference

Price-based

Market prices for goods and services are observed in actual markets, such as the market price for timber, which can be calculated by using the market price of the wood and considering factors like species, quality, and market demand. The market price of fish and seafood is used to value the economic contribution of marine and freshwater. The market value of carbon mitigation can be observed through the price of carbon credits.

Cost-based

Cost-based approaches estimate the values of a good or service if it is lost or needs to be replaced. Avoiding flood damage costs by maintaining wetlands and marshes is estimated by the cost of flood damage to structures (homes, roads) if the wetland or marsh is not present.

Forest values for filtration services are estimated by the avoided water filtration costs of building, operating, and maintaining a water filtration plant or system that filters to the same levels.

Replacement costs are similar to avoided costs. The value of an ecosystem service is based on what it would take to replace a similar function of the service. Constructing artificial flood protection like levees is a replacement cost that estimates the value of wetlands and marshes to provide flood protection services.

Restoration costs estimate the value of restoring an ecosystem from a degraded state to a restored state. The cost of all necessary items for the restoration is considered the value of the services provided by the particular ecosystem.

Production-based

Production functions and net factor income are ways of estimating indirect ecosystem services.

Production functions estimate how an ecosystem service contributes to the delivery of another in an existing market. First, a scientific cause-effect relationship is established between the service and the delivery of the market good. Then, the production function can model how changes in the resource impact economic activity.

When natural resources are a factor in producing some good, changes in the quality or quantity of the resource change the production costs by making production more or less expensive. The change in input costs affects the price or quantity of the final good. An example is protecting a forested area to preserve water quality and collecting data on the decreased chlorine needed for disinfection. The water supply costs will decrease and can be attributed to protecting the forested area.

Revealed Preference

Revealed preference travel cost and hedonic analysis are two ways economists can use observable data like the cost of a trip to a particular outdoor activity or the sales prices of homes near a park to estimate ecosystem value.

Researchers establish characteristics of specific sites for travel costs and then collect data on the costs of traveling and enjoying the sites' resources. Then, statistical models estimate the value of the differences between the sites. For example, the value of a more pristine pond for fishing may be estimated by analyzing different trip values to other ponds to determine what people are willing to pay to travel to the pristine site compared to the other sites.

Hedonic analysis researchers collect data on houses in an area and select houses with similar characteristics and other controls to isolate the factors that may influence the house's sales price. It is well known in the real estate markets that houses near green spaces, parks, or open spaces typically have higher values than houses in areas without these nearby. This approach is called "revealed preference" because people's choices of expenditures reveal their value.

Stated Preference

The final group of approaches and methods to estimate ecosystem values is called stated preference.

Researchers typically use surveys and ask structured questions with answers that can be statistically analyzed for value relationships. This is the only way to estimate what people "may" value for the non-use value category in total economic value. It can also be used for use values and typically asks hypothetical questions to see what people value for changes to a resource.

Contingent value, choice modeling, contingent ranking, and group valuation are different approaches to surveying people and estimating their willingness to pay for a change in the resource.

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