



## FINANCING BIOPHILIC CITIES

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In our rapidly urbanizing world there is a growing appreciation and understanding of the value of nature in cities both for nature's personal biophilic health benefits and for the large-scale ecosystem services that nature provides, such as: clean air and water; climate regulation; and a buffer for increasingly inconsistent flood and weather systems. Biophilic cities embrace these diverse values by nurturing native, natural systems to grow green infrastructure that provides cost effective environmental benefits but also creates the opportunity for urban residents to interact with nature on their doorsteps. Biophilic cities

see opportunities in their investments in green infrastructure to restore, repair and enhance urban ecological systems. These investments reap economic, environmental and biophilic benefits for these cities.

These benefits are gradually being internalized and quantified by our economic markets, which are increasingly accounting for the need for healthy and active natural systems within cities in new and innovative ways. Operating at their best, these market forces not only embrace the utilitarianism of urban nature but also provide an avenue for promoting biophilic interests. They can

spur the development and conservation of diverse urban ecologies, which create the opportunity for residents to observe and experience nature in urban settings.

The result is a new magnitude of financing for nature in cities and a promise of funding for biophilic solutions to environmental problems that are growing beyond the capacity of traditional governmental and philanthropic sources. Cities across the U.S. and globally are embracing non-traditional sources of financing to enhance urban natural ecosystems and are, consequently, increasing biophilia within their borders. Financing efforts include a new level of partnership and collaboration with private investors, but also a heightened government funding focus on green infrastructure.

### Growing Green Investment

A report from The Nature Conservancy's investment unit, NatureVest, identified [\\$23.4 billion in global "conservation impact investments"](#) over the five year period of 2009 to 2013. The report defines these investments, which I term "green investments" here,

as investments intended to return principal or generate profit while also enhancing natural resources and ecosystems. The figures provided by NatureVest have only increased since 2013, as an estimated \$10.6 billion was invested in 2014 with an additional 16 percent of increased investment projected by JP Morgan for 2015. Separately, the fixed income green bond market tripled in size from \$11 billion in 2013 to \$37 billion in 2014.

These investments can return sustained benefits. For one thing natural, green infrastructure does not depreciate over time in contrast to man-made structures. Consider one example cited by [Goldman-Sachs](#) and The Nature Conservancy, which is the investment in oyster reefs versus a man-made seawall to protect New Orleans against rising sea levels. Both options have similar initial capital costs, but the sea wall depreciates over time while the oyster reefs remain undiminished and produce ancillary benefits like commercial fisheries, clean water and fish habitat.

Green investments also create small individual scale benefits that collectively



(OPPOSITE)  
Green Infrastructure in Philadelphia.  
Photo Credit: [phillywatersheds.org](http://phillywatersheds.org)

(LEFT)  
Kennedy Center Green Infrastructure  
Streetscape Project from Nitsch  
Engineering  
Photo Credit: [D.C. Water](http://D.C. Water)

amass to significant economic savings in terms of increased worker productivity and reduced healthcare costs. A [Terrapin Bright Green report](#) on the economics of biophilia estimates savings of \$2,000 per employee per year with increased productivity related to office natural daylighting and \$93 million per year in healthcare costs related to shorter hospital stays by providing patients with views of nature.

Other added benefits of green investments include the reduced cost and risk for public entities that are not forced to solely shoulder the cost of green infrastructure improvements. Private investments leverage other new sources of capital and create a greater connection between the private community and cities' natural amenities. [New sources of private funding](#) can also help to accelerate the development of green infrastructure and help to reduce increased costs that are lost as project time lines lengthen.

Accordingly, interest is growing in a variety of financial sectors. For example, in 2014 Goldman Sachs convened an Environmental Innovation Finance Summit to overview the availability of investment opportunities in solutions that benefit the environment as well as investors. Supported by a growing network of international policy the Executive Director for the United Nations Environment stated that 2016 was the "Year of Green Finance"; a refrain that has been echoed by variety of financial experts with the urging that global cities embrace green financing to ensure that their growth is sustainable.

In this article, I take a closer look at Washington, D.C., and Philadelphia, which are two examples of biophilic cities using green finance to increase the presence of nature in their cities both for the ecosystem services that nature can provide and also for the biophilic benefits that result from healthy native urban ecological landscapes.

Washington, D.C.

Washington, D.C., has undertaken a few different measures to enhance nature by using green financing opportunities. A primary driving force is the city's need to control stormwater as the fastest growing contributor of pollution to the Chesapeake to the tune of 3 billion gallons of stormwater and overflowing untreated sewage waste contributed to the Chesapeake watershed annually. DC is seeking to address this environmental challenge by funding green infrastructure with a specific emphasis on the use of native landscaping.

In 2013, the city initiated a stormwater credit trading program to fund private green infrastructure development within the city. At the outset, the DC Department of Energy & Environment modified its stormwater management regulations to require that new development account for the capture of stormwater from their sites for all but the largest rain storms.

Specifically, the 2013 Stormwater Rule applies to new major disturbances of land and new substantial improvements to structures. These new developments must capture the majority of rainfall



Race Street Pier  
Photo Credit: James D. Brown

onsite. The stormwater must be managed with one or more approved green infrastructure best management practices, which include: green roofs; rain gardens; constructed wetlands; and tree planting and protection.

In practice, developments are only required to capture 50% of the stormwater onsite and have some flexibility with the option of purchasing credits for the remaining 50% from other developments that have exceeded their obligations. Developers can also alternatively pay an in-lieu-of fee to the city. The fees are used to fund other green infrastructure projects with the city. A purchaser can choose to bank credits that it purchases and that exceed its annual obligations for later use or sale.

Thus, a developer that invests heavily in green infrastructure in its site design can create additional returns on investment by selling the stormwater credits it generates to other new developments that are not meeting their stormwater capture obligations. The net aim for the city is to capture and treat stormwater at unprecedented lev-



Cira Green  
Photo Credit: James D. Brown

els and for less than the cost of traditional grey infrastructure methods.

Two recognized early challenges for the program are creating sufficient liquidity within the credit market and lack of a centralized entity to facilitate trades. A stormwater credit retention fund has been established by NatureVest and EKO Asset Managers who are working jointly to solve these market challenges.

DC's guidance for implementing stormwater projects promote the use of native landscaping that holds the promise of creating vibrant ecosystems for flora and fauna. For example, street level stormwater projects, like bioretention and constructed wetlands, emphasize native plant species. The city has developed demonstration sites that promote native vegetation for these project types. The similar use of native plants for green roofs is more challenging given the need to emphasize particularly hardy species that can tolerate more intense rooftop conditions. However, the recommended plant lists for green roofs also include plant species that are native to the region



Stonecrop Blossom  
Photo Credit: Courtesy Alan Cressler,  
Lady Bird Johnson Wildflower Center

and the U.S., such as various species of wild stonecrop from the succulent *Sedum* family.

Complementing the stormwater credit trading program's promotion of native landscaping are DC's [Green Area Ratio \(GAR\)](#) landscape and design standards for new development. The GAR is a comparative weighting of landscape features with the aim of increasing the quantity and quality of the urban landscape's environmental performance in the areas of stormwater retention, air quality and heat reduction. The GAR scoring system provides a bonus for the use of native landscaping that is set out in the U.S. Fish & Wildlife Service's Native Plants for Wildlife Habitat and Conservation Landscaping in the Chesapeake Bay Watershed.

These various efforts by DC emphasize the value of flourishing native ecosystems in creating answers to the environmental problems that trouble all growing urban areas. The investments encouraged by DC's recent efforts demand that the city's infrastructure perform double-duty: to meet the environmental needs of a major city in terms of clean air and water; and to enhance the urban landscape to provide

individuals with the opportunity to connect with nature in the course of their daily lives.

#### Philadelphia

Philadelphia is a second city getting creative with financing to increase the presence of nature. Since 2011, as part of its [Green City, Clean Waters program](#), over 1,110 new green landscaping features have been added to the city's streets to capture stormwater. Philadelphia has achieved this result by reconsidering how it invests public funds.

At its completion, the estimated clean water improvements and financial savings are quite impressive. Through the addition of "living landscapes" on current impermeable surfaces, including roofs, streets and sidewalks, it is estimated that stormwater pollution can be reduced by 85%. This would improve the quality of the city's waters beyond that for any city resident within living memory. The estimated savings to accomplish this task: \$5.6 billion!

So how is Philadelphia accomplishing this feat? By combining its investments in stormwater control and the development

of public parks. The Philadelphia Water Department (PWD) is teaming up with the Parks and Recreation Department to respond to the demand for more green space within the city, while cost effectively controlling stormwater pollution. The first piece of this puzzle was to use PWD funding from residents' water bills to add 500 acres of new park space within the city by 2015 with integrated green stormwater infrastructure as part and parcel of the parks.

Other aspects of the green investment include a large-scale street tree program, conversion of vacant and abandoned lots, and restoring streams. Philadelphia plans to continue its current commitment and spend \$2.4 billion over 25 years to capture over one-third of the city's stormwater from impervious surfaces. This plan was developed after 10 years of pilot programs and careful consideration as to its feasibility.

Philadelphia's commitment has leveraged additional financial commitments. Beginning in 2012, the Environmental Protection Agency (EPA) committed to ensuring that Philadelphia accomplishes its 25-year Green City, Clean Water plan, as a demonstration of the EPA's support for innovative greening approaches. In 2014, EPA provided \$5 million in funding to five Philadelphia area universities to explore the financial and social benefits of the green infrastructure plan.

Prior to the adoption of the plan, in 2006, the city adopted a requirement that new

#### PORTLAND, OREGON

For other remarkable savings consider Portland, Oregon's River to Tabor program, which used green infrastructure to control stormwater on the city's east side. The projected cost of a traditional stormwater control project using pipes was estimated at \$144 million, while the green infrastructure alternative cost 44% less at \$81 million: a savings of \$63 million.

developments larger than 15,000 square feet manage the first inch of stormwater runoff from their sites. The city estimated that over 25 years the benefits of this requirement would exceed \$1 billion. Similarly, in 2010, the city began phasing in an update to its stormwater utility fee that bases the fee on the square footage of impervious surfaces. The city has developed a [stormwater credit and grant program](#) to assist non-residential properties in retrofits that increase green infrastructure on their property and reduce their stormwater utility bills. The Green City, Clean Waters plan complements these private investments in green infrastructure to put in place a city-wide plan for greening.

One last piece of the puzzle is the redevelopment of vacant lots with an eye towards green infrastructure. As of 2011, there were over 40,000 vacant lots within Philadelphia, which is the result of a 24% reduction in the population of the city since World War II. The city has a community vacant lot program that provides clean up services for the 74% of vacant lots that are privately owned. The city is also aggressively looking to move the lots it owns to private ownership to encourage redevelopment. For those lots with limited redevelopment potential, the city is developing a plan to dedicate these lots for green infrastructure. A [December 2012 Report](#) indicates significant potential for improving the greening of vacant lots within the city. One tremendous added benefit of greening vacant lots is providing access to green



Shoemaker Green at University of Pennsylvania  
Photo Credit: James D. Brown

space for the more than 200,000, mostly low income, residents without half-mile access to public green space.

All this effort has translated into 441 different green infrastructure projects with unique biophilic qualities on over 837 acres across the city within the first five years of the program. Projects include rain gardens in municipal parks and stormwater tree trenches in public right-of-ways, along with private projects within commercial parking lots and residential common areas. As with DC, the challenge is for these projects to maximize the use of native and diverse landscaping to not only provide infrastructure services but also to grow healthy urban ecosystems that create an opportunity for residents to find respite and to connect with nature during the course of their daily lives.

Thinking outside the box will result in significant benefits for Philadelphia as it is enjoying a new era of access to nature and clean water, at substantial savings compared to a traditional stormwater infrastructure plan, and with the knowledge that green infrastructure can be maintained in perpetuity. As emphasized by the city, the plan has a triple bottom line that provides economic, social and environmental benefits. To the extent that the resulting projects can create vibrant and

functioning urban ecosystems, these projects can contribute and also enhance the presence of biophilia across the city.

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