EARTH ECONOMICS

# Green Infrastructure:
# Advancing Nature-Based Solutions to Urban Challenges
# Webinar Q&A

Thank you for attending the February 14th webinar, *Green Infrastructure: Advancing Nature-Based Solutions to Urban Challenges.* We received many insightful questions from you during the webinar, but unfortunately could not address them all during our time together. The purpose of this document is to compile the questions we received during the webinar and provide written responses. Of course, many of these topics are broad and nuanced, and we can't hope to do justice to them in a short document like this one. If you'd like to further discuss any of these topics, or have clarifying questions, please do not hesitate to contact us at urbansolutions@eartheconomics.org.

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## Methods and Data

**How do you monetize benefits like improved air quality? How do you account for some potentially negative impacts of GI, like increased rodents or crime?**

A variety of methods have been developed by economists to value the co-benefits of green infrastructure, including avoided cost, replacement cost, contingent valuation, and hedonic pricing. You can find more detailed examples of valuation methods here. Not all valuation methods are suitable for all benefits. In other words, most benefits are associated with one or more specific methods of measurement. For example, to monetize a benefit like air quality, you could look at the reduced healthcare costs that result from improved air quality, or you could use surveys to measure peoples' willingness to pay for cleaner air.

Full accounting of a green infrastructure project should always include any negative externalities. Holistic analysis requires addressing diverse costs as well as diverse benefits in order to identify solutions that are sustainable. To account for negative impacts of green infrastructure, we can use




Office 253.539.4801
Fax 253.539.5054
Address 107 N. Tacoma Avenue
Tacoma, WA 98403

many of the same methods that we use to measure the benefits. Typically, we approach green infrastructure valuation from a 'cost-benefit analysis' view point. In our projects, we compare the costs and benefits (including financial, social, and environmental costs and benefits) of different alternatives. So, any negative impacts of green infrastructure would be measured as costs and included in our analysis.

**Could you describe where you get the benefits information for property value uplift? Who or what resource is a good one to look into for other communities?**

To measure the impact of green infrastructure on property values, we often use existing literature on home price comparisons of areas with and without green infrastructure. We may use studies like this one:

> " Saphores, J. D., & Li, W. (2012). Estimating the value of urban green areas: A hedonic pricing analysis of the single family housing market in Los Angeles, CA. Landscape and urban planning, 104(3-4), 373-387" – which analyzed the home value impacts of urban trees in Los Angeles.

If we are evaluating the property value impact of a specific green infrastructure development, we may collect information about the sales prices of nearby properties and conduct a statistical analysis of the values before and after the installation of the green infrastructure asset. We can then isolate the price effect that is specific to the green infrastructure asset by controlling for other variables that we know affect property values. This is known as a hedonic real estate price analysis.

**We are working with one state DEQ that says it would cost $250K to do a study of stormwater benefits of preserving mature trees so they can "count" towards stormwater management goals. Are there studies you recommend they can adapt for their use that would cost less? Thanks!**

Rather than completing a custom, or "primary," study for your area, which could be expensive (as you've noted), one approach would be to use a "benefits transfer" or "function transfer" approach to valuing the green infrastructure assets you're looking at. You could review existing research conducted in a comparable location and "transfer" the economic (or physical) benefits found in this research to your site of study. This method is widely accepted as an alternative to primary analysis, which is often prohibitively costly. When employing the benefits transfer method, you should try to include multiple values from multiple studies, to ensure that the estimates are appropriately conservative. For example, to place a value on the stormwater benefits of mature trees, you could look at studies that quantify the cost savings associated with using trees for stormwater management versus traditional grey infrastructure. A couple of studies that may be useful include:



*Office* 253.539.4801 *Fax* 253.539.5054 *Address* 107 N. Tacoma Avenue Tacoma, WA 98403

"'Stormwater to Street Trees: Engineering Urban Forests for Stormwater Management" (2013) US Environmental protection agency. Retrieved from: *https://www.epa.gov/sites/production/files/2015-11/documents/stormwater2streettrees.pdf*"

"Matteo, M., Randhir, T., & Bloniarz, D. (2006). Watershed-scale impacts of forest buffers on water quality and runoff in urbanizing environment. Journal of water resources planning and management, 132(3), 144-152"

**Can you refer to a document/source that would list examples of $ savings when GI used or examples how the cost-benefit analysis can be performed?**

Although the financial savings of green infrastructure solutions can be very specific to the area in which they are installed, here is an example of how these numbers can be determined:

"Mittman, T, Moss, C. (2014) The Economics Benefits of Green Infrastructure: A Case Study of Lancaster, PA. US Environmental Protection Agency" – provides and extensive analysis of Green Infrastructure costs and benefits. Retrieved from: https://www.epa.gov/sites/production/files/2015-10/documents/cnt-lancaster-report-508_1.pdf"

The EPA also has a page dedicated to samples and studies of green infrastructure Cost Benefit Analysis reports, which may be useful as well. That page can be found at: https://www.epa.gov/green-infrastructure/green-infrastructure-cost-benefit-resources.

**Where can we access the hard data that shows the measured benefits claimed for each of the categories (water supply, reduced heat, water treatment, etc. for each of the green technologies (permeable pavement, green roofs, etc.)?**

Most of our studies are public, and provide detailed information about the methods we use to value each category. You can view our publications online at http://www.eartheconomics.org/publications. If you're interested in a specific study or result, but you can't find the report online, please contact us at urbansolutions@eartheconomics.org.

**I see the stated benefits (prior slide), however, is there data to support each item or are these just PR bullets?**

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In addition to our own work, many academics and practitioners have conducted are currently conducting research that enumerates the benefits that we've listed per asset. As mentioned above, the benefits can be quite site specific, and many values are difficult to quantify, like social benefits. But we believe that without these values, no CBA is comprehensive. For an example of the type of research being done to value some of these social and public health benefits of urban nature, we recommend checking out the Human Dimensions of Urban Forestry and Urban Greening.

**This goes for the econ data and numbers, but also it would be great to have more info on the specific projects. Is there a report I can get more info on the Mirabeau project and others?**

The Mirabeau triple bottom line report, which we worked on with Impact Infrastructure, is available here (note the link does not seem to be working at present – we will contact our partners). Most of our studies are public, and provide detailed information about the methods we use to value each category. You can view our publications online at http://www.eartheconomics.org/publications/. If you're interested in a specific study or result, but you can't find the report online, please contact us at urbansolutions@eartheconomics.org.

**Can you/do you quantify or assign a value for switching to permeable concrete vs. impermeable surfaces (i.e. for heat or stormwater quality)?**

**+**

**What's the lifetime of the infiltration achieved by permeable pavement? In other words, how long can an infiltrated area continue to provide that filtering service?**

**+**

**Is the life expectancy of permeable pavement comparable to traditional pavement?**

One approach to assign a value for switching to permeable pavement from impermeable services would be to conduct a benefit-cost analysis, which would compare the costs of replacing the pavement alongside the added benefits (reduced stormwater management costs, water quality, groundwater recharge, reduced maintenance etc.). Evaluating impermeable pavement is not our specialty, but if you are interested more specifically in the value of this type of infrastructure we would recommend the following journal articles that may be applicable:

This article examines the financial costs and runoff performance of a variety of green infrastructure installations, including permeable pavement, compared to their conventional counterparts:



*Office* 253.539.4801
*Fax* 253.539.5054
*Address* 107 N. Tacoma Avenue
Tacoma, WA 98403

"Montalto, F., Behr, C., Alfredo, K., Wolf, M., Arye, M., & Walsh, M. (2007). Rapid assessment of the cost-effectiveness of low impact development for CSO control. Landscape and urban planning, 82(3), 117-131."

This articles provides a lifecycle cost analysis of permeable pavement. This research finds that permeable options have comparable life cycle durability to their conventional alternatives:

"Brattebo, B. O., & Booth, D. B. (2003). Long-term stormwater quantity and quality performance of permeable pavement systems. *Water research*, *37*(18), 4369-4376."

## Equity and Gentrification

**Can you address the idea of anticipating and limiting gentrification? I work in Chicago where there is anxiety that GI to manage stormwater and provide cooling etc. will be "too" nice and will create amenities that raise property values very quickly, pricing out current residents.**

**+**

**Does your analysis of any gentrification results from cleanup - do homeowners who are a part of the community benefiting from cleanup as property value increases?**

We know that gentrification and displacement are potential negative outcomes of neighborhood improvement and revitalization, including both green and grey infrastructure amenities. However, gentrification need not be an inevitable or natural result of neighborhood investment. Many underlying social factors make residents more vulnerable to displacement. Some of these factors include: low wage jobs, a high percentage of renters, and a high foreclosure rate. These factors are best addressed through public policies that focus on addressing systemic inequality. Green infrastructure alone cannot solve inequity, and infrastructure investments – green or other – should be part of larger policies and programs centered on equity. As part of a larger framework of solutions that address equity as an explicit policy goal, infrastructure investments can help community residents thrive in place by improving access to jobs, health benefits, and safe spaces.

We don't present ourselves as having all the answers to complex issues like equity. Our goal is to continue to bring an economic perspective to conversations about these issues, because we believe that by empowering communities with economic knowledge, we enable them to leverage our work to meet their challenges in a more holistic way. That said, we are constantly working to better educate and train our team to consider equity in our work, and all suggestions are welcome.



*Office* 253.539.4801
*Fax* 253.539.5054
*Address* 107 N. Tacoma Avenue
Tacoma, WA 98403

In the meantime, here are a few resources that may be of interest:

- Race Forward - Green Equity Toolkit: Advancing Race, Gender and Economic Equity in the Green Economy. https://www.raceforward.org/research/reports/green-equity-toolkit-advancing-race-gender-and-economic-equity-green-economy
- Partnership for Southern Equity - http://psequity.org/
- Puget Sound Sage - Transit Oriented Development That's Healthy, Green, and Just. http://pugetsoundsage.org/wp-content/uploads/2016/10/TOD-that-is-Healthy-Green-and-Just-1.pdf

**How does your process incorporate the opinions, cultural norms, and preferred ecological design of the communities that you work in? Does it ever negatively affect or deter green infrastructure projects at Earth Economics?**

At Earth Economics, we strive to reveal the hidden costs and benefits of different development scenarios. Though most of the design of alternatives is completed before we begin our economic analysis, we try to incorporate social and cultural values whenever possible and let the community drive decisions around the benefits that are important to them. We also recommend that infrastructure and development projects make equity an explicit goal, so that affected communities are included in the design, planning, and implementation process.

## Federal Green Infrastructure Policy

**Can you explain how green infrastructure is being integrated into FEMA's CBO evaluation and do you have any examples of states/cities that have addressed their flooding concerns in such a way?**

In 2013, FEMA became the first federal agency to adopt ecosystem service valuation in formal policy development, using values and concepts provided through a project with Earth Economics. Faced with rising natural disaster costs and climate uncertainty, FEMA approved Mitigation Policy FP-108-024-01, which allows the inclusion of ecosystem services in benefit-cost analysis for flood-related acquisition projects. In a 2016 policy update, recognizing the value of green infrastructure for resilience, FEMA then expanded the policy to cover drought and wildfire mitigation actions. This means that pre- and post-disaster mitigation funds can now be spent on projects that support resilience through green infrastructure approaches, including aquifer storage and recharge, and floodplain and stream restoration. Also critically important, recognizing the value of the ecosystem



*Office* 253.539.4801 *Fax* 253.539.5054 *Address* 107 N. Tacoma Avenue Tacoma, WA 98403

services provided by forests, post-wildfire mitigation actions such as soil stabilization, flood diversion, and reforestation are now considered immediately cost-effective if they cost less than $5,250 per acre, which streamlines the process for communities who are recovering from wildfires.

To answer the second part of your question, we would love to know which communities have adopted these new funding opportunities through FEMA, but it has been a challenge to find out. Unfortunately, FEMA does not track the use of these new policies in a way that makes it easy for them to analyze the data. Though we have put in several data requests, and we are optimistic, we have not yet been able to secure the data. FEMA has also told us that while they encourage the use of these policies, many communities are still unaware of these opportunities, so Earth Economics has been focused on educating local agencies about these new policies.

**Are you involved at all/have any hope that ESS valuation could be included in the new Federal infrastructure proposal in valuation?**

We are not directly involved, but we have had some requests from partners to provide language or guidance around green infrastructure to support their policy efforts. We are optimistic though, as more and more we are seeing federal agencies recognize the value of including ecosystem services in their policy decisions, especially since the 2015 CEQ directive "Incorporating Natural Infrastructure and Ecosystem Services in Federal Decision-Making." For example, HUD encourages the use of green infrastructure methods for the post-disaster support it is currently providing in Texas and Puerto Rico. For another project we recently started, we are analyzing the streams of federal and local infrastructure funding, and we believe that even diverting a small fraction of these streams to green infrastructure could result in billions of dollars more in resilience investments. Stay tuned for more!

**How is Earth Econ's valuation framework different than other resilience and sustainability frameworks, such as 100 Resilient Cities or LEED?**

Our valuation framework is intended to bolster many of the existing resilience and sustainability frameworks with the addition of economics. There are of course too many to list, but the 100 Resilient Cities (100RC) framework is a good example. We have been a "Platform Partner" on the 100RC program since 2015, which means that we can help resilient cities in need of our ecosystem valuation services (and the Kresge Foundation has generously supported some of this engagement). 100RC has developed the "City Resilience Framework", which according to their website describes the essential systems of a city in terms of four dimensions: Health & Wellbeing; Economy & Society; Infrastructure & Environment; and Leadership & Strategy. Though we believe the environment is



*Office* 253.539.4801
*Fax* 253.539.5054
*Address* 107 N. Tacoma Avenue
Tacoma, WA 98403

crucial and interconnected with all these areas, within this particular framework, we support the 100RC network with expertise around the "Infrastructure & Environment" component of their framework. Regarding LEED, we do not work directly with LEED, but in the past we developed a framework to look at the ecosystem service benefits of "green buildings," which are typically LEED-certified.

**Do you have any examples where co-benefits have been used not only to increase support, but to actually bring in additional funding from sectors that would benefit from the co-benefits? (for example, using health care dollars to invest in urban tree programs that reduce health care costs)**

As you suggest, one important outcome of valuing co-benefits can be to bring in new stakeholders or sectors that can support investments in green infrastructure. Your healthcare example is a good one: We're currently working with the Center for Community Investment to develop a framework for valuing some of the broader benefits of community investments like affordable housing, food security, and urban green space. Broadly, the goal is to engage the Healthcare Sector, and demonstrate why it makes sense for them to support these investments from a social, economic, and financial perspective.

Our valuation work has also been used by several government agencies to support bond measures for open space, trails and parks. Using economic valuation, these agencies were able to bring in new stakeholders – often the business community or fiscally conservative voters – and show them the economic benefits/return on investment of supporting these investments.

**What is cost of your services?**

As we discussed on the webinar, we can currently offer pro-bono services to Kresge Foundation grantees. For other projects, the costs can vary according to the type of analysis, level of detail, and number of staff involved. If you have a project in mind, we would be glad to discuss it with you and come up with a budget estimate. We can often be flexible and scale the analysis to fit within your budget.



*Office* 253.539.4801
*Fax* 253.539.5054
*Address* 107 N. Tacoma Avenue
Tacoma, WA 98403