RP2014

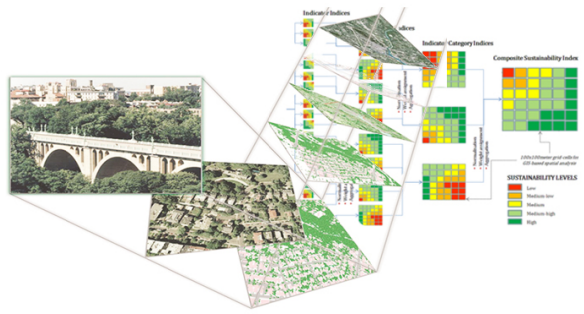
QUANTIFYING THE CONTRIBUTION OF GREEN INFRASTRUCTURE TO CARBON AND ENERGY PERFORMANCE: MEASURING THE SUSTAINABILITY PERFORMANCE OF GI

Problem

The rising level in urbanization puts additional pressure on land consumption, resulting in landscape fragmentation, biodiversity loss, urban heat islands, greenhouse gas emissions, and the destruction of sensitive ecosystems. There is also a decrease in human health and well-being, among other negative impacts on society.

As a remedy to some of these negative consequences, green infrastructure as opposed to grey infrastructure is identified as an alternative nature-based and cost-effective solution for increasing the sustainability of urban development. It is increasingly valued in a wide variety of settings from water purification to climate change adaptation and mitigation.

Figure 1 Schematic of composite indicator-based model



Solution

The ability to assess the sustainability performance of the built and natural environments based on measurable criteria at a variety of temporal and spatial scales is critical for sustainable urban development.

There is an emerging body of tools that assess the performance of some factors of green infrastructure, yet there is no tool that is comprehensive and integrative across all factors and all types of green infrastructure.

Therefore, this project establishes a comprehensive and integrated assessment framework, performance benchmarks for each indicators and consequently composite indicator-based model for GI projects. This will lead to reduction in carbon emissions and save energy usage in buildings with green elements.

Figure 2 Indicator set of the model

Categories	Sub-Categories		Indicators
PROVISIONING SERVICES	*Material and resources*	1	Food (e.g. fish, game, livestock) provision
		2	Water (e.g. for drinking, irrigation, cooling)
		3	Raw Materials (e.g. fibre, timber, fuel wood, fodder, fertilizer)
REGULATING SERVICES	*Climate regulation (Climate change adaptation and mitigation)*	4	Reduced building energy consumption for heating
		5	Avoided carbon emissions from building energy savings for heating
		6	Reduced peak summer surface temperatures
		7	Reduced building energy consumption for cooling
		8	Avoided carbon emissions from building energy savings for cooling
		9	Carbon stored and sequester in wooded landscape
		10	Carbon stored and sequester in non-wooded landsape
	Regulation of water flows and waste treatment	11	Energy emissions savings from reduced stormwate volume entering combined sewers
		12	carbon emissions savings from reduced stormwate volume entering combined sewers
		13	Reduction in wastewater treatment costs
		14	Avoided costs of traditional water drainage infrastructure
	Air quality regulation (e.g. capturing (fine) dust, chemicals, etc.)	15	Air pollutant removal SO2, NO2, CO and O3 formaton
	Noise reduction	16	absorb noise pollution by woodland, grass and shrubs (distance)
	Soil erosion prevention	17	area protected from erosion
CULTURAL SERVICES	*People and place*	18	aesthetic aspects: Willingness to pay for a view of urban green space
		19	Opportunities for tourism (economic value of numbe of visitors)
		20	Recreation use by local population (economic value)
		21	Employment creation (job)
	Health and wellbeing	22	Health costs savings from increase in physical activity
		23	Health cost savings from reduction in mental health disorders
		24	Reduced mortality from increased walking
		25	Health cost savings from reduced in-patient stays
	Land value	26	Residential land and property value uplift
		27	Commercial land/property value uplift
	Mobility	28	Reduced cost of using private car by walking and cycling and light railway
HABITAT SERVICES	*Biodiversity*	29	Number of migratory species (Maintain and protec)
		30	Area designated for nature and wildlife conservation (woodland and wetland)

Since green infrastructure is identified as a nature-based and cost-effective solution for improving the sustainability of urban development, a comprehensive, integrated and multi-criteria model at a variety of temporal and spatial scales is required to evaluate its performance.

Benefits

The value of this study for the industry is the ability to evaluate the overall performance of the entire infrastructure project across a number of selected indicators and trade-off between proposed various scenarios. This includes the buildings and infrastructure which are associated with green infrastructure projects from the design to the ongoing performance during their life cycle.

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