

RP2014

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

## Research Question

**What are the criteria for designing a comprehensive and integrated assessment model that measures the sustainability performance of green infrastructure networks and is able to do so in ways that are both comprehensive (addressing economic, social, and ecological factors) and integrated (dealing with the nature of green infrastructures as interconnected networks with multiple purposes)?**

- Ecological Network
- Recreational/cultural Network
- Economic Network

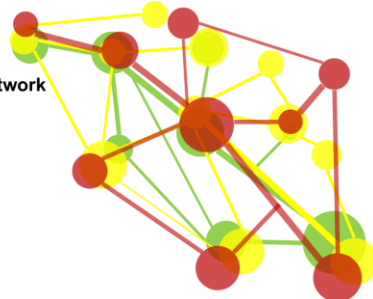


Figure 1: Schematic Concept (Network of GI)

## Objective

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

*This project is intended to establish a comprehensive and integrated assessment framework, performance benchmarks and a composite indicator-based model for GI projects. This will lead to reduction in carbon emissions*

*and energy use in the built environment.*

Based on the literature, semi-structured interviews and online questionnaire survey, a **conceptual framework** has been developed. This framework is based on a combination of ecosystem services, human health and well-being. It determines what is going to be measured, why it is being measured and will lead to the establishment of the composite indicator-based model.

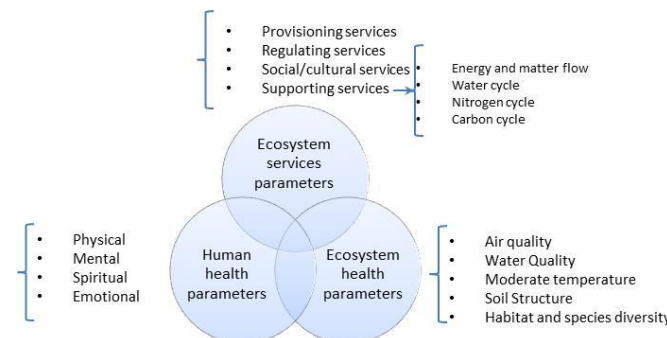


Figure 2: Conceptual framework links GI performance into ecosystem services, ecosystem health & human health & wellbeing.

## • Model Development- Part 1: Semi-structured interviews

Semi-structured interviews were used to extract views on green infrastructure definitions, structure, concepts and framework to verify the conceptual framework. The expert knowledge and experience of the interviewees was employed to identify the appropriate performance indicators.

## • Model Development- Part 2: Online Questionnaire

An online questionnaire (373

respondents) was used to rate the importance or “weight” of the indicators. The indicators were then normalized, weighted and aggregated based on the OECD (2008) handbook on constructing composite indicators.

## • Model Development- Part 3: Develop a composite index, build and test the model

Two methods, Grid-based and the Object-based, were reviewed to identify the most appropriate way to present the results. A range of modelling software has been reviewed, and the object-oriented dynamic modelling software STELLA was selected together with the IDRISI software that is used for land use- land cover change modeling, ecosystem services modeling and image processing. These two software tools, STELLA and IDRISI will be applied to develop the indicator-based model and prepare data to export to ArcGIS for model verification and validation.

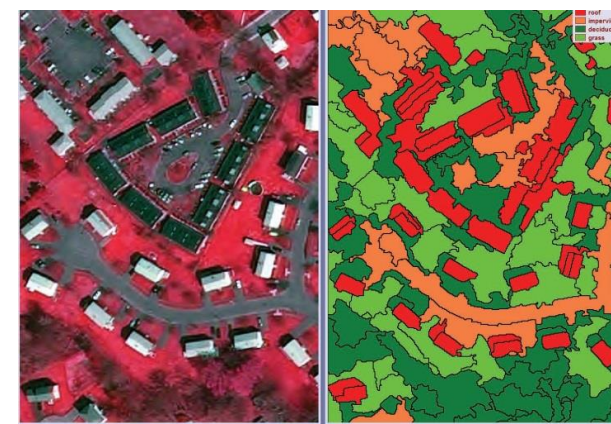


Figure 3: Model development based on land use land cover (Image segmentation by IDRISI)

## Results

Analysing and coding the interviewees’ responses revealed nine major concepts and themes that were consistent across all interviewees:

- Concept 1: Climate change adaptation and mitigation
- Concept 2: Human health and wellbeing
- Concept 3: Healthy ecosystem
- Concept 4: Biodiversity
- Concept 5: Economic benefits
- Concept 6: Alignment with political issues and city strategies
- Concept 7: An active travel network
- Concept 8: Water management
- Concept 9: Food production

Based on the literature review and interviews, a set of 30 indicators in four categories including ecological indicators, health indicators, socio-cultural indicators and economic indicators has been proposed.

## Anticipated impacts

**The value of this study to industry is the ability to evaluate the overall performance of an entire infrastructure project across a number of selected indicators and to trade-off between scenarios.**

## Contact

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