LivGBGI: Living Lab Demonstration of Green-Blue-Grey Infrastructure's Multiple Co-benefits (heatwave, flood, drought and noise)

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Introduction

Globally accelerated urbanisation and the ageing population make heatwaves a significant threat to humans. Its intensity, duration, frequency, and extent are invigorating with climate change. GBGI are low-cost alternatives to infrastructure; can be flexible and can handle multiple climatic hazards. Studies have suggested that the Installation of specific GBGI, e.g roadside trees, can reduce the impacts of heatwaves and climate change.

Objectives

The main objective of the project is to build evidence for the co-benefits of GBGI against heatwaves. It includes two specific objectives (SO):

[SO1]: Evaluate GBGI's direct benefits in reducing heatwave impacts through direct monitoring from the network of sensors.

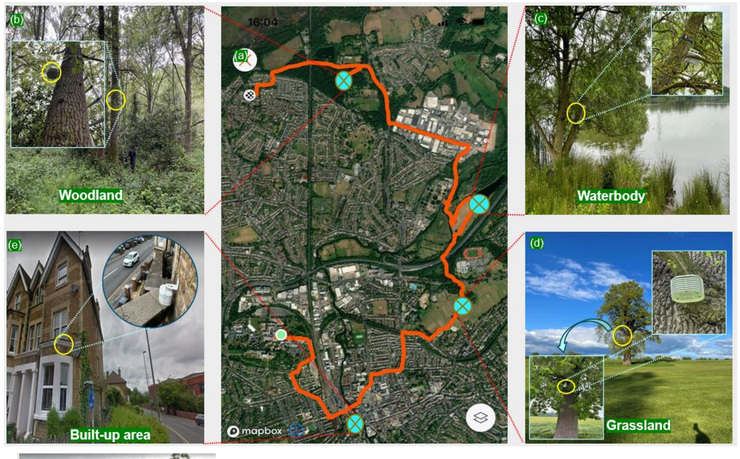
[SO2]: Analyse GBGI's co-benefits in reducing hydro-meteorological (drought and flood) and environmental (noise) through modelling.

[SO3]: Develop a recommendation guide to help assess the effectiveness of GBGI c0-benefits and ease its future implementation and upscaling.

Methodology

An existing network of temperature and RH sensors installed at five different types of GBGI (pond, park, green woodland and built environment) expanded to demonstrate their benefit, in terms of heat. The data utilised to assess temporal (seasonal and diurnal) variation in the mean or peak daytime local temperatures, heatwave risk, Urban Heat Island (UHI) effect, and cooling efficiency of GBGI.

Existing network of sensors



Newly developed

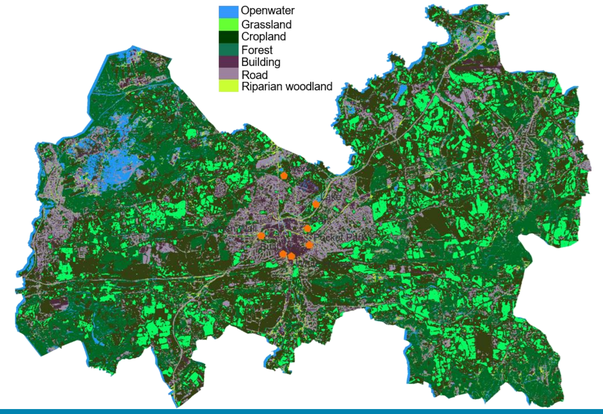
Stationary monitoring

Extension sensors:
- 1 Constructed GI (green wall)
- 1 Pocket park
- 1 Mixed green and blue infrastructure

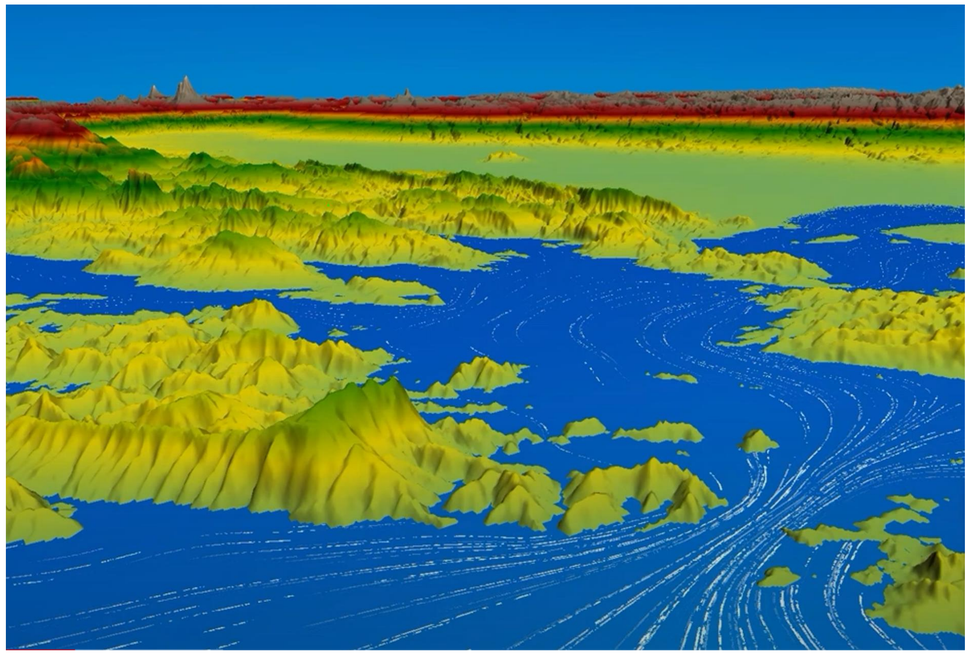
Network of sensors:
- 4 Green (woodland, park, pocket park, green wall)
- 2 Blue (waterbody, riverway (mixed))
- 1 Urban (built environment)

Sensor Installation

Land use and land cover classification



Numerical Modelling



- GBGI co-benefit: (1) Flooding – in progress
- GBGI co-benefit: (2) Calculating Noise Mitigation Provided by GBGI – in progress
- GBGI co-benefit: (3) Drought reduction – in progress

References

1Sahani, Debele, Kumar (2022). Efficiency assessment of nature-based solution for heatwaves. Under preparation.

GLL (2022). The first phase of the Heat-Cool initiative successfully completed. Available at: https://www.surrey.ac.uk/news/first-phase-heat-cool-initiative-successfully-completed.

Sahani, J., Kumar, P., Debele, SE., et al. (2019). Hydro-meteorological risk assessment methods and management by nature-based solutions. Science of the Total Environment 696, 1-17.

Acknowledgements

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