Modelling the impact of planting choices and management on the delivery of multiple ecosystem services by domestic gardens

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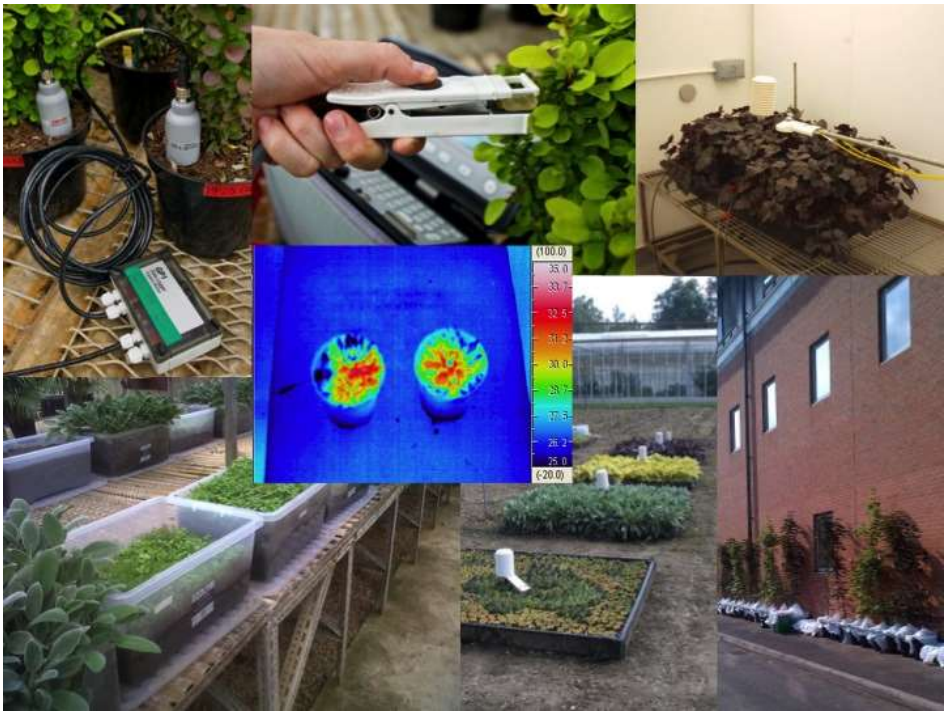
What we plant and how we manage our gardens can have a significant impact on the environment. Domestic gardens cover up to 30% of UK urban areas, and recent research[1] has linked garden plant characteristics (in terms of their structure and function) with provision of key ecosystem services. Using garden plants with specific environmental benefits could reduce risks posed by extreme weather (such as droughts, floods and heatwaves) while increasing the sustainability of urban spaces. Solid scientific evidence that brings together information on how green space planting choice influences the local climatic conditions, and the delivery of multiple environmental benefits, now and in the future, is much needed. It would inform the advice that organizations such as the Royal Horticultural Society (RHS) provide the UK gardening public to help them maximize beneficial ecosystem services, whilst minimizing environmental risks.



In this project the student will investigate the following research questions:

I. How will plant choice and plant management affect the water- and energy balance of plant types (forbs, grasses, hedges and solitary trees) that are currently pervasive in domestic UK gardens
II. What are the implications of these plant choices for a range of ecosystem services (e.g., cooling, runoff reduction), and ecological benefits such as micro-climate refugia, increased biodiversity and associated service provision (e.g., pollination services)
III. What are the trade-offs between these various services and benefits?
IV. Based on these findings, what recommendations can be made to UK gardeners in the context of climate change adaptation?

[1]Blanuša et al. 2019 (doi.org/10.1016/j.ufug.2019.126391); [2] Vaz Monteiro et al. 2017 (doi.org/10.1016/j.enbuild.2017.02.011)

Training opportunities:

The student will be trained in process-based modelling in the soil-vegetation-atmosphere system as well as on the theory behind techniques used for the environmental monitoring of garden plants and how plant structural and functional parameters are obtained. You will also receive training on the intricacies of the interactions between habitat, climate and plant-pollinator interactions.

RHS as a CASE partner will provide extended opportunities to the student, including access to the data of their My Garden App, participation in the annual RHS Student symposium and science lecture, and the ability to showcase the findings of the project on one of the RHS Flower Shows. There will also be opportunities to receive RHS Media training on science writing for non-scientific audiences and to publish a summary of the findings in RHS publications. There is also the possibility of a 1-month secondment to RHS Education or Communities Department.

Supervisors profile:

Professor Anne Verhoef has extensive expertise in ecosystem and land surface modelling, and related experimental campaigns. She has built up a large portfolio of research grants (e.g., NERC, Innovate-UK) and related papers broadly in the context of water-, food- and energy security, and related impacts of weather extremes (flooding, droughts) on ecosystem services and risks. She has successfully supervised 24 PhD students to completion, and she currently has 4 PhD students. She has also supervised a large number of UG and MSc dissertation projects; many of those involved modelling of the soil-plant-atmosphere system and/or the soil water balance.

Dr Tijana Blanusa has a strong past record of collaboration and publication within the research area closely linked to this project (i.e., provision of regulating ecosystem services such as cooling, flood alleviation and air quality by urban vegetation). Several of her well cited publications highlighted the importance of understanding plant traits required to maximise the provision of environmental benefits by urban gardens. She has supervised 6 PhDs to timely completion + 5 current PhDs, 20+ MSc projects to completion. Verhoef and Blanusa have a track record of successful past PhD co-supervision (Madalena Vaz Monteiro; they published 2 joint research papers (2016, 2017) in high impact factor journals) and will build on that during this project.

Dr Deepa Senapathi is a landscape ecologist with over 10 years' experience on environmental change impacts on biodiversity and associated ecosystem services. She has particular expertise on the impacts of climate and land use changes on pollinator communities and has worked with a range of stakeholders involved in landscape management including floral interventions to enhance abundance and diversity of pollinators and associated pollinations services. Dr Senapathi has successfully supervised 3 PhD students to timely completion and currently supervises 5 students. Her PhD students have a good track record of publishing in high impact journals such as Global Change Biology and Agriculture, Ecosystems and Environment. She has also supervised a number of UG and MSc dissertation projects.

Student profile:

This PhD would suit a student with a background in environmental science, or a background in mathematical modelling but with an interest in applying this knowledge to environmental science. Students with additional knowledge of soil science, botany or plant community ecology would be particularly well placed to take on this research topic.

https://research.reading.ac.uk/scenario/