



Royal
Botanic Garden
Edinburgh

Plants with Purpose: Enhancing flood management and multi-functional performance of green infrastructure by evaluating plant functional traits.

Join our innovative new research programme making a practical difference to urban life using Nature-based Solutions.

Climate change is causing ever worsening social, practical, and economic shocks for urban communities. Traditional urban planning and grey infrastructure offer limited opportunities for managing hydrometeorological hazards such as flash flooding and extreme heat waves. Nature-based Solutions (NbS) offer a holistic route towards achieving [UN Sustainable Development Goal 11](#) by simultaneously addressing climate, biodiversity, and human wellbeing challenges. However, significant gaps must be overcome to successfully adopt NbS across society (Consumer Scotland, 2023). This project tackles one such gap: how do we design and maintain green infrastructure systems using plants most effectively to maximise function and benefits?

RBGE's '[Plants with Purpose](#)' programme focuses on plant selection and performance to:

- (1) Advance our understanding of plant functional traits and the impacts of plant choice on ecosystem service delivery (*right plant, right place*);
- (2) Provide the evidence and support for water sector professionals to monitor and improve the long-term, multi-functional performance of green infrastructure; and
- (3) Encourage greater adoption of NbS for urban challenges across society.

This PhD is embedded within a collaborative team based at the Royal Botanic Garden Edinburgh (RBGE), Heriot-Watt University (HWU), and Scottish Water. Using an experimental approach, the successful candidate will evaluate the functional traits of plants and analyse their performance in delivering beneficial ecosystem services under a range of changing environmental conditions and stressors.

Proposed work areas:

The student will address research questions aimed at optimising the long-term multi-functional performance and adoption of urban green infrastructure. These questions include:

- RQ1) Which plants and traits are best suited for optimising the long-term flood management benefits and multi-functional performance of green infrastructure systems in Scotland and the UK?**
- RQ2) Which currently under-utilised plant species and cultivars (including native species) should be prioritised and adopted for urban green infrastructure plant selection due to their suitability, evapotranspirative behaviour and multiple beneficial functions?**

RQ3) What does a robust measurement framework for hydrological and ecological performance entail, and how can this framework at the individual plant or planting feature scale be applied to neighbourhood-, city-, catchment- and landscape-level development?

RQ4) How does urban planting impact the uptake of urban green infrastructure, and how can plant choice be used to increase the speed at which successful NbS can be adopted and integrated across society?

The PhD will adopt an interdisciplinary approach giving the student the opportunity to develop a wide range of skills. Potential methods include systematic reviews of plant traits and NbS performance, development and study of experimental testbeds, numerical modelling and upscaling (e.g. Flood Modeller, LISFlood or SWMM) and community-based research methods (e.g. citizen science monitoring, social survey, participatory mapping, and qualitative data analyses).

Research environment:

The student will have dual access to the research communities within RBGE and Heriot-Watt University.

This project fits within RBGE's wider work on [nature and community-based solutions for the urban environment](#), 'Plants with Purpose' research programme, and the development of a 'Living Lab' of real-world NbS applications. This programme builds on RBGE's legacy in urban ecology (e.g. Hyam 2020; Krivtsov et al. 2022; Miller, Krivtsov, and Cohen 2022; Kelly et al. 2020), NbS innovation on our estates (e.g. the [Edinburgh raingarden](#) and [Dawyck green roof](#)), and long-term community and partnership work (e.g. the Edinburgh Living Landscape, The Good City, Edinburgh Shoreline and Square Meter for Butterflies). The successful applicant will contribute within a [cohort of PhD students](#) with access to an internationally renowned group of Scientists and Postgraduate Researchers within our Science department.

The student will be registered with HWU and embedded within the NbS Research Group within the School of Energy, Geosciences, Infrastructure and Society (EGIS). The student will have access to laboratory and testing facilities on the HWU Edinburgh Campus (including a green roof testing facility, integrated slope/rainfall simulator facility, and potential to develop soil mesocosm experiments).

This PhD is match-funded by Scottish Water as a case partner, enabling the student to access NbS infrastructure and data, engage with technical staff, and access data feeds from Scottish Water monitoring. To maximise research impact and dissemination, the student will be encouraged to develop this relationship through a placement with Scottish Water.

Training: Specific training will be available in ecology, hydrometeorology, horticulture, social science and numerical modelling methods, and on the ethics and practicalities of working in urban systems. Support for statistical methods and data handling is also available through courses, access to BLOSS training programs, and bespoke funded opportunities.

Requirements and eligibility: This project will suit a student with a background in ecology, geography, or similar field, but we welcome applicants from diverse backgrounds and experience. Alongside enthusiasm to operate as part of the wider NbS teams at RBGE and HWU, an interdisciplinary approach and willingness to learn new experimental and analytical methods are vital. This is an exciting and rapidly growing field in which the student will have the opportunity to make a real difference to urban sustainability.

The successful candidate will ideally have a Masters Degree in a related field. We also consider candidates who can demonstrate appropriate alternative learning, such as workplace experience or professional qualifications.

Funding: Full tuition fees (UK student), stipend of £19,237 p.a, equipment budget up to £15,000, a generous Research Training and Support grant of £4,000 for participation in conferences, and a knowledge exchange support package of £3,000 are available over the 4-year studentship.

Supervisory Team: [Dr Emma Bush](#) (RBGE), [Caitlyn Johnstone](#) (RBGE), [Dr Daniel Green](#) (Herriot-Watt University), [Dr Chris Ellis](#) (RBGE) and Lucy Broadie (Scottish Water).

How to apply: Send your CV, details for 2 references, and a 2-page cover letter outlining your interest and relevant experience by 5pm on the 2nd August to naturebased@rbge.org.uk.

Interested candidates are encouraged to contact the team before applying (naturebased@rbge.org.uk).

Interviews will be held at the Royal Botanic Garden Edinburgh between 12th and 23rd August, with an expected start date of October 2024.