Biogeomorphology of lake, river and coastal shorelines: Plant traits and physical forcing

Supervisors:

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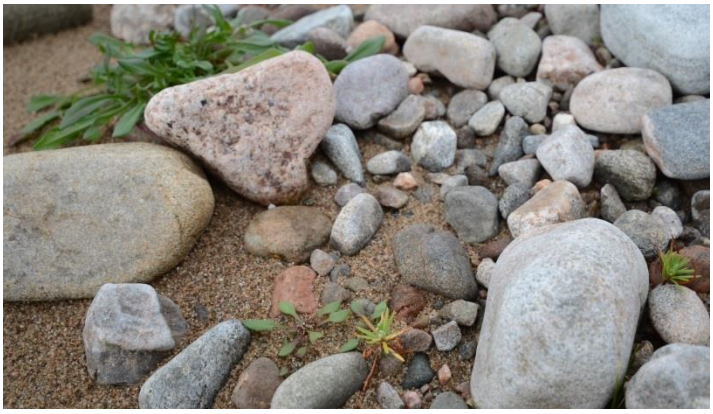
Funding:

This project has been shortlisted for funding from SAGES+ and the University of Glasgow. One student will be put forward for interview. Five studentships will be awarded from fifteen shortlisted projects.

This is a 3.5 year PhD studentship with an annual student stipend of £14,553.

How to apply:
Please send your CV and cover letter to Thorsten.Balke@glasgow.ac.uk before 26th of January 2018.

Introduction:



Increasing appreciation of the ecosystem services provided by riparian and marsh vegetation has renewed our interest in restoration, management and ecosystem functioning of habitats at the land water interface. Ecosystem engineering species occupying these transitional zones closely interact with physical processes (hydrodynamics, sediment transport etc.). However especially during the establishment phase, physical forcing exerts a direct control on survival and species distribution of plants. New theories and concepts have been put forward in recent years to generalise bi-directional feedbacks between ecology and geomorphology across ecosystems whereas plant traits and temporal variability of physical forcing emerge as key determinants of local biodiversity and landscape formation. Mechanistic understanding across ecosystems will not only advance fundamental ecological and geomorphological science but can be directly applied to improve restoration and management of floodplains and coastal wetlands. Transitional habitats at the land-water interface provide important ecosystem services yet are globally threatened by development.

Objectives:

The candidate will develop a conceptual framework across vegetated land-water transitions of lake shores, riparian floodplains coastal areas by combining field and laboratory experiments and statistical modelling.

Trait-flow interactions:

O 1. With a regional focus on Scotland fieldwork will be carried out to determine plant traits of key ecosystem engineering species in episodically flooded habitats across land-water interfaces from catchment to coast. Plant traits (e.g. height, diameter, stiffness etc.) will be linked to monitored environmental parameters through statistical modelling. Local scale differences between traits within species will be investigated (for example exposed vs. sheltered sites, lake shore vs. riparian habitats). This survey will inform the design of plant mimics (see objective 2).

O 2. Manipulative field experiments will be set up using plant mimics with different traits (stiffness, height, density, stem diameter etc.) and their effects on small scale hydrodynamics and sediment dynamics will be quantified in contrasting environments. Detailed hydrodynamics within and around the patches will be measured in the field and in hydrodynamic flumes based at the School of Engineering, Glasgow University.

Seed dispersal-flow interactions

O 3. A) Astro-Turf mats will be deployed across local elevational transects to quantify timing and biodiversity of seed deposition from catchment to coast. Trapped seeds will be collected and brought to the greenhouse in fixed intervals during a two year period. Seed traits (morphology, floatation, root initiation etc.) of the most relevant species will be determined and linked to deposition pattern under various hydrological conditions in riparian and coastal settings. B) Manipulative seeding experiments across elevational gradients will be carried out at various time steps in the hydrological year and survival monitored for at least one growing season.

Synthesis

O 4. The collected data will be used to inform statistical models and a conceptual framework in combination with meta-analysis of trait and dispersal data. Direct recommendations to managers will be made regarding ideal hydrological regimes for habitat restoration to create resilient ecosystems for ecosystem service provisioning in coastal and riparian settings.

Anticipated Public Outputs, Stakeholder Engagement and preferred publication outlets

This PhD studentship will generate new insights in bio-physical interactions across ecosystems and elucidate general biogeomorphological and ecological principles based on plant traits. At least 3 peer reviewed articles are anticipated to result from this research.

The PhD student will spend 2 weeks at the headquarters of Scottish Natural Heritage for a knowledge-exchange placement in the 3rd year. The aim of this placement is to review current management practise of riparian and coastal habitats in Scotland for mutual benefits of biodiversity protection and ecosystem service provisioning.

Supervisory team*

The supervisory team combines unique coastal and fluvial expertise on biogeomorphology.

Balke has made significant advances in integrating biological and geomorphological research often with the aim to improve management and restoration of coastal ecosystems. He has developed new concepts in biogeomorphology across tropical and temperate ecosystems.

Soulsby has worked extensively on the ecohydrology of riparian landscapes and in-stream processes. This work has included understanding the role of flood events in the distribution of invasive species and the role of stream bed vegetation on flow hydraulics and sediment deposition.

Please contact Thorsten.balke@glasgow.ac.uk for any questions