Assessing the socio-economic impacts of soil degradation on Scotland's water environment

Introduction

The Centre of Expertise for Waters (CREW) wishes to commission a **capacity building** project within CREW's **Land and Water Resource Management** theme, aligned to protecting soil resource and the wider water environment.

Aim and key considerations

The overall aim of this project is to develop and apply (as supported by available relevant data) a method to assess the socio-economic-environmental impacts of soil degradation in Scotland. The project will consider both the on-site impacts to land-based businesses and off-site impacts, e.g., impacts on communities and the wider economy due to damage from flooding caused by increased runoff from soil compaction. The project should make use of existing data on costs of actions already taken to reduce social, economic, and environmental impacts.

The project will:

- consider how existing frameworks could be built on / amended to include other relevant soil degradation processes, e.g. a method previously developed to estimate the costs of soil erosion,
- consider the key soil degradation processes relevant in Scotland, including physical[1] (e.g., compaction, sealing, loss of organic matter), chemical (e.g., contamination) and biological (e.g., loss of biodiversity),
- assess[2] direct, on-site costs to land-based businesses and indirect, wider (on- and off-site) costs to society, with a focus on the impacts on water quality, aquatic habitats and species, biodiversity, and flooding,
- demonstrate how best to validate and apply the method in Scotland,
- estimate the costs of soil degradation in Scotland as far as possible, and
- recommend additional cost-effective, holistic actions for communities, business and decision-makers based on the project outputs.

Background & knowledge gap

Soil degradation is defined as the decline in soil quality - such that soils can no longer carry out the functions we expect or provide the benefits we depend on. Soil degradation impacts a wide range of policy/regulatory/industry areas. These include river basin management planning; natural flood management; valuing natural capital; rural support; and sustainable use of resources. Soil degradation impacts and is impacted by land use (e.g., agriculture and forestry), climate change adaptation and mitigation, and changes in biodiversity. Additional relevant policy areas include drinking water quality and water scarcity (See Annex 1). The measures required to avoid soil degradation (and thus the

[1] Soil erosion has been covered by the study cited above.
[2] Researchers will work with the Project Steering Group upfront to design a matrix/framework for assessment.

consequences) may need to be implemented by businesses, and in areas, not necessarily related to the communities and businesses who will gain the most benefit from them.

The soil resource (part of our natural capital) delivers a wide range of benefits to people (ecosystem goods and services). Degraded soils may no longer provide these benefits and can result in damage to people, businesses, and the environment. However, the true costs of soil degradation in Scotland for land-based businesses, and the wider costs to society due to its impacts on water quality, flooding, climate, and biodiversity, is unknown.

The report 'Developing a method to estimate the costs of soil erosion in high-risk Scottish catchments', published in 2020, used Scottish soils data and was built on a methodology developed for England and Wales. It found that soil erosion may cost the Scottish economy between £30 million and £50 million a year. Estimating the costs of soil erosion is a good start, but only part of the picture.

The study conducted in England and Wales (Graves et al., 2015) estimated that annual costs of compaction on agricultural productivity were around five times greater than those of erosion, while the costs of flooding because of compaction were estimated to be around 2.5 times greater than those of erosion – so it's not unreasonable to suggest that costs of soil compaction in Scotland could be similarly higher than erosion. A major knowledge gap is how the costs of compaction and other soil degradation processes in Scotland compare to those of erosion, and whether they exceed it by a similar order of magnitude.

This CREW project will consider further key soil degradation processes, both individually and in combination, to obtain a more complete picture of the (socio-)economic impacts of soil degradation, including the costs of flooding caused by soil degradation. The results should also contribute to estimation of the total value of soil ecosystem services to society and the economy.

Anticipated impacts

The project outputs will be used to demonstrate a) the economic impact of soil degradation to land-based businesses and to society, with a particular emphasis on interactions with the water environment and b) will help improve estimates of the total value of soils and the ecosystem services they provide. The project outputs may inform future work on impacts of soil degradation on food security, climate change and terrestrial habitats and species.

Having a robust estimate of the value of soils as a resource, the benefits they provide, and the socio-economic impacts of soil degradation will help people make better, more informed decisions. Expanding on earlier work on erosion will provide a more complete picture and allow more holistic actions to be taken to prevent wider (and potentially more costly) social and environmental impacts. It could also inform decisions on how to finance actions required to prevent soil degradation.

By preventing soil degradation, we will in turn prevent impacts on water quality, flood risk, climate, food security, and nature and as a result on people and communities (e.g., preventing run off risk from degraded soils protects businesses and communities from muddy floods; helping reduce carbon loss from soils helps achieve climate change targets, etc).

Understanding the impacts and costs of soil degradation will inform national policies and local practices and help value the soil resource in its role of delivering a range of ecosystem goods and services that support a broad spectrum of human activities and associated benefits.

Deliverables

The project will produce:

- A framework for assessing impacts and identifying costs (with input from the Project Steering Group)
- Application of the framework for up to three key soil degradation processes as supported by available relevant data and in agreement with the Project Steering Group
- A specialist stakeholder workshop to evaluate the framework and discuss further applications
- A final report of 20-30 pages, excluding annexes and the bibliography, and including:
    - a critical analysis of available literature and data
    - an overview of the development of the framework including workshop outcomes
    - a summary of the findings from applying the framework
    - a summary of implications, recommendations, and priorities for action
    - report cover image(s) with associated photo credits
    - annexes detailing data sources and how estimates have been derived, for transparency and repeatability
- Infographics
- A plain English project summary (up to 2 pages)
- A website summary (200 words)
- A policy brief

Anticipated timescale

The project will commence in February 2023 with the project outputs signed off by the CREW Director by January 2024.

Funding

The maximum amount of funding available inclusive of VAT (where applicable) is **£ 85,000**

This includes an associated costs (excluding sub-contractor) budget of **£ 2,700** to cover:

- start-up and end project steering group room and equipment hire,
- workshop room and equipment hire, and
- travel and subsistence.

Further information for applicants

Project management

Day-to-day communication will be between the research/review team (the contractor) and a CREW Project Manager and is likely to involve short catchups as agreed.

Project steering group

CREW project steering groups (PSGs) generally include representatives of Scottish Government and its delivery partners plus a CREW representative. The PSG for CRW2022_04 will likely include representatives from SEPA, Scottish Government, NatureScot, and CREW.

Submitting a proposal

Please send a completed application form (available here) addressing the project requirements.
A copy of expectations and the award criteria are provided overpage for reference.

Proposals need to be submitted to the Research Support Officer – Centres of Expertise (Regan.Tammi@hutton.ac.uk) for evaluation **by noon on Friday 28th January 2023.** We aim to notify the successful bidder by **Friday 17th February 2023** and we may request a pre-contract meeting.

Please contact the Research Support Officer Regan.Tammi@hutton.ac.uk if you would like any clarification on any of the above. You should highlight any potential conflicts of interest in your proposal. For queries about what may constitute a potential conflict of interest please contact the CREW Deputy Manager (Nikki.Dodd@hutton.ac.uk).

Expectations

No.	Criteria	Descriptor
1	Duration	The proposed duration will align closely to the details provided in the anticipated timescales section of the specification.
2	Staff time and effort	The proposed allocation of staff time and effort is appropriate and includes all deliverables. The proposal must also provide a commitment that named staff members will be available to work on the contract if the bid is successful.
3	Project costs	The estimated breakdown of project costs is realistic and inclusive of all deliverables.

Award criteria

No.	Criteria	Descriptor
1	Understanding the project ask and policy background	The proposal should include an introduction which demonstrates a clear understanding of the project requirements. This should include an understanding of the policy background and the supporting role of this project; the need for this research; the project aim; and how the proposal will address this aim.
2	Proposed methodology	The proposal should demonstrate a high quality and workable methodology, including: • how the evidence will be identified, reviewed and assessed • consulting relevant stakeholders and/or experts where appropriate to address the key questions and produce the deliverables in the timescales required. It should explain the suitability, robustness and limitations of the proposed methodology.
3	Milestones	The project milestones are logical, practical and include all deliverables.
4	Project Management	The staff, resources and expertise are appropriate for conducting the proposed project. The proposal should name the project lead and outline their project management experience.
5	General and specific topic expertise and experience	The proposal should provide details of individual staff members who will work on this project and demonstrate how they will meet the project requirements, specifically: - general research experience and expertise; - specific experience and expertise on the topic of soil degradation.
6	General communication and deliverables	The proposal should describe the approach to producing the deliverables, which will be published on the CREW website. It should detail who will take lead responsibility for report-writing and overall report quality. It should provide examples of previously published literature reviews and cost assessments in which they have been involved.
7	Quality assurance	The proposal should provide details of quality assurance procedures to demonstrate how the contract will be continuously delivered to a high standard. It should specifically address issues of quality control at different stages of the project, including evidence gathering, analysis and report writing. It should include a timetable for delivery of tasks, project milestones and allocation of staff and staff time against each task, covering the duration of the contract.
8	Risk	The proposal should provide a risk assessment matrix detailing any risks identified in relation to the delivery of this contract, and proposed mitigation measures to minimise their probability and impact, focused particularly on risk to completion on time.

Annex 1: Reference material

A. Reports

Rickson, R.J., Deeks, L.K., Graves, A.R., Hannam, J.A., Keay, C., Lilly, A. and Baggaley, N.J. (2020). Developing a method to estimate the costs of soil erosion in high-risk Scottish catchments. Report to Scottish Government.

Graves, A.R., Morris, J., Deeks, L.K., Rickson, R.J., Kibblewhite, M.G., Harris, J.A., Farewell, T.S. and Truckle, I. (2015). The total costs of soil degradation in England and Wales, *Ecological Economics*, 119

Glenk, K., McVittie, A., Towers, W., Watson, C. and H.I.J. Black (2010). Socio-economic data on Scottish soils – collection and development. Scottish Environment Protection Agency Commissioned Report

B. Specific policies

- The Environment Strategy for Scotland and knowledge accounts place emphasis on valuing i) Natural Capital and ii) sustainable use of resources such as soil, plants and animals. It notes that land degradation and declines in soil health, notably erosion and compaction, are compounded by climate change. Erosion and compaction have major implications for water quality and flooding and can exacerbate the impacts of water scarcity.

- The River Basin Management Plan for Scotland 2021-2027 recognises that sustainable land use is necessary to protect the water environment. Soil degradation contributes to water pollution and affects water storage potential.

- The Flood Risk Management (Scotland) Act 2009 introduced a more sustainable and modern approach to flood risk management that is better suited to current needs and can accommodate the impacts of climate change. The Act and supporting guidance place a requirement on responsible authorities to identify opportunities to protect or restore natural features to help mitigate flood risk. SEPA's soon to be published flooding strategy, further reinforces the importance of this approach.

- The Scottish Soil Framework aims to *promote the sustainable management and protection of soils consistent with the economic, social and environmental needs of Scotland*. The Framework highlights the benefits soils provide for many different policy areas and the importance of safeguarding soils to ensure they can continue to provide these benefits for future generations.

- The Update to the Climate Change Plan 2018-2032 highlights the importance of managing soils and land appropriately to reduce GHG emissions. It recognises that soil degradation can lead to loss of soil carbon and contribute to greenhouse gas emissions.

- Scotland's third Land Use Strategy recognises the importance of land (and hence soil – as part of the natural capital it supports) and the critical role it plays in providing solutions to the climate and

nature emergencies as well as its role in producing food, protecting water quality and reducing flood risk.

- Climate Ready Scotland: climate change adaptation programme 2019-2024 The way land and soils are used and managed can help provide resilience to the impacts of climate change and reduce the impacts on water quality and flood risk.

- The Revised Draft National Planning Framework 4 (NPF4) was laid in the Scottish Parliament on 8 November 2022 for consideration and approval. Should Parliament approve NPF4, Scottish Ministers would move swiftly to adoption to allow the Scottish Government to progress onto implementation and delivery. On adoption, the Scottish Government will commence the provisions in the 2019 Planning Act which will make the NPF part of the statutory development plan. NPF4 is effectively a national development plan for Scotland, and the Revised Draft includes a policy on soils that aims to minimise the impact of development on soils and maximise protection of these valuable natural resources in the long term.

- Scotland as a leader in sustainable and regenerative farming: aims to deliver high quality food, mitigate and adapt to climate change and to address the nature emergency. Regenerative farming is based on maintaining / improving / restoring degraded soils and is centred around soil organic matter. Many regenerative farming practices are designed to avoid the loss of soil organic matter and thus reduce soil degradation, they will also therefore help prevent water pollution, reduce flood risk and the impacts of drought.

- Scotland's Biodiversity Strategy has recently been consulted on. Soils support habitats and species – soil degradation can result in the loss of soil biodiversity and can result in the loss of other soil functions dependent on that biodiversity. Loss of soil biodiversity itself is a form of soil degradation. Soils are the basis of many nature-based solutions, including solutions to reduce water pollution and flood risk.

- Scotland's National Peatland Plan: sets out the benefits of healthy peatlands and how we can improve peatland that is in poor condition. Peatlands are supported by peat and peaty soils. Degraded peat soils can increase the risk of flooding, damage drinking water quality and contribute to climate change.