

Resilience of soft capping under future climates

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With thanks to Elizabeth Cooke, Martin Coombes, Jo Jones and Heather Viles
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Soft capping

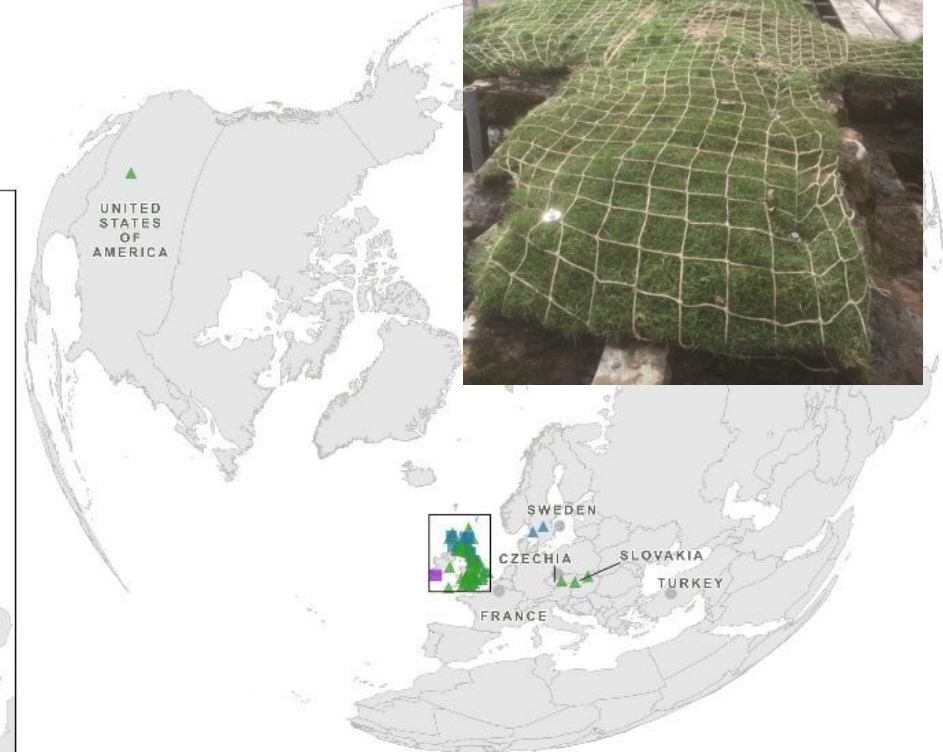
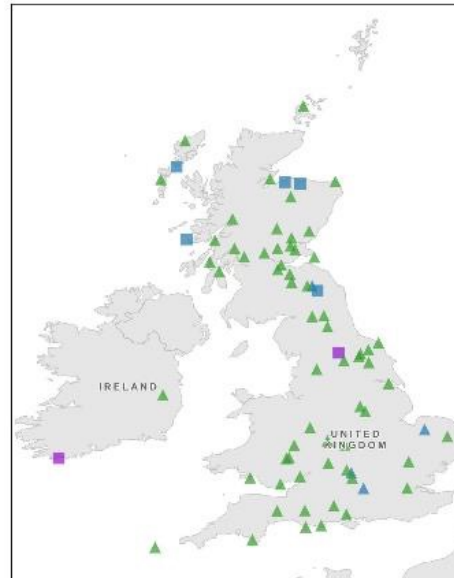
- Nature-based conservation strategy
- Minimises thermal fluctuations
- Minimises moisture ingress and surface runoff
- Relatively cheap strategy
- Implemented widely at ruined sites across the UK

Soft capping installation, Furness Abbey (Picture credit: English Heritage)



Soft Capping Sites - Type

- ▲ Turf
- ▲ Turf + Sedum
- Turf with self-planted sedum
- Natural growth
- Other



Why are we concerned?

- Temperatures increasing
- Heatwaves becoming more frequent
- Changing seasonality of rainfall



SO...

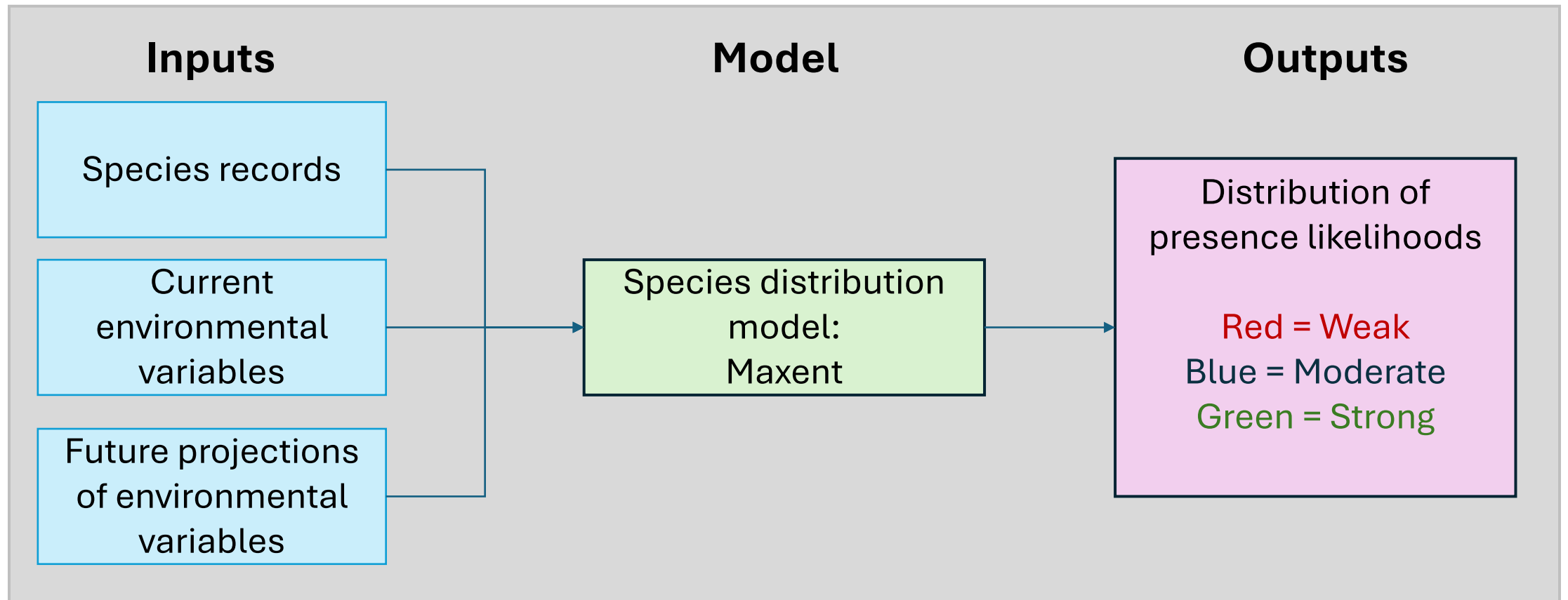
Will soft capping be resilient over the next century?

- (1) Will the species that form the soft caps be able to survive?
- (2) Will the soft caps continue to function in a way that minimises weathering processes?



Method: Species distribution modelling

Predicts future distributions of a species based on current environmental factors



Sedum matting species

Sedum album



Sedum acre



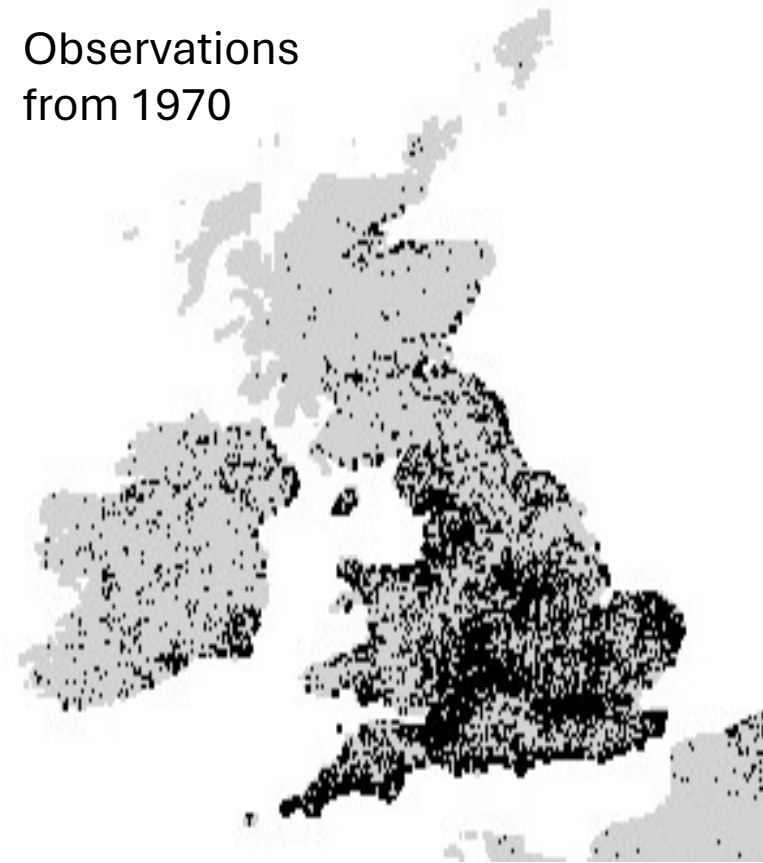
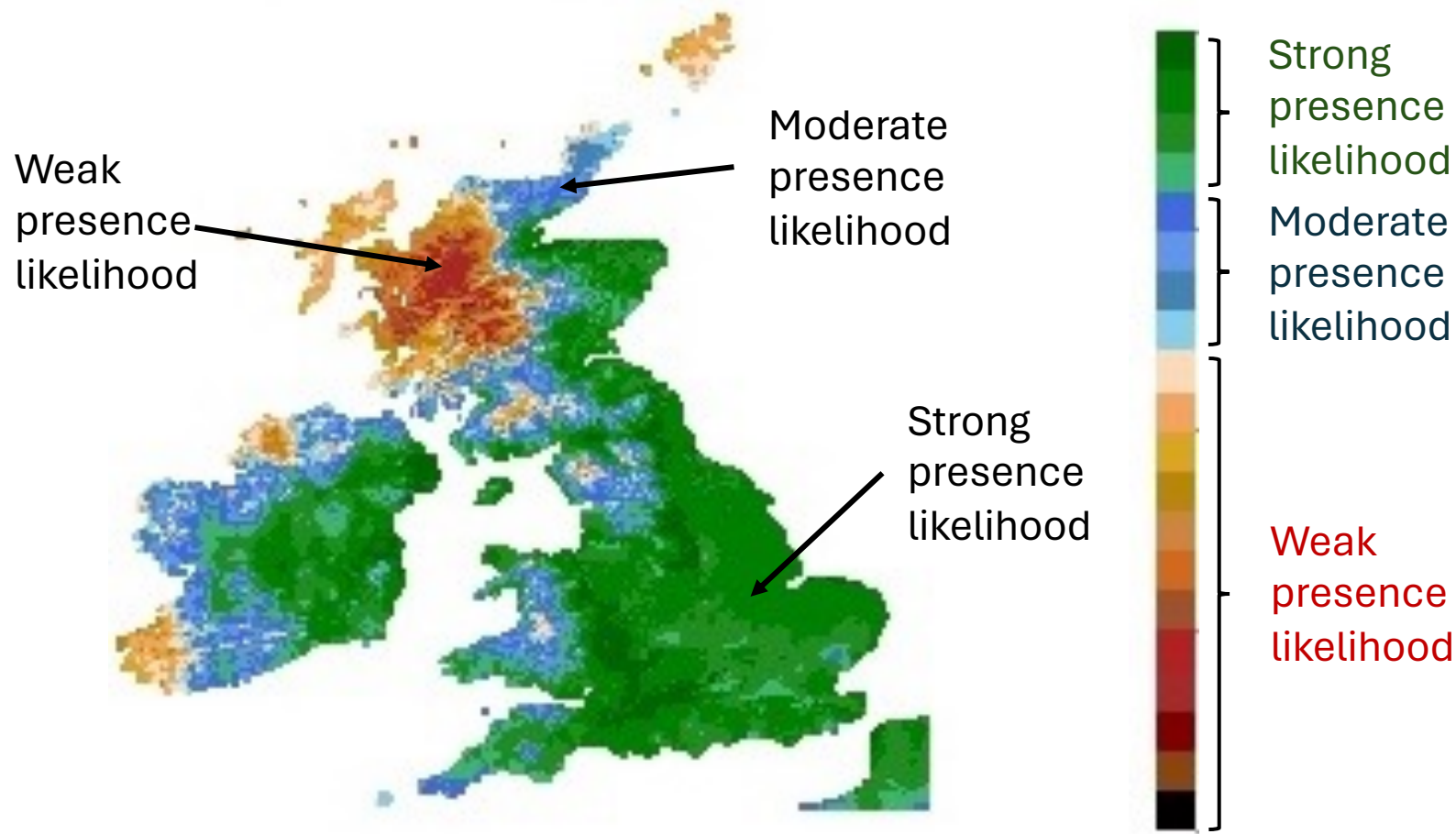
*Sedum
anglicum*



*Saxifraga
granulata*



Results: *Sedum album* (1970-2000)

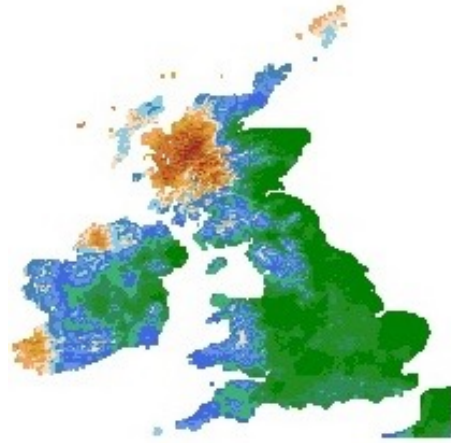


1970 - 2000

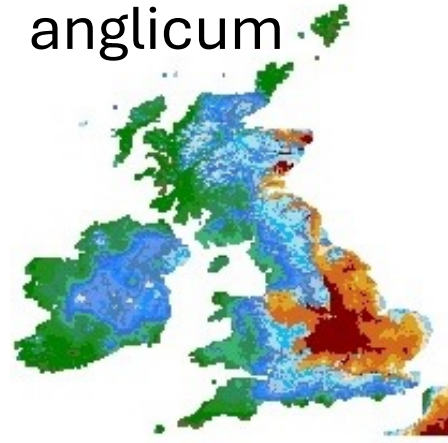
Sedum album



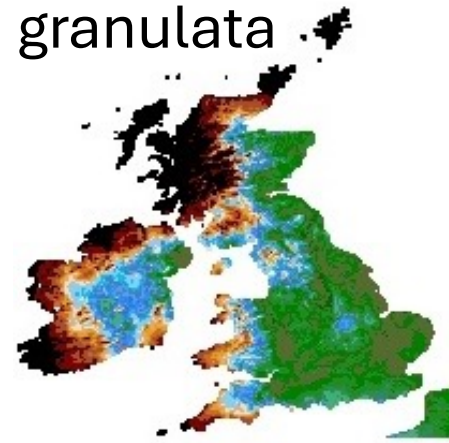
Sedum acre



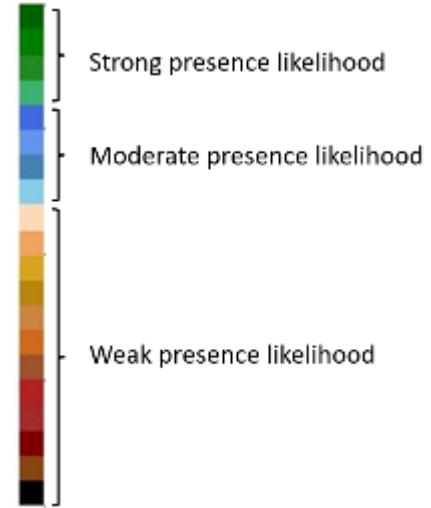
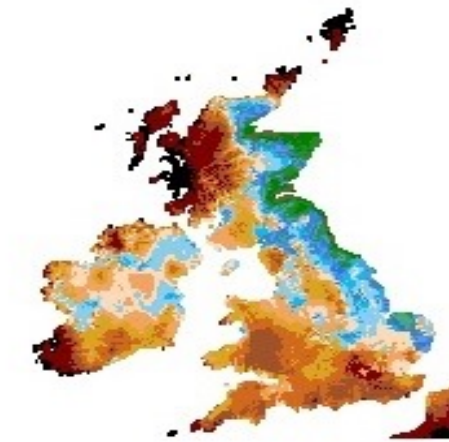
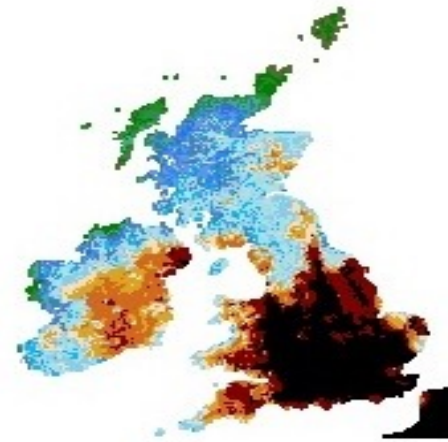
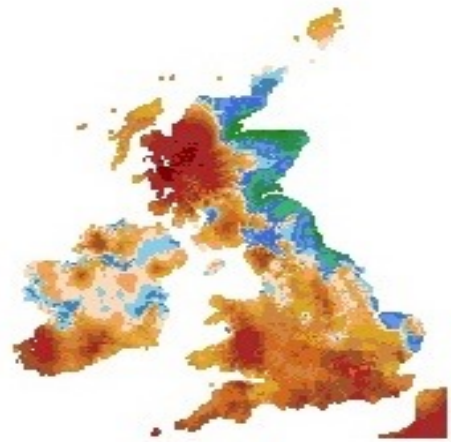
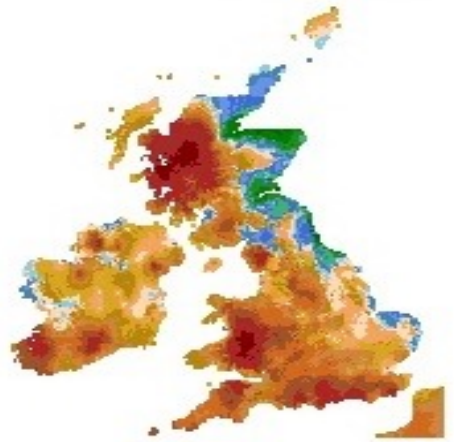
*Sedum
anglicum*



*Saxifraga
granulata*



End century



What about grasses?

Festuca rubra



Poa pratensis



Catapodium rigidum



Poa annua



Commonly found in western Europe
Suitable for low nutrient environments

Conclusions

- Only the east coast of Scotland maintained suitability for the studied sedum species by end of century
- The studied grass species were more likely to remain successful
- Increased and additional maintenance, such as watering, may be required during extended periods of drought or in heatwaves.
- This is a gradual change, with mid-Century being an important time for reassessment depending on the future emission pathway



Thank you

If you want to read more our paper on sedums is available open access:
<https://www.tandfonline.com/doi/full/10.1080/02723646.2023.2212422>

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Evaluating the robustness of nature-based solutions: future resilience of sedum-based soft capping as a conservation approach for heritage sites in Britain and Ireland

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ABSTRACT

Nature-based solutions are seen to benefit both society and biodiversity. However, research into their future resilience is required. Soft capping is a nature-based conservation strategy that mimics the natural colonisation of plants on top of ruined walls and reduces rates of material deterioration. To remain effective, soft capping species must be tolerant of future climatic conditions. We use the Maxent species distribution model to assess the resilience of soft capping species to low and high emission scenarios across Britain and Ireland. We assess the mid- and end-century presence probability of four native and archaeophyte species used in soft capping (*Sedum album*, *S. acre*, *S. anglicum* and *Saxifraga granulata*). Future presence probabilities were calculated using the climate models HadGEM3-GC31-LL, IPSL-CM6A-LR and MIROC6. Results suggest that current sedum-based soft caps will remain viable until mid-century with additional maintenance (e.g. watering) during droughts, although soft caps predominantly formed of *Sedum album* may be prone to failure in south-eastern England. In the future, species more resilient to arid conditions may need to be preferentially selected for soft capping to ensure resilience under a warming climate. Species distribution modelling provides a useful way of predicting the future resilience of nature-based solutions.

ARTICLE HISTORY

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KEYWORDS

Nature-based solutions;
maxent; emission pathway;
weathering; biodiversity;
built heritage

Introduction

Nature-based solutions (NbS) are increasingly being deployed by environmental managers and policymakers. NbS are actions that work with nature to address societal challenges, and involve the protection, restoration or management of natural and semi-