Leverhulme Doctoral Scholarships Programme for Interdisciplinary Resilience Studies (PIRS)

University of Southampton

RECRUITMENT CYCLE for studentships starting: October 2025 (Cohort 2)

SUPERVISORY TEAM

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STUDENTSHIP PROJECT TITLE

Evaluating the **N**ature-based solutions for **C**oastal **R**esilience and **E**ffectiveness (**ENCORE**)

OVERVIEW

ENCORE assesses the effectiveness of managed realignment as a nature-based solution (NbS) in the UK to enhance biodiversity, support climate adaptation and improve resilience in coastal communities. It combines empirical biodiversity, physical and social data. The combined datasets will feed into a socio-ecological model to evaluate NbS benefits and trade-offs.

SUMMARY

What the project sets out to do: By investigating managed realignment sites across the UK, we aim to determine how well these areas support (1) biodiversity, (2) physical environment and (3) communities' resilience to adapt to climate change, contributing to evidence-based recommendations for expanding NbS approaches (Stafford et al., 2021).
What is involved: The project includes a comprehensive literature review that informs the selection of the managed realignment sites where the PhD student will collect and analyse existing and new empirical data, with community engagement also achieved through citizen science initiatives. The PhD student will gain hands-on experience with ecological fieldwork (e.g. coastal and aquatic surveys; e.g. Lønborg et al. 2022) and geospatial data collection (e.g. drone surveys; Guillot et al., 2018), using tools like CoastSnap (Harley and Kinsela, 2022) to monitor coastal changes. Additionally, the candidate will collect qualitative data from local communities to capture perceptions of NbS trade-offs, benefits and barriers (e.g. Anderson et al. 2021). Data will be integrated into socio-ecological models (e.g. agent-based modelling and Bayesian belief networks; Lippe et al., 2019; Dominguez Almela et al., 2024) to predict the performance and scalability of NbS across diverse locations, evaluating ecological and socio-economic trade-offs.
Impact: The project has strong potential for applied environmental impact. By developing scalable models and insights into NbS trade-offs, we contribute valuable knowledge to policymakers and stakeholders. Long-term, this work supports the broader goal of establishing resilient coastal systems, aligned with UK biodiversity and climate adaptation targets.

PROJECT CONCEPT

Rationale – Coastal areas are facing significant challenges from climate change, such as sea-level rise, erosion and biodiversity loss (Oppenheimer et al., 2019; Costello et al., 2022). In response, NbS are gaining popularity for their potential to meet environmental goals while enhancing coastal community resilience (Stafford et al., 2021). Approaches such as managed realignment, coastal dune restoration and sand-trapping structures are being implemented successfully to stabilize shorelines and restore natural habitats (E.g; Bonte et al., 2021; Eichmanns et al., 2021; Yasmeen et al., 2024). However, while NbS hold great promise, the question remains as to whether they can consistently deliver a "triple win" across biodiversity enhancement, climate adaptation, and community resilience. Studies on NbS applications, such as oyster reefs for shoreline protection or sea dikes that foster ecological benefits (Scheres and Schüttrumpf, 2019; Howie and Bishop, 2021), suggest potential but highlight the need for comprehensive assessments to understand how these solutions perform across all three areas. Challenges remain around local community acceptance of NbS, as the perceived costs and benefits often vary by community (Anderson and Renaud, 2021). To achieve successful NbS outcomes, it is essential to consider the economic trade-offs and actively involve communities in planning and monitoring these projects. **ENCORE aims to determine the effectiveness of managed realignment in achieving the triple win by assessing (1) biodiversity, (2) physical environment and (3) community resilience at various UK coastal sites**.

Methods –

1. ENCORE will involve a systematic review of managed realignment outcomes in the UK, focusing on where these are located and how they impact biodiversity, climate adaptation and local community resilience. This will establish a foundation for identifying key areas of focus and contextualising the effectiveness of NbS.
2. Empirical data collection from a selection of UK sites informed by the review will address existing gaps of knowledge, with surveys capturing biodiversity indicators (e.g. plant diversity, invertebrate populations), physical parameters (e.g. sedimentation, erosion) and social perceptions of existing schemes (e.g. interviews with local residents) to capture site-specific social insights, where missing.
3. Engaging communities through citizen science initiatives (e.g. CoastSnap) will allow local residents to monitor coastal changes, bringing wider collaboration to the project and enhancing the resilience on these areas through increased awareness.
4. Using these data (i.e. biodiversity, physical and social), the PhD student will develop a Bayesian belief network model (BBN) to assess the cost-benefit of the current NbS within the UK. We will then integrate these data into an agent-based model (ABM) to assess the long-term outcomes of NbS and scalability across various environmental and social scenarios.

Wider implications – Findings will offer valuable insights for policymakers on the scalability and effectiveness of NbS, informing future policy directions to align with the UK's biodiversity and climate adaptation goals. By actively involving communities through citizen science and collaborative workshops to study the changing coast together the project aims to improve public understanding and acceptance of NbS as sustainable alternatives. The socio-ecological models developed will serve as decision-support tools to identify optimal coastal management strategies under varying conditions, highlighting the triple-win potential of NbS. The research supports the UK's goals and contributes to the global evidence-base for NbS, providing a research model for other coastal regions facing similar challenges and promoting a shift towards sustainable community-supported climate adaptation strategies.

Contribution to interdisciplinary resilience studies:

This project makes a valuable contribution to interdisciplinary resilience studies by integrating ecological, physical and social dimensions into a holistic assessment of NbS for coastal resilience. Traditionally, resilience studies have focused on isolated aspects, such as biodiversity enhancement or physical infrastructure, without fully examining how these elements interact to build resilient coastal communities. This project bridges these gaps by assessing the ecological impacts (e.g., biodiversity gains), physical outcomes (e.g., erosion reduction) and social perceptions of managed realignment sites in the UK.

Through empirical data collection and community engagement through citizen science, the project brings local knowledge and involvement into resilience studies, empowering communities and enhancing their adaptive capacity. By developing models using BBNs and AMBs, the project advances interdisciplinary methods for evaluating NbS trade-offs and scalability. This approach has the potential to capture the complexity of ecosystem dynamics and socio-economic factors, while providing a framework for long-term resilience planning adaptable to various environmental and social contexts.

Please list and describe any specific/additional technical training or support to undertake and successfully deliver this project. *Note that students recruited into this programme will undertake a bespoke training curriculum. Students and their supervisory teams will also identify generic skills gaps to address through training courses offered by the University's Doctoral College.*

Quantitative methods (R, python or similar)
Social-ecological modelling courses (agent-based modelling, Bayesian belief networks)
Qualitative research methods (NVivo)
Geospatial data analysis using GIS
UAV pilots license qualification (as needed, but have 'in-school' support too)
UAV data processing techniques (Structure from Motion, Ortho-mosaic production)
