# Leverhulme Doctoral Scholarships Programme for Interdisciplinary Resilience Studies (PIRS)
## University of Southampton

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**RECRUITMENT CYCLE for studentships starting: <u>October 2024</u>**

**SUPERVISORY TEAM**

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| **Primary Supervisor \*\*** | Prof Felix Eigenbrod |
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**STUDENTSHIP PROJECT TITLE**

**Do socio-economic and ecological factors affect the resilience of people in England to extreme weather events?**

**OVERVIEW**

Surprisingly little is known about people's resilience to climate change. You will address this gap by using big data to map out individual adaptation and resilience strategies to extreme weather events in England, and identify how these vary by poverty levels, greenspace access and future vulnerability to climate change.

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**SUMMARY**

Extreme weather events driven by climate change are already increasingly common in the UK, and near certain to increase under all climate change scenarios. As such, building national resilience through adaptation – in addition to mitigating further emissions – is a national priority. However, there is no clear method for gathering evidence of adaptation and resilience, and relatively little large-scale evidence of individual adaptation.

In this studentship you will help to fill this gap by providing the first large-scale mapping exercise of individual adaptation strategies to extreme weather events in England. You will then identify how these vary by socio-economic and ecological context, as well as by the degree of vulnerability to future climate change.

This highly novel project will involve combining different datasets (Office of National Statistics consumer data, Google search trends, maps of poverty, vulnerability to future climate change, and greenspace quality and quantity) to understand not only what adaptations people are already taking, but how this differs with poverty levels (and other indicators of social vulnerability) and risks to future climate change. You will also test if access to greenspace (or blue space e.g. the sea) affects how people adapt to extreme weather events.

Overall, the work is highly topical and policy relevant, and it is expected it could be of considerable interest both to government, industry and academia as it shows the baseline level of adaptation, which is needed to make an assessment of current resilience to climate change and variability.

## PROJECT CONCEPT

Extreme weather events driven by climate change are already increasingly common in the UK, and near certain to increase under all climate change scenarios. Resilience, as defined by the US Army Corps of Engineers (USACE), and adapted by Townend et al (2021) is "the ability of a system to prepare, resist, recover, and adapt to disturbances in order to achieve successful functioning through time". To create this type of social resilience, actions are needed to prepare, resist, recover, and adapt – we refer to this collective set of actions as 'adaptations'. As such, adaptation – in addition to mitigating further emissions – is a national priority.

However, there is no clear method for collating evidence of adaptation, and the only large-scale evidence for how individuals are adapting to extreme weather events come from case studies compiled in a global systematic review and containing only 1628 empirical articles (Berrang Ford et al, 2021).

In this studentship we propose to fill this gap by providing the first large-scale mapping exercise of individual adaptation strategies to extreme weather events in England, and then identify how these vary by socio-economic and ecological context, as well as by degree of vulnerability to climate change. We focus on England as indirect measures of climate change adaptation (i.e. consumer trend data from the Office of National Statistics (ONS) ([Consumer trends: chained volume measure, not seasonally adjusted - Office for National Statistics](#)), family spending ([Family spending in the UK - Office for National Statistics (ons.gov.uk)](#) and family food costs ([Family food datasets - GOV.UK (www.gov.uk)](#) ), but also Google search term trends related to adaptation actions (preparing, resisting, recovering and

adapting) over time. The latter data is freely available and can be broken down to the region level (https://newsinitiative.withgoogle.com/en-gb/resources/trainings/advanced-google-trends/). These known datasets will be complemented by other large-scale datasets containing proxies for the resilience building aspects of adaptation (i.e. preparing, resisting). A systematic search for such proxies will be carried out early during the PhD.

The first chapter will focus on collating evidence of adaptations by comparing spend and searches with previous years, and will explore the month preceding the announcement of early warning, the extreme event phase, and 8 weeks after the event to identify processes of recovery and rebuilding. Eight weeks should provide sufficient evidence of integration of longer-term risk mitigation into rebuilding and recovery actions. The final part of this chapter will be to check how well these large-scale datasets capture adaptations undertaken in relation to known recent extreme climate events (e.g. the 40C heatwave of 2022 or the storms of early 2022 including Storm Eunice) and the degree to which they correspond with what is known from small scale studies on climate adaptation. Extant knowledge suggests resilience building approaches vary by income, place in life-course, home ownership status and perceptions of risk, responsibility and capability to adapt.

The focus of the second chapter will be to assess how interest in climate adaptation – as measured by the regional Google search trends – varies across English regions and local authorities, and how this relates to future vulnerability and adaptive capacity. To assess future vulnerability, we will use published risk maps (e.g. Climate Risk Indicators; https://uk-cri.org/; the Environment Agency's flood risk map; https://www.esriuk.com/en-gb/content/products?environment-agency-flood-maps but also heat stress risk, as well as new datasets produced from the UKRI funded project "Co-developed Environmental Solutions to Mitigate the Impact of Temperature Extremes on the Health of Vulnerable Populations" on which FE is a co-I. To assess adaptive capacity, we will use the index of multiple deprivation (available at https://data-communities.opendata.arcgis.com/datasets/4ad3e5a10872455eaa67ce4e663d0d01_0/explore?location=52.800440%2C-2.489783%2C6.96) and new maps of food poverty Smith et al. 2022) - both of which are available at the local authority scale. Together, these analyses will enable us to assess for the first time how *interest* in adaptation aligns with future *vulnerability* and *adaptative capacity* to climate change.

Finally, the third chapter will focus on testing the degree to which interest in climate adaptation measures varies by the ecological intactness of different local authorities, and the degree to which this is affected by adaptive capacity and vulnerability (Chapter 2). There is considerable evidence that access to greenspace and blue space improves mental health (e.g. Collins et al. 2023), but we do not know if such access has any effect (positive or negative) on levels of adaptation, and how this is affected by vulnerability and adaptive capacity. This chapter combine the analyses from Chapter 2 with data the state of the natural environment (e.g. proximity of local

authorities to National Parks and Areas of Outstanding Natural Beauty, as well as measures of greenspace quantity and quality used in previous work by FE (Collins et al. 2023), including bird species richness.

In summary, this PhD will lead to the first national datasets of how people already adapt to climate extremes, and the degree to which interest in adaptation aligns with the ability to adapt, as well as future vulnerability. The work is highly topical and policy relevant, and it is expected it could be of considerable interest both to government, industry and academia as it shows the baseline level of adaptation, which is needed to make an assessment of current resilience to climate change and variability.

## References

Townend, B. I. H., et al (2021). Operationalising coastal resilience to flood and erosion hazard: A demonstration for England. *Science of The Total Environment*, **783**, 146880. https://doi.org/10.1016/j.scitotenv.2021.146880

Berrang-Ford, L., Siders, A.R., Lesnikowski, A. *et al.* A systematic global stocktake of evidence on human adaptation to climate change. *Nat. Clim. Chang.* **11**, 989–1000 (2021). https://doi.org/10.1038/s41558-021-01170-y

Kennedy-Asser A.T. *et al* Projected risks associated with heat stress in the UK Climate Projections (UKCP18) *Environ. Res. Lett.* **17** 034024 (2022) https://doi.org/10.1088/1748-9326/ac541a
 Smith, D.M. et al. (2022) Household food insecurity risk indices for English neighbourhoods: Measures to support local policy decisions. *PLoS ONE* 17(12): e0267260. https://doi.org/10.1371/journal.pone.0267260

Collins, R.M. et al (2023) The relative effects of access to public greenspace and private gardens on mental health. *Lands. Urb. Planning*. 240: 104902 https://doi.org/10.1016/j.landurbplan.2023.104902

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## Contribution to interdisciplinary resilience studies:

Resilience, as defined by the US Army Corps of Engineers (USACE) is "the ability of a system to prepare, resist, recover, and adapt to disturbances in order to achieve successful functioning through time". To create this type of social resilience, actions are needed to prepare, resist, recover, and adapt – we refer to this collective set of actions as 'adaptations'. As such, understanding what adaptations are already being taken to climate change is a critical priority within interdisciplinary resilience studies.

Our project is particularly interdisciplinary as it combines expertise and methods for understanding how people adapt to climate change (the particular expertise of Emma Tompkins) with innovative spatial analyses (the

particular expertise of Felix Eigenbrod) to understand how these adaptations – and interest in adaptations as measured via Google search trends – align with poverty (which affects adaptative capacity) and future vulnerability to climate change, as well as the degree to which green and blue space moderate these effects.

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**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.*

The student will get specific training in systematic review methods (building on the expertise of Eigenbrod in supervising students in this area), spatial analyses using R (Eigenbrod), as well as interdisciplinary methods and theory in climate change adaptation (building on expertise of Tompkins).

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