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# Quantifying Climate Risk and Building Resilience in the UK

*Edited by*

Suraje Dessai · Kate Lonsdale · Jason Lowe · Rachel Harcourt

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Editors

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# Foreword

Emission of greenhouse gases by human activity has now warmed the average temperature of our planet by more than 1°C, causing significant change to the climate system. It is critical that we limit further emissions and meet the international goals of the Paris Agreement but even as we do so, warming and climate change will continue. Human societies have developed with rather constant climate conditions, so today's changes are a shock to our systems. To thrive in the future we must be ready. We must be resilient to climate change.

In the UK we have seen increased instances of flooding, water shortages, storm damage, coastal denudation, and summer temperatures that have topped 40°C for the first time in recorded history. Modelled climate projections show us, with confidence, that these changes will become more severe even with the most ambitious emissions reductions. How we prepare for these changes will determine the scale of harm caused to our infrastructure, our health, the systems we rely on such as food and transport systems, and the harm we inflict on nature.

The UK has been a global leader in climate adaptation policy. The Climate Change Act 2008 legally requires the UK government to conduct a five-yearly Climate Change Risk Assessment (CCRA) for the UK, and requires my Government Department—Defra—to produce a National Adaptation Programme for England. Devolved legislation provides a comparable framework of adaptation planning and evaluation for Scotland, Wales, and Northern Ireland. UK research has also been world

leading in identifying actions needed to manage climate risks and to reduce damage without exacerbating existing inequalities. There is much more to do, however, and national preparedness against many of the climate risks identified in the last CCRA remains inadequate. Governments, business, and wider society need to plan and take action to improve our resilience to climate change.

The *UK Climate Resilience Programme* (UKCR) is a research programme addressing this need for adaptation action. It was funded by UK Research and Innovation with strong support from Defra throughout its work. UKCR enhanced the UK's resilience to climate variability and change through interdisciplinary research and innovation on climate risk, adaptation and climate services, working with stakeholders and end users to ensure the research is useful and usable.

UKCR made significant contributions to the UK's third CCRA, and its tools, datasets, and learning will be important for the UK's fourth CCRA and beyond. The programme has deepened our understanding of the climate services sector, with projects on climate service standards and valuation, and a roadmap for development and implementation of UK climate services. Engagement with cities across the UK has raised awareness in a wide range of audiences about the need to respond to the climate challenge.

UKCR has not all been about natural science, but has included valuable contributions from many disciplines. The programme funded arts and community-based projects, and pioneered an embedded researcher scheme in which researchers collaborate with host organisations to help them understand and address their needs. The programme has been hugely valuable in creating a more coherent community of climate resilience researchers and practitioners across the UK.

I congratulate the UKCR programme for their achievements, captured in this book. Their learning and communication will be of long-lasting value to the climate resilience community. I hope that the climate resilience community that came together to achieve this work will go from

strength to strength as we work together to build our resilience in the face of climate change.

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Finally, we thank everyone who has supported and contributed to the programme through delivering research, participating in events, and ensuring the UK is building resilience to a changing climate.

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CHAPTER 6

# Learning from Arts and Humanities Approaches to Building Climate Resilience in the UK

*Edward Brookes, Briony McDonagh, Corinna Wagner, Jenna Ashton, Alice Harvey-Fishenden, Alan Kennedy-Asser, Neil Macdonald and Kate Smith*

**Abstract**

- This chapter shares insights from five arts and humanities-led UK Climate Resilience Programme (UKCR) projects, presenting key learnings and pathways for future research and policy interventions.

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- We highlight the significant potential of place-based arts and humanities approaches for working with and engaging communities in building climate resilience and driving climate action.
- We underline the importance of generating genuine two-way dialogue, knowledge exchange and co-creation between academics, practitioners, and community members.
- We point to the importance of robustly and reflexively assessing the effectiveness of arts and humanities-led engagement.
- We argue that working collectively to develop more integrated climate and arts/cultural policy is imperative for supporting future long-term climate resilience.

**Keywords** Arts · Humanities · Community engagement · Climate resilience

## 1 Introduction

Over the last decade, a growing body of research has identified the effectiveness of arts and humanities approaches for connecting climate science with communities that stand to be most affected by climate change [1–3]. This links to a range of strategies that explore how audiences can be engaged with climate issues through creative, historical and place-based encounters [4–7]. However, the outcomes and opportunities for learning from arts and humanities-based research are not always well disseminated or valued by disciplines outside of arts and humanities circles [7–9]. This includes at national policy level where arts and humanities have exerted little influence over the ways in which climate change is framed

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within public discourse and climate policy—despite targeted recommendations for policymakers [9–11]. As a result, the benefits of mobilising arts and humanities approaches in order to build climate resilience remain underutilised by climate scientists and policymakers [11].

This chapter addresses these research and policy gaps, sharing key learnings from five arts and humanities-led UKCR projects. Here we provide an overview of the evolving academic and practice-based discussions that emerged during the lifespan of each project, and present reflections identified in a series of collaborative workshops with project teams in spring 2022 and subsequently through a paper session at the Royal Geographical Society Annual International Conference in August 2022 [12]. In doing so, this chapter will demonstrate the value of arts and humanities approaches for engaging communities with climate change impacts and action, and the importance of place and dialogue for building effective climate resilience. The projects are as follows:

- 'Community climate resilience through folk pageantry' (Creative Climate Resilience), led by Dr Jenna Ashton at the University of Manchester.
- 'Risky Cities: Living with water in an uncertain future climate' (Risky Cities) and the related UKCR impact project On the Edge, led by Professor Briony McDonagh at the University of Hull.
- 'CLandage: Building climate resilience through community landscapes and cultural heritage' (CLandage), led by Professor Neil Macdonald at the University of Liverpool.
- 'Once upon a time in a heatwave' (Once Upon a Time), an embedded researcher project led by Dr Alan Kennedy-Asser at the University of Bristol.
- 'Time and Tide: Resilience, adaptation, art' (Time and Tide), an embedded researcher project led by Professor Corinna Wagner at the University of Exeter.

What follows is divided into three sections. The first reflects on the importance of place-based approaches in driving awareness, action and resilience building, while the second explores issues around community dialogue. The third focuses on the impacts of these projects, including local and national policy outcomes. The final section summarises our key learnings and suggests directions for future enquiry.

## 2 Importance of Place

Central to all projects was a belief that place mattered and that place-based approaches help make climate impacts more tangible and relatable to members of the public—and so build a platform for engagement and action [7, 13]. Local stories and place-specific climate messages proved valuable for each of the UKCR projects in being able to transition from small-scale questions about community resilience to larger scale issues such as climate change, so that personal and community resilience was built through understanding past extremes in the local area. Importantly, several projects utilised the local as a lens through which to connect the past, present and future in productive ways to drive anticipatory action. Understanding historical relationships to place and environment proved important for facilitating engagement with generational and longer-term interactions that communities have had with their environment. This helped to generate a sense of identity and environmental continuity that was conducive to positive climate action [14].

The UKCR projects variously harnessed place-based and historically informed approaches, using different geographical lenses and delivering project outcomes at varying geographical scales. 'CLandage' and 'Risky Cities' worked with archival material including maps, civic records, antiquarian histories, diaries and newspapers—for Cumbria, Staffordshire and the Outer Hebrides, and Hull and the East Riding of Yorkshire, respectively—to research experiences of living with climate, weather and flood for use in delivering local climate interventions. By contrast, 'Creative Climate Resilience' worked at a much smaller scale, focusing on the ward of Miles Platting and Newton Heath in Manchester, selected in part because of its high socioeconomic, health and political inequalities and conflicting development agendas. Working within an area defined by its political boundary offered insights into how local authority practices materialise at a micro level in ways that are distinct from city or regional scales. Investigating people's perceptions, knowledge and experiences of 'local' place and neighbourhoods—distinctiveness, care, activity, networks, assets—proved vital for local participation and inclusion in underlining the complexity of community resilience, and what this offers for mitigation and adaptation strategies. In turn, explorations of folklore and mythological storytelling have helped transform the way place and landscape are perceived and imagined in Miles Platting and Newton Heath, folding nature and culture together and promoting a

personal connection to climate change that stimulates awareness, action and resilience.

Narratives connected to place are also important to the 'Once Upon a Time' and 'Time and Tide' projects. Memory and anecdote add personal stories to otherwise impersonal data. In 'Once Upon a Time', participants explored their relationship to place and how this intersected with climate-related experiences to generate individual stories. These often tied memories of weather extremes to dates, places, activities or senses, or explored a theme in the past, present and future. The insights were then brought together to produce compelling narratives, as was the case for the 'Future of the Northern Irish Countryside', a story produced in collaboration with local storyteller Liz Weir. The creative act of storytelling provided an alternative way for the climate research community to explore place-based climate data at more intimate scales than is produced by climate risk modelling. The 'Time and Tide' project features large sculptural bells that ring at high tide, installed at sites around the British coast from the Isle of Lewis to Cornwall (Fig. 1). The bells were catalysts for sharing memories about climate change in coastal communities, with each bell a centrepiece for conversations amongst local grassroots groups, educators, regional conservation groups and arts hubs. Participants designed and implemented activities ranging from beach schools to 'TEDx'-style panels with the aim of translating place-based stories into plans of action on climate change. As a result, members of citizen science groups have collaborated with academics and contributed to scientific findings while the Friends of Par Beach and school groups in Harwich, Essex have cleaned beaches.

## 3 Generating Dialogue

All the projects went beyond addressing specific knowledge deficits or one-way communication, working instead to foster two-way dialogue, knowledge exchange and co-creation between academics, practitioners and community members. They all centre on equity and social justice concerns, working to ensure that communities have agency over the knowledge that they are part of producing and that it is used in ways that are beneficial to them. This was especially important in working with communities whose past experiences may have been of research being 'done on' rather than 'with' them.

**Fig. 1** Appledore Time and Tide Bell. Artist: Marcus Vergette (*Photograph* Corinna Wagner, 2021)

Arts and humanities-based approaches offer unique opportunities to facilitate dialogue creation. Creative workshops offer an approachable way for communities to engage in academic research. At the same time, creative practices, especially handwork (such as sewing, knitting and crafting), can offer space for difficult conversations about sea level rise, coastal erosion and loss, particularly when they draw upon place-based and historically informed stories, which make big stories of global change more relevant and legible at the local scale. For 'Risky Cities' and 'CLandage', intensive programmes of archival recovery [15, 16] fed into creative workshops, offering opportunities for participants to work with archival materials, maps and material objects while sharing their experiences of weather, climate and flood. 'Risky Cities' recovered an 800-year history of living with water and flood in Hull and the surrounding region, using these resources to inform a series of place-based, historically informed arts events (see the discussion of FloodLights below) and a community engagement programme involving textile and creative writing

workshops, a soundscape and a touring exhibition. 'CLandage' developed workshops and exhibitions that used cultural heritage materials from Staffordshire and the Outer Hebrides to generate dialogue around climate and extreme weather; for example, the project utilising qualitative records of past weather as a prompt for participants to write about their own memories, or to reinterpret the original source material coloured by their own experiences and understanding of the local environment.

In both projects, participants' experiences fed into the research process, culminating in co-created outputs including poetry, [17] creative writing, craft and storytelling that were used in digital and in-person exhibitions curated by and displayed within the communities concerned. Each exhibition also facilitated discussion around climate change between workshop participants and their family and friends. Similarly, with the 'Time and Tide' initiative, local oral histories collected at bell sites (e.g. Morecambe in Lancashire, Redcar in North Yorkshire and Harwich in Essex) were the starting point for multi-artist exhibitions and creative writing publications. Oral histories revealed much about the decline of coastal industries, land erosion and flooding, but also provided insights into the language, images and cultural references that people use to express their feelings and plans. Age-old narratives of 'The Flood[1]' formed the basis of performances by Cornwall-based theatre group Prodigal UPG (https://prodigalupg.com), while video responses to the question "What does the sea mean to you?" were reproduced in the film COTIDAL (https://timeandtidebell.org/cotidal-new/), by artist Tania Kovats.

'Once Upon a Time' also used a simple question to generate dialogue: "What is your favourite thing about the countryside?". Participants were then able to use this prompt to explore their own experiences of place and climate change. 'Creative Climate Resilience' utilised a related but distinct model of socially engaged practice through arts-based research, generating stories, images, performances, music and creative objects (Fig. 2) in order to encourage residents, local authority members, environmental charities, religious organisations, community developers, youth workers and schools to participate in creatively articulating perspectives and solutions for climate mitigation and adaptation issues—and thus feed into local climate action plans. As one contributor to this chapter eloquently

[1] The use of 'The Flood' refers to stories of flooding or deluge often attributed to deity or deities, sent to destroy civilisations or punish the wicked, often in an act of divine retribution.

put it, "Researching through embedded engagement brings people with you on a journey of curiosity and knowledge creation, and ensures that both the academic research and creative outputs are genuine public scholarship". Crucially, practice such as this demonstrates how creative research is joyful and playful, while also having serious implications for decision-making.

Similar experiences were reported in On the Edge, a collaborative project between the National Youth Theatre and the University of Hull, funded by a UKCR impact award. The 90-minute, co-created theatrical performance platformed young people's experiences of living with climate change in coastal and estuarine communities on a global policy stage at the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow UK. It comprised a new play by Adeola Yemitan called I Don't Care, and a climate cabaret directed by Tatty Hennessey including spoken word, poetry, music and magic. This rich and stimulating project

**Fig. 2** Creating objects for the 'Creative Climate Resilience' project (*Photograph* Jenna Ashton, 2021)

was characterised by intensive two-way dialogue between researchers and young creatives, facilitated via online development workshops and in-person rehearsals. Reflective journals kept by participants—including the academic researchers—chart the cognitive, bodily and emotional experiences of those involved in producing a piece of theatre that critiqued the barriers to climate action experienced by young people, and challenged collective expectations about young people's experiences of the climate crisis.

## 4 Understanding Community and Policy Impacts

Demonstrating the value of arts and humanities approaches to do more than simply 'window dress' climate science required each of the teams to robustly and reflexively assess the effectiveness of arts and humanities-led engagement to drive climate resilience. This demand was addressed in three ways. First, each of the projects worked to ensure measures for assessing effectiveness were developed in relation to the needs and existing resources within communities, rather than imposed upon them, even though the precise measures of success used varied across the projects. In the case of 'Creative Climate Resilience', effectiveness was understood as a scale where outcomes were identified by and with the participants. For some participants, that meant empowering them to join the conversation around climate action; for others it meant exploring how they could move from climate or political apathy to awareness and action. Effectiveness also included being able to provide new insights for decision-makers and developing new processes, content and storytelling that contributed to existing resilience activities and supported the community to thrive not just survive. These outcomes were then measured utilising an embedded process that identified the individual and organisational changes amongst those involved in the project, as well as the legacy projects that emerged from engaging in the research process.

At the same time, the project teams recognised that persuading policy audiences of the value of arts-based engagement in driving climate action—and thereby increasing the uptake of these approaches—is facilitated by being able to chart (and on occasion, quantify) our impacts. 'The Risky Cities' team, for example, analysed audience feedback from its programme of community arts interventions including 'FloodLights' (Fig. 3), a series of multimedia, light and sound installations exploring Hull's experiences of living with water past, present and future, which

took place in Hull city centre in October 2021 and attracted an audience of more than 11,000. Survey responses demonstrate that the event drove shifts in people's thinking about living with water, flooding and climate change, with 64% of respondents reporting that the event made them think about climate futures, and a third reporting behavioural changes they planned to make in relation to this.[2] As the survey results make clear, place-based approaches—in particular, site-specific installations that mobilised Hull's watery histories and identities—were crucial in generating engagement and action towards climate resilience.

Finally, the UKCR projects discussed here each made direct policy interventions. 'Creative Climate Resilience' centred their approach around the co-design of an open access toolkit for different interest groups to be able to undertake their own climate action planning. This was embedded across a wider spectrum of knowledge exchange with local authority actors—including neighbourhood teams, climate officers, elected members, community groups and scrutiny committees—that all fed into the local climate action plan. This was also a reflexive process, documenting policy engagement as the project progressed and sharing processes and findings. Similarly, 'Risky Cities' targeted a range of local and national policy audiences to shape best practice for resilience building through arts and humanities. This included hosting a climate resilience workshop for local stakeholders; developing a policy brief shared with MPs across Hull and the local council; contributing to flood risk policy (e.g. Hull City Council's Local Flood Risk Management Strategy for 2022–2028, POSTNOTE 647 on Coastal Management [11, 18, 19]; and tabled amendments to the Levelling Up Bill by Hull MP, Emma Hardy); and contributing to cultural policy (e.g. responses to the Department for Digital, Culture, Media and Sport inquiry on culture, place-making and the levelling up agenda) [20].

## 5 Conclusions

In conclusion, we highlight three key learnings and two directions for future research and policy interventions and, in doing so, advocate for a specifically arts and humanities approach to climate resilience that centres

[2] Based on 457 survey responses.

**Fig. 3** Audience members enjoying the Sinuous City installation, part of the FloodLights event in Hull (*Photograph* Briony McDonagh, 2021)

on people and their experiences and helps us to rethink what resilience means at the local, community scale.

First, the projects collectively underline the significant potential of place-based, arts and humanities approaches—including those drawing on learning histories—to raise awareness, drive climate action and build climate resilience. These approaches make complex scientific ideas meaningful and big global narratives tangible at the local level, supporting people to understand what complex climate futures might mean for them. Second, we highlight the importance of generating genuine dialogue and co-creation, rather than one-way communication about climate futures. The projects here exemplify varying approaches and possibilities, but all sought to grant community stakeholders and policymakers the agency and urgency through which to act and inform future resilience building strategies. Third, all the projects stress the importance and the difficulties of assessing the 'effectiveness' of arts and humanities-led approaches. They push us to think about what successful engagement means, while also recognising that measurable outcomes—whether expressed qualitatively or quantitatively—are important in persuading others about the value of arts and humanities-led approaches for climate resilience.

Relatedly, our research and policy engagements have also identified important knowledge gaps which must be addressed if the full impacts of arts and humanities-led climate interventions are to be realised. As all the UKCR arts and humanities-led projects show, future long-term resilience plans need to respond effectively to the local cultural and place-specific impacts of climate change. Working collectively to develop more integrated climate and arts policy is, therefore, imperative in supporting this. At the same time, current national cultural policy prioritises the economic value of arts and heritage events [21]. Future policy needs to go beyond this and recognise both intangible benefits of arts engagement *and* its importance for addressing climate concerns and building resilience [22]. We look forward to working collectively with policymakers, climate scientists, community stakeholders and other actors in embracing these challenges.

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# Project References

This section provides further detail for each of the UK Climate Resilience projects referred to in this volume.

Listed for each are: project title (followed by extended title where applicable), project aim, principal investigators and collaborating institutes, project webpage(s) and funding tranche.

**AquaCAT (Flood risk estimates using techniques from catastrophe modelling)**

This project aims to combine information from UKCP18 with catastrophe modelling and apply it to climate-driven changes in UK flood risk.

Paul Sayers (Sayers and Partners), with UK Centre for Ecology and Hydrology, Vivid Economics Loughborough University

https://www.ukclimateresilience.org/projects/flood-risk-estimates-using-techniques-from-catastrophe-modelling/

*Met Office—Improving Climate Hazard Information, from Climate Hazard to Climate Risk*

**ARID (ARID: School buildings adaptation, resilience and impacts on decarbonisation in a changing climate)**

This project aims to develop risk-informed resilience of school building stock and optimise the opportunities from a transition to a low carbon future.

Daniel Godoy Shimizu (University College London), with Department for Education



S. Dessai et al. (eds.), *Quantifying Climate Risk and Building Resilience in the UK*,
https://doi.org/10.1007/978-3-031-39729-5

https://www.ukclimateresilience.org/projects/arid-school-buildings-adaptation-resilience-and-impacts-on-decarbonisation-in-a-changing-climate/

*Embedded Researcher Cohort 1*

**Bristol Heat Resilience (Developing an urban heat resilience plan for Bristol)**

This project aims to co-develop a heat vulnerability index and heat resilience plan for Bristol, to support climate resilience strategies.

Charlotte Brown (University of Manchester), with Bristol City Council

https://www.ukclimateresilience.org/projects/developing-an-urban-heat-resilience-plan-for-bristol/

*Embedded Researcher Cohort 1*

**Catchment Erosion Resilience (Erosion hazards in river catchments: Making critical infrastructure more climate resilient)**

This project aims to model how future climate scenarios will affect erosion hazards in river catchments and vulnerability of associated infrastructure.

James Cooper (University of Liverpool), with CoirGreen, ARUP, Waterco

https://www.ukclimateresilience.org/projects/erosion-hazards-in-river-catchments-making-critical-infrastructure-more-climate-resilient/

*Phase 1 Projects*

**CLandage (Building climate resilience through community, landscapes and cultural heritage)**

This project aims to use learning from the past to better understand how communities might adapt to future changes in places and landscapes.

Neil McDonald (University of Liverpool), with Historic England, University of Glasgow, Northumbria University, Staffordshire Record Office, Museum & Tasglann nan Eilean Siar, Fjordr

https://www.ukclimateresilience.org/projects/clandage-building-climate-resilience-through-community-landscapes-and-cultural-heritage/

https://historicengland.org.uk/whats-new/research/building-climate-resilience-through-community-landscapes-and-cultural-heritage/

*Living with Uncertainty*

**ClimaCare (Governing the climate adaptation of care settings)**

This project aims to quantify climate-related heat risks in care settings nationwide.

Mike Davies (University College London), with London School of Hygiene and Tropical Medicine, Oxford Brookes University, Care Quality

Commission, Ministry of Housing, Communities and Local Government, Chartered Institution of Building Services Engineers, the Greater London Authority, Aston House, PRP, Met Office

https://www.ukclimateresilience.org/projects/climacare-governing-the-climate-adaptation-of-care-settings/

*Governing Adaptation*

Climate Information for Decision-Making (Climate information to Inform UK decision-making)

This project aims to determine what is needed to support UK climate risk assessment and adaptation decision-making over the next decade, through engagement with users and providers.

Murray Dale (JBA Consulting), with Cardiff University, Becky Venton

https://www.ukclimateresilience.org/projects/climate-information-to-inform-uk-decision-making/

*Met Office—Improving Climate Hazard Information, from Climate Hazard to Climate Risk*

**Climate Resilience Standards (Review of standards, guidance and codes of practice for enhancing climate resilience)**

This project aims to understand the climate information inputs into commonly used national guidance standards.

Murray Dale (JBA Consulting Ltd), John Dora Consulting Limited, TRIOSS, University of Leeds, British Standards Institute

https://www.ukclimateresilience.org/projects/review-of-standards-guidance-and-codes-of-practice-for-enhancing-climate-resilience/

*Met Office—Pilot Climate Services*

**Climate Risk Indicators (Developing indicators of climate risk using UKCP18 to support risk assessments and enhance resilience)**

This project aims to provide first estimates of a series of indicators of climate risk, relevant to national, regional and local climate risk assessments.

Nigel Arnell (University of Reading), with UK Centre for Ecology and Hydrology, University of Leeds

https://www.ukclimateresilience.org/projects/climate-risk-indicators-developing-indicators-of-climate-risk-using-ukcp18-to-support-risk-assessments-and-enhance-resilience/

https://uk-cri.org/

*Phase 1 Projects*

**Climate Services Standards (Climate services standards and value)**

This project aims to establish a coherent set of standards for climate services, so decision-makers can improve their capacity to manage climate-related risk.

Murray Dale (JBA Consulting Ltd), with Climate Sense, Paul Watkiss Associates, Becky Venton, Prof Rob Wilby

https://www.ukclimateresilience.org/projects/climate-services-standards-and-value/

*Met Office—Operational Climate Services*

**Climate Stress Testing (Climate stress testing the UK food supply chain using earth observation)**

This project aims to bring together UK food supply chain stakeholders with earth observation researchers, to create climate stress testing tools to improve UK food security.

Caitlin Douglas (King's College London), with Space4Climate, London Climate Change Partnership

https://www.ukclimateresilience.org/projects/climate-stress-testing-the-uk-food-supply-chain-using-earth-observation/

*Embedded Researcher Cohort 1*

Coastal Climate Services (Climate service pilot: Improving coastal resilience)

This project aims to co-develop with users a coastal resilience service, by further developing the existing UKCP18 Sea Level Rise tool.

Rachel Perks, Dan Bernie (Met Office)

https://www.ukclimateresilience.org/projects/climate-service-pilot-improving-coastal-resilience/

*Met Office—Pilot Climate Services*

**CoastalRes (Coastal resilience in the face of sea level rise: Making the most of natural systems)**

This project aims to develop and demonstrate prototype methods to assess realistic pathways for strategic coastal erosion and flood resilience in response to climate change.

Robert Nicholls (University of Southampton) with University College London, Middlesex University, National Flood Forum, National Trust, Network Rail, Wildfowl and Wetlands Trust, ABPmer, Natural England

https://www.ukclimateresilience.org/projects/coastal-resilience-in-the-face-of-sea-level-rise-making-the-most-of-natural-systems/

https://www.coastalmonitoring.org/ccoresources/coastalres/

*Phase 1 Projects*

**Creative Climate Resilience (Community climate resilience through folk pageantry)**

This project aims use community knowledge to deliver a case study that responds to Manchester's climate action policies and community contexts.

Jenna Ashton (University of Manchester), with Manchester Climate Change Agency, Manchester City Council, Neighbourhoods North Manchester, Northern Chamber Orchestra, National Trust North Region, Manchester Arts and Sustainability Team, Manchester Institute of Education, Black Environment Network, A Bird in the Hand Theatre, Manchester Environment Education Networkhttps://www.ukclimateresilience.org/projects/community-climate-resilience-through-folk-pageantry/

https://creative-climate-resilience.org/

*Living with Uncertainty*

**CREWS-UK (Characterising and adapting to climate risks in the UK wine sector)**

This project aims to generate practical support for climate resilience in the UK, particularly for the wine sector.

Declan Conway (London School of Economics), with University of East Anglia, Wines of Great Britain

https://www.ukclimateresilience.org/projects/crews-uk-characterising-and-adapting-to-climate-risks-in-the-uk-wine-sector-climate-resilience-in-the-uk-wine-sector/

https://www.lse.ac.uk/granthaminstitute/resilient-wine/

*Phase 1 Projects*

**CROP-NET (Monitoring and predicting the effects of climate change on crop yields)**

This project aims to scope out the requirements for a robust, real-time crop and grass yield monitoring and modelling service for the UK to provide improved predictions of future climate change impacts.

Richard Pywell (UK Centre for Ecology & Hydrology), with University of Reading, University of Leeds

https://www.ukclimateresilience.org/projects/crop-net-monitoring-and-predicting-the-effects-of-climate-change-on-crop-yields/

https://cropnet-demonstrator.datalabs.ceh.ac.uk/

*Phase 1 Projects*

**eFLaG (Prototype development: enhancing the resilience of the water sector to drought events)**

This project aims to co-develop a pilot climate service to ensure a coherent, national approach to ensure drought resilience for the UK's water sector under a changing climate.

Jamie Hannaford (UK Centre for Ecology and Hydrology) and Chris Counsell (HR Wallingford)

https://www.ukclimateresilience.org/projects/enhancing-the-resilience-of-the-water-sector-to-drought-events-climate-service-pilots/

*Met Office—Pilot Climate Services*

**Environment Agency Incident Response (Adapting Environment Agency incident response for climate resilience)**

This project aims to characterise and quantify Environment Agency flood and drought incident response activity in current and future climates.

Elizabeth Lewis (Newcastle University), with Environment Agency

https://www.ukclimateresilience.org/projects/adapting-environment-agency-incident-response-for-climate-resilience/

*Embedded Researcher Cohort 1*

**EuroCORDEX-UK (Use and understanding of EuroCORDEX data over the UK)**

This project aims to extend the current suite of UKCP climate projections by incorporating information predominantly from the Euro-CORDEX downscaling experiment.

Richard Chandler, Claire Barnes and Chris Brierley (University College London)

https://www.ukclimateresilience.org/projects/use-and-understanding-of-eurocordex-data-over-the-uk/

https://github-pages.ucl.ac.uk/UKCORDEX-plot-explorer/

*Met Office—Improving Climate Hazard Information, from Climate Hazard to Climate Risk*

**ExSamples (Extreme samples)**

This project aims to better understand the sampling statistics of extreme events in three winters predicted to be the hottest or wettest in UKCP18 global projections.

David Wallom (University of Oxford), with Met Office, University of Bristol

https://www.ukclimateresilience.org/projects/exsamples-extreme-samples/

*Met Office—Improving Climate Hazard Information, from Climate Hazard to Climate Risk*

**FREEDOM-BCCR (Forecasting risk of environmental exacerbation of dissolved organic matter—building climate change resilience)**

This project aims to predict climate impacts on the water industry, to inform best practice climate resilience strategies.

Don Monteith (UK Centre for Ecology & Hydrology), with University of Leeds, University of Glasgow, Scottish Water, United Utilities, Welsh Water, Yorkshire Water

https://www.ukclimateresilience.org/projects/freedom-bccr-forecasting-risk-of-environmental-exacerbation-of-dissolved-organic-matter-building-climate-change-resilience/

*Phase 1 Projects*

**Freshwater Monitoring and Forecasting (Delivering resilience to climate impacts on UK freshwater quality: Towards national-scale cyanobacterial bloom monitoring and forecasting)**

This project aims to demonstrate the power of new satellite data for monitoring algal blooms in waterbodies across the UK.

Peter Hunter (University of Sterling), with UK Centre for Ecology and Hydrology, University of Glasgow, Plymouth Marine Laboratory

https://www.ukclimateresilience.org/projects/delivering-resilience-to-climate-impacts-on-uk-freshwater-quality-towards-national-scale-cyanobacterial-bloom-monitoring-and-forecasting/

*Phase 1 Projects*

**FUTURE-DRAINAGE (Ensemble climate change rainfall estimates for sustainable drainage)**

This project aims to update guidance for drainage design and urban surface water flood risk assessment in the UK.

Hayley Fowler (University of Newcastle), with Loughborough University, Southern Water, United Utilities, Thames Water, JBA Consulting, Welsh Water, Scottish Environment Protection Agency, Anglian Water, Yorkshire Water

https://www.ukclimateresilience.org/projects/future-drainage-ensemble-climate-change-rainfall-estimates-for-sustainable-drainage/

*Phase 1 Projects*

**Health Sector Resilience (Prototype development: Addressing the resilience needs of the UK health sector)**

This project aims to characterise extreme events linked to ill-health in the UK and quantify how climatic and demographic changes might necessitate resilience in health and social care in future decades.

Andrew Charlton-Perez (University of Reading)

https://www.ukclimateresilience.org/projects/addressing-the-resilience-needs-of-the-uk-health-sector-climate-service-pilots/

*Met Office—Pilot Climate Services*

**Improving Climate Hazard Information (Improving climate hazard information)**

This project aims to produce a method to estimate changes in the probability density function of extreme value statistics compatible with the UKCP18 approaches.

Simon Brown, Peter Stott, Lizzie Kendon, Rob Shooter, William Keat, Daniel Cotterill, James Pope (Met Office)

https://www.ukclimateresilience.org/projects/improving-climate-hazard-information/

*Met Office—Improving Climate Hazard Information, from Climate Hazard to Climate Risk*

**London Climate Action (Climate action strategy for City of London—Adaptive design/pathways for London's cubic mile)**

This placement aims to support the delivery of the City of London Corporation's Climate Action Strategy 2020–2027.

Katy Freeborough (British Geological Survey), with City of London Corporation

https://www.ukclimateresilience.org/projects/climate-action-strategy-for-city-of-london-adaptive-design-pathways-for-londons-cubic-mile/

*Embedded Researcher Cohort 2*

**MAGIC (Mobilising adaptation—governance of infrastructure through co-production)**

This project aims to demonstrate and evaluate a community-led approach to reducing flood risk.

Liz Sharp (University of Sheffield), with University of Hull, Queen Mary University of London, Living with Water Partnership, Hull and East Riding Timebank

https://www.ukclimateresilience.org/projects/magic-mobilising-adaptation-governance-of-infrastructure-through-co-production/

*Governing Adaptation*

**Manchester Climate Action (Adaptation and Resilience: Planning and action for Manchester)**

This project aims to establish a policy and action-planning framework to enable Manchester sectors to take urgent and sustained action to increase resilience to climate variability.

Paul O'Hare (Manchester Metropolitan University), with Manchester Climate Change Agency

https://www.ukclimateresilience.org/projects/adaptation-resilience-planning-action-for-manchester/

https://www.manchesterclimateready.com/

*Embedded Researcher Cohort 1*

**Meeting Urban User Needs (Prototype development: Meeting urban user needs)**

This project aims to understand user needs for specific applications of local decision-making in aspects such as health, infrastructure and water.

Claire Scannell and Victoria Ramsey (Met Office)

https://www.ukclimateresilience.org/projects/prototype-development-meeting-urban-user-needs/

https://www.metoffice.gov.uk/research/approach/collaboration/spf/ukcrp-outputs

*Met Office—Pilot Climate Services*

**Multiple Hazards (Multiple hazards and compound events)**

This work aims to characterise risks from multiple climate hazards and how they may change in terms of location, severity, frequency and duration throughout the twenty-first century.

Dan Bernie and Freya Garry (Met Office)

https://www.ukclimateresilience.org/projects/from-climate-hazard-to-climate-risk/

*Met Office—Improving Climate Hazard Information, from Climate Hazard to Climate Risk*

**National Framework for Climate Services (Facilitating the delivery and use of climate services)**

This project aims to engage with climate services stakeholders to determine whether there is a need for a UK National Framework of Climate Services.

Natalie Garrett, Louise Wilson and Nicola Golding (Met Office)

https://www.ukclimateresilience.org/projects/facilitating-the-delivery-and-use-of-climate-services/

*Met Office—Operational Climate Services*

**Once Upon a Time (Once upon a time in a heatwave)**

This project aims to explore storytelling to communicate impacts of—and adaptation to—a changing climate in Northern Ireland, with a particular focus on agricultural and rural communities.

Alan Kennedy-Asser (University of Bristol), with Climate Northern Ireland

https://www.ukclimateresilience.org/projects/once-upon-a-time-in-a-heatwave/

*Embedded Researcher Cohort 2*

**OpenCLIM (OpenCLIM: Open climate impacts modelling framework)**

This project aims to support UK assessment of climate risk and adaptation by developing and applying an integrated assessment model.

Robert Nicholls (Tyndall Centre, University of East Anglia), with Newcastle University, University of Bristol, Science and Technology Facilities Council, UK Centre for Ecology and Hydrology, Environment Agency, Climate Ready Clyde, Broads Authority, Anglian Water, Arup, RMS, MottMacDonald, Universiteit Utrecht, Paul Sayers and Partners

https://www.ukclimateresilience.org/projects/openclim-open-climate-impacts-modelling-framework/

*Enhancing Climate Change Risk Assessment*

**Resilience for Churches (Co-developing resilience strategies for churches and their communities)**

This project aims to co-develop climate resilience in church buildings across the UK.

Chris Walsh (University of Manchester), with Church of England

https://www.ukclimateresilience.org/projects/co-developing-resilience-strategies-for-churches-and-their-communities/

*Embedded Researcher Cohort 2*

**RESIL-RISK (RESIL-RISK: Understanding UK perceptions of climate risk and resilience)**

This project aims to investigate how people currently conceptualise the relationship between climate risk, resilience and adaptation policy, as evidence for designing future communications.

Nick Pidgeon (Cardiff University), with Climate Outreach

https://www.ukclimateresilience.org/projects/resilrisk-understanding-uk-perceptions-of-climate-risk-and-resilience/

*Phase 1 Projects*

**Risk Assessment Frameworks (Comparison of risk assessment frameworks)**

This project aims to establish how to best assess climate change risk in support of climate resilience efforts, by identifying and comparing UK specific risk assessment frameworks.

Dan Bernie, Laura Dawkins and Kate Brown (Met Office)

https://www.ukclimateresilience.org/projects/from-climate-hazard-to-climate-risk/

*Met Office—Improving Climate Hazard Information, from Climate Hazard to Climate Risk*

**Risky Cities (Living with water in an uncertain future climate)**

This project aims to develop research-informed learning histories for flood-prone Hull for use in community-based arts and heritage interventions and large-scale productions.

Briony McDonagh (University of Hull), with Absolutely Cultured, Hull City Council, Hull Minster, Hull: Yorkshire's Maritime City, Living with Water Partnership, National Youth Theatre

https://www.ukclimateresilience.org/projects/risky-cities-living-with-water-in-an-uncertain-future-climate/

https://riskycities.hull.ac.uk/

*Living with Uncertainty*

**SEARCH (SEARCH: Sensitivity of estuaries to climate hazards)**

This project aims to evaluate climate flooding hazards in UK estuaries.

Peter Robins (Bangor University), Hull University, British Geological Survey

https://www.ukclimateresilience.org/projects/search-sensitivity-of-estuaries-to-climate-hazards/

https://www.researchgate.net/publication/363166162_Historic_Spatial_Patterns_of_Storm-Driven_Compound_Events_in_UK_Estuaries/link/631009675eed5e4bd136f581/download

*Present and Future Climate Hazard*

**Stochastic Simulation (Facilitating stochastic simulation for UK climate resilience)**

This project aims to explore how weather generators could be more widely used to support climate resilience activities in the UK, especially in flood and water management projects.

David Pritchard (Newcastle University), with JBA Consulting

https://www.ukclimateresilience.org/projects/facilitating-stochastic-simulation-for-uk-climate-resilience/

*Embedded Researcher Cohort 2*

**STORMY-WEATHER (STORMY-WEATHER: Plausible storm hazards in a future climate)**

This project aims to use the latest climate projections to develop a new methodology to understand what drives changes in extreme rainfall and windstorms for different storm types.

Hayley Fowler (Newcastle University), with University of Exeter

https://www.ukclimateresilience.org/projects/stormy-weather-plausible-storm-hazards-in-a-future-climate/

*Present and future climate hazard*

**Time and Tide (Time and tide: Resilience, adaptation and art)**

This project aims to investigate how the arts can catalyse communities to act—and become more resilient—as climate change intensifies and socioeconomic inequalities increase.

Corinna Wagner (University of Exeter), with Time and Tide Bell

https://www.ukclimateresilience.org/projects/time-and-tide-resilience-adaptation-art/

*Embedded Researcher Cohort 2*

**Tourism Adaptation (Climate change and the tourism sector: impacts and adaptations at visitor attractions)**

This project aims to investigate the relationship between weather/climate and visitation to heritage attractions under current and future climatic conditions.

Tim Coles (University of Exeter), with National Trust, Historic Environment Scotland

https://www.ukclimateresilience.org/projects/climate-change-and-the-tourism-sector-impacts-and-adaptations-at-visitor-attractions/

*Embedded Researcher Cohort 2*

**Transport/Energy Climate Services (Climate services for the transport and energy sectors)**

This project aims to scope and co-develop initial prototype climate services for the UK's transport and energy sectors.

Erika Palin and Kate Brown (Met Office), with Department for Transport

https://www.ukclimateresilience.org/projects/climate-services-for-the-transport-and-energy-sectors/

*Met Office—Pilot Climate Services*

**UKCR Synthesis (Linking to the national Climate Change Risk Assessment (CCRA) process and synthesis of SPF resilience projects)**

This project aims to ensure consistency with the CCRA3 and proper co-development of science.

Peter Stott, Richard Betts, Simon Brown and Elizabeth Kendon (Met Office)

https://www.ukclimateresilience.org/projects/improving-climate-hazard-information/

*Met Office—Improving Climate Hazard Information, from Climate Hazard to Climate Risk*

**UK-SSPs (UK socioeconomic scenarios for climate research and policy)**

This project aims to produce UK-specific downscaled socioeconomic narratives and gridded data for a range of indicators, extended to 2100.

Jon Stenning (Cambridge Econometrics), with UK Centre for Ecology and Hydrology, University of Edinburgh, University of Exeter

https://www.ukclimateresilience.org/projects/uk-socioeconomic-scenarios-for-climate-research-and-policy/

*Met Office—Improving Climate Hazard Information, from Climate Hazard to Climate Risk*

**Upscaling Climate Service Pilots (Upscaling of climate service pilots into routine services)**

This project aims to consider how existing UKCR-developed pilot services can be up-scaled to routine services, making them useful and accessible to stakeholders.

Galina Guentchev, Erika Palin and Christopher Goddard (Met Office)

https://www.ukclimateresilience.org/projects/upscaling-of-climate-service-pilots-into-routine-services/

*Met Office—Pilot Climate Services*

**Water Sector Resilience (Towards forecast-based climate resilience and adaptation in the water sector)**

This project aims to understand how improved forecast capabilities can inform future operations adaptation in the water sector in response to climate change and population growth.

Charles Rougé (University of Sheffield), with Anglian Water

https://www.ukclimateresilience.org/projects/towards-forecast-based-climate-resilience-and-adaptation-in-the-water-sector/

*Embedded Researcher Cohort 1*

**Yorkshire Climate Action (Whose role is it to act on climate resilience? Implementing Yorkshire's Climate Action Plan with Leeds City Council)**

This project aims to assist Leeds City Council's flood risk management team in developing a stronger leadership role on climate resilience and adaptation planning.

Stephen Scott-Bottoms (University of Manchester), with Leeds City Council, Flood Risk Management

https://www.ukclimateresilience.org/projects/whose-role-is-it-to-act-on-climate-resilience-implementing-yorkshires-climate-action-plan-with-leeds-city-council/

*Embedded Researcher Cohort 2*

# Index




S. Dessai et al. (eds.), *Quantifying Climate Risk and Building Resilience in the UK*,
https://doi.org/10.1007/978-3-031-39729-5