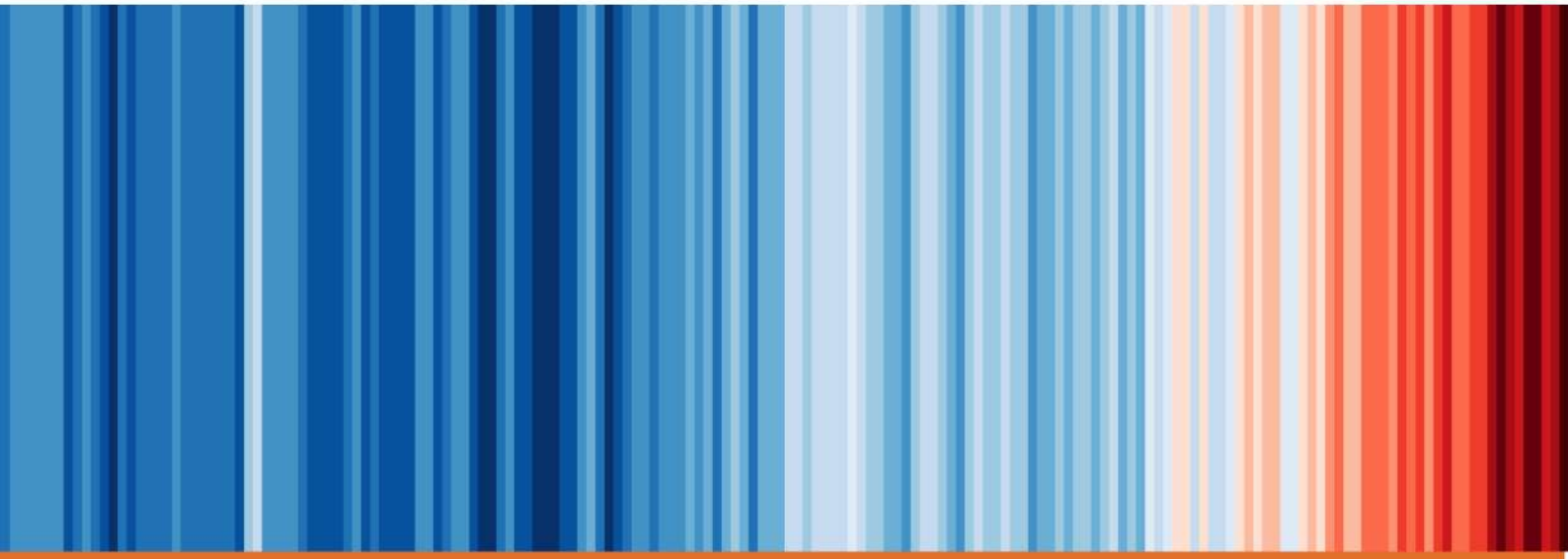
Tyndall Centre for Climate Change Research

25

POSTER SHOWCASE



CRITICAL DECADE FOR CLIMATE ACTION CONFERENCE: 2025

Posters displayed at the poster showcase reception at the Sainsbury Centre at the University of East Anglia (UEA) on Monday 8 September 2025, as part of the Tyndall Centre for Climate Change Research's 25th anniversary conference.

Justice in Community-led Energy Transitions

Beirut's buildings and their response to 2021s electricity crisis

Urban life in Beirut

- Residents own or rent apartments in building blocks
- Most buildings have committees (resident associations) that manage common areas
- With state failures, the committee takes on infrastructure services like electricity and water

State failures and energy provision

- Expensive and polluting diesel-generator subscription services are the norm
- Lebanon's financial and political crisis started in 2019
- Total blackout in October 2021
- A solar boom; mainly individual households purchasing PV systems

Building profiles

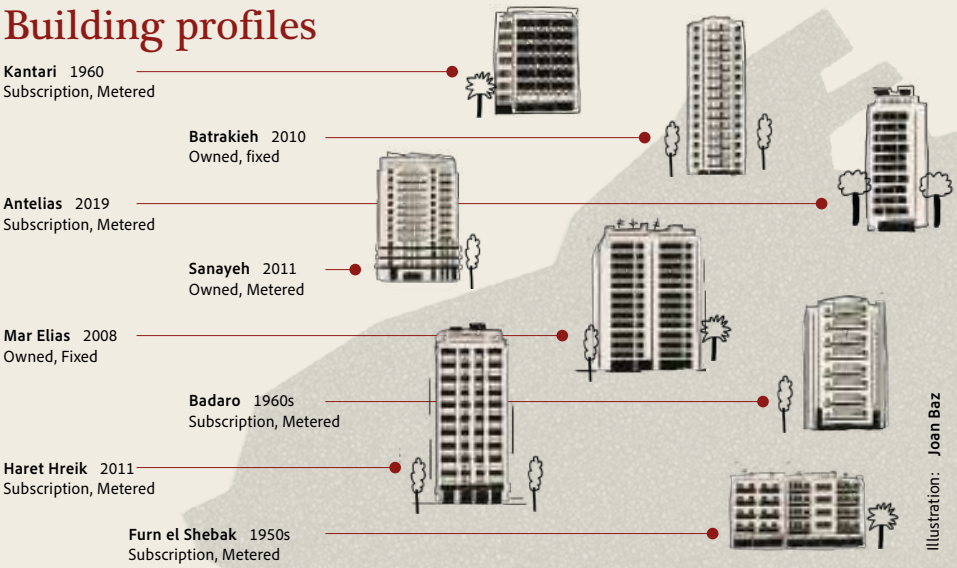


Illustration: Joan Baz

Approach and case studies

- Building committees are spaces of self-organisation often overlooked in energy studies
- To capture everyday dynamics and what 'emerges between the cracks', we followed a collaborative ethnographic approach to understand how people live with the energy crisis in Lebanon
- 8 buildings where resident-researchers observed and noted daily life and interviewed other residents and committee members
- Buildings covered various types of generator services (metered or fixed price), building age and location

Burden?

"[As a committee member] I am, as you can see, the local government, the electricity company, a social mediator, and much more"

Equal?

A key/remote control was installed to limit access to the lift for those who pay, dividing residents.

Inclusive?

"I am an owner in this building not a renter, I have a right to the generator and its operating hours"

"Those who have not paid their subscriptions this month do not have the right to object"

Collaborative?

Individual
The needs of individual households are met, independent of the building's collective system (e.g. install a UPS at home)

Collective
All households participate, expenses are shared, but decisions are made by a minority without consultation or consensus (e.g. mandatory payment for services)

Exclusionary
The needs of some households are met, giving selective access to those who can pay (e.g. access to elevator services controlled by key)

Collaborative
All households contribute and receive the benefits of a solution based on collective decision making and inclusivity (e.g. an affordable monthly payment for less electricity)

Conclusion

- Local and self-organised 'solutions' to crises are not always just or equitable
- Tracing everyday dynamics to document energy injustice and what it looks like
- Just energy transitions in fragile contexts must go beyond technical fixes to consider political and socio-economic infrastructures that can influence collaborative forms of energy provision

مجموعة إيبلا البحثية
Ebla Research Collective

Authors: Ebla Research Collective (Dana Abi Ghanem, Zeina Abla, and Muzna Al-Masri).
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Funded by: Rosa Luxemburg Foundation, Beirut

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Running to stand still: the state of UK wheat farming

Using complex systems methods to understand different wheat farm systems and how they are coping with compound climate events

Alice Ainsworth, Felix Eigenbrod[1], Emma Tompkins[1], Jonathan Storkey[2]

University of Southampton [1] ROTHAMSTED RESEARCH [2]

ERGO ID: 100975

1. Background and context

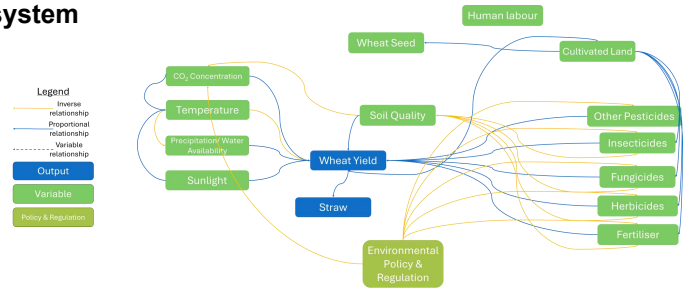
1.1 Importance

- Global wheat yield losses of 4-6% are predicted for each 1ºC increase in global average temperature (Xiong, Reynolds et al. 2024)
- Further losses expected due to weather extremes and climate-induced pest and disease outbreaks
- In the UK, ~31% of people's daily energy intake comes from wheat and >80% of wheat consumed is produced domestically (DEFRA, 2024).
- Limited research addresses UK farm level adaptation to climate change.

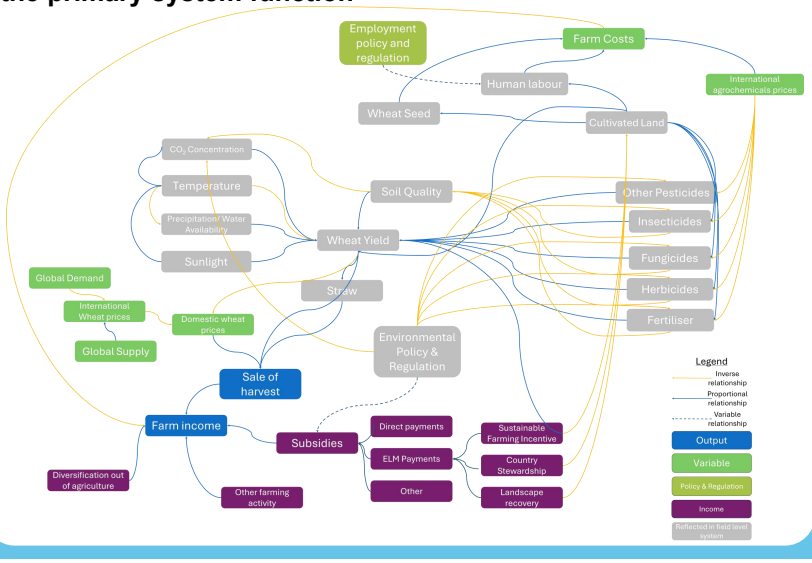
1.2 Misaligned and competing priorities between national policy and farm businesses is creating tension

Farm Challenges	Government Challenges
Volatile growing conditions with compound climate change	Maintaining national food security under climate change
Diminishing margins: high input costs and low commodity prices	Competing demands for land: housing development, energy security and producing food
Pressure to transition from intensive agricultural production to low impact	Meeting Net Zero by 2050
Increasing agronomic pressures (e.g. pesticide resistance)	Meeting national biodiversity and nature recovery targets

1.3 Current literature focusses on field level adaptation, providing an incomplete picture of the complexity of a farm system



1.4 The challenges and opportunities to address shocks and stresses look very different when you consider farm income as the primary system function



2. Planned research

2.1 Research Aim

Understand how English wheat farms are affected by compound climate events and how they cope within the context of the farm system.

2.2 Proposed Research Questions

1. What different types of wheat farms are there in England?
2. How are different types of wheat farm exposed to/ impacted by compound climate events?
3. What are farms doing to cope with stresses from compound climate events
4. How important is climate change as a driver of change within the farm system relative to other pressures?

2.3 Proposed Method(s)

Semi-structured interviews with wheat farmers and associated stakeholders

Policy analysis of agricultural policy

Systematic review of phenological wheat studies

Systems analysis of English wheat farming showing influence of shocks, stressors and adaptations

2.4 Planned Output

System diagrams to represent current state of English wheat farming including relative influence of stressors and shocks and actions taken to cope.

3. Next Steps:

Email Alice.Ainsworth@soton.ac.uk if you would like to find out more about the upcoming interviews

1. Explore transformational approaches to wheat farming in the UK to build farm systems which thrive in uncertainty
2. Carry out an assessment of the trade-offs associated with transformation scenarios

References:

DEFRA (2024). UK Food Security Report 2024.
Xiong, W., et al. (2024). "New wheat breeding paradigms for a warming climate." Nature Climate Change **14**(8): 869-875.

Exploring the nexus between decarbonising & decolonising international research collaborations

Worrying about the carbon footprint of *your* academic air travel & what to do about it?

What's at stake?

- Flying dwarfs 'any other environmental impact a … person can exert' (*Monbiot 2006*)
- Reducing academic air travel likely among fastest ways to decrease emissions in higher education (*Nevins et al. 2022*)
- Academic air travel perpetuates colonial inequities in knowledge production (costs, visa issues, etc., *Sultana 2024*)

Where's the conversation at?

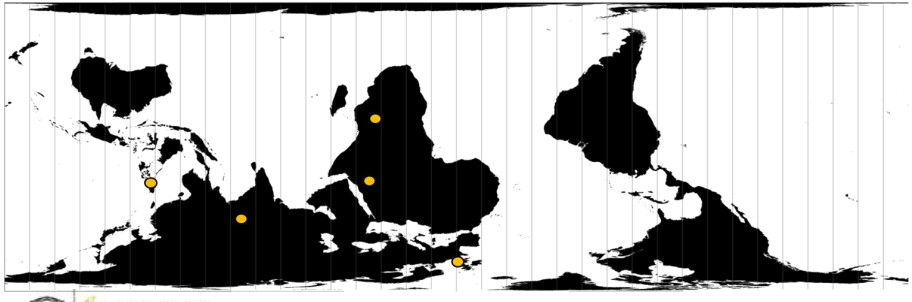
- Scholarship on decarbonising research focuses on Global Minority institutions – little insights into views of Global Majority researchers
- Little exploration of how low-carbon agenda relates to imperatives to decolonise research

What are we trying to do?

- Use international research collaborations in Comparative & International Education (CIE) as case study
- Construct a recent 'carbon history' of CIE research, asking what it can tell us about the shape of current knowledge production systems & opportunities / challenges for decarbonising & decolonising
- Document how differently positioned CIE researchers experience the decarbonisation / decolonisation nexus (synergy? trade-off?), centring Global Majority voices
- Explore what has enabled successful low-carbon decolonial collaborations in the past & what lessons they offer for future research
- Create toolkit to support future low-carbon decolonial research practice

Who are we?

- Collective of researchers associated with UEA UNESCO Chair in Adult Literacy & Learning for Social Transformation & its partner institutions
- Get in touch: Dr Hannah Hoechner h.Hoechner@uea.ac.uk



Bahir Dar University / Ethiopia +++ University of Malawi / Malawi +++ Tribhuvan University / Nepal +++ University of Santo Tomas / Philippines +++ University of East Anglia / UK

Mind the GAPS in achieving net zero: CDR from promise to practice

Naomi E. Vaughan (UEA), **Aimie Hope** (UEA), Clair Gough (Manchester), Isabella Butnar (UCL), Harry B. Smith (UEA)

Introduction

Carbon dioxide removal (CDR) is essential for net zero but also a risk to its achievement. Most modelling includes large amounts of CDR, but the feasibility of delivering this has been questioned. Many 'real-world' factors (e.g., social and ethical) which are not constraints within models may play an important role in reality. Furthermore, most CDR does not yet exist because it is either not technologically ready or at scale, and essential supporting infrastructure is not in place (e.g., CCS, pipelines). Another risk to net zero is 'mitigation deterrence', where modelling undermines motivation for current emissions reductions by presenting these as far more costly than future CDR. There is therefore a significant 'promise to practice' gap which must be bridged for CDR to be successfully implemented to contribute to net zero.

Progress on CDR has been slow. Land-based methods such as tree planting are consistently behind target despite being relatively low cost to deliver and technologically ready. More costly engineered methods have also been slow to progress despite considerable investment and policy support. Consequently, there is a growing gap between the amounts of CDR envisioned in models and actual progress on delivery. While current methods of assessing CDR feasibility focus on techno-economic factors, we argue that it is hard to account for this lack of progress without considering a wider set of factors.

GAPS Framework

Here we introduce the 'GAPS' framework which is intended to complement existing techno-economic focused assessments by providing a structure by which to expose relatively immediate (<10 years) delivery risks which may otherwise be overlooked. Secondly, GAPS helps to account for the current state of CDR, namely the apparent appeal of engineered methods and poor performance of land-based methods (both from a central government perspective).

Trait	Description	
	Concise	*Question*
Goals	Number and diversity of decision-making goals.	*why* is the CDR method being implemented? what objectives will the CDR method meet?
Actors	Number of actors involved in implementation and their current power and influence.	*who* will implement the CDR method? how many key stakeholders are involved? how much power and influence do they have?
Place	Number of locations where implemented and current use.	*where* will the CDR method be implemented? how many locations will it be implemented in? what are the current characteristics of the locations the CDR method will be implemented in?
Substance	Tangible, observable, near-immediate outcome.	*what* is the visible outcome of the CDR method? *when* will the carbon removal outcome be delivered? how much immediate political currency can be gained? how easy is it to measure and verify the carbon removal? how vulnerable to loss is the carbon once stored?

Trait	Perceived ease of implementation	
	Easier	Harder
Goals	**Few goals** *Cost, carbon.*	**Many goals** *Cost, carbon, biodiversity, water quality, flood alleviation, amenity provision.*
Actors	**Few, strongly connected actors.** *10-30 companies, with strong connections to central government, national or multinational companies.*	**Many, weakly connected actors.** *10,000 - 50,000 individuals, households or landowners. Distributed individuals, communities, local governments or regions.*
Place	**Few locations with existing similar current use.** *Infrastructure to be sited in locations with existing similar industries.*	**Many locations, with change of use.** *Multiple sites shifting land use from livestock production to woodland habitat conservation.*
Substance	**Structure or object visible upon implementation.** *A new industrial facility.*	**Invisible, or only visible after more than 5 years.** *Saplings in tree protectors or change in soil health.*

Apply GAPS to CDR methods in the UK

The GAPS framework can be used to account for both the apparent enthusiasm for engineered methods (e.g., as demonstrated by funding and policy support) and the poor performance of land-based methods (e.g., as demonstrated by decades of failure on tree planting targets). Engineered methods such as BECCS offer clear goals (carbon capture); involve working with only a few powerful and incumbent actors (extractive industries) who hold expertise and access to critical infrastructures; lower disruption by having a few large projects on existing industrial sites; and a clear demonstration of progress (a physical BECCS unit). In contrast tree planting is messy. It involves many conflicting goals (e.g., biodiversity, flood management, carbon) and tens of thousands of actors (e.g., farmers) dispersed across the UK. There is no immediate pay back as saplings take time to establish and MRV is more challenging. The above table summarises the relative ease of implementation from a central government perspective.

Figures 1 and 2 illustrate how GAPS reveals relatively immediate delivery risks, complementing existing techno-economic assessments to give more realistic expectations of CDR delivery.

Figure 1: GAPS applied to tree planting

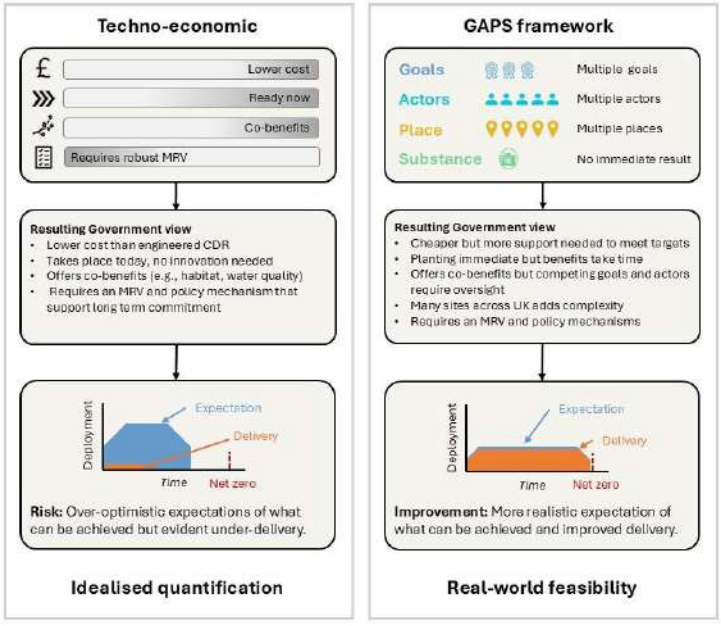
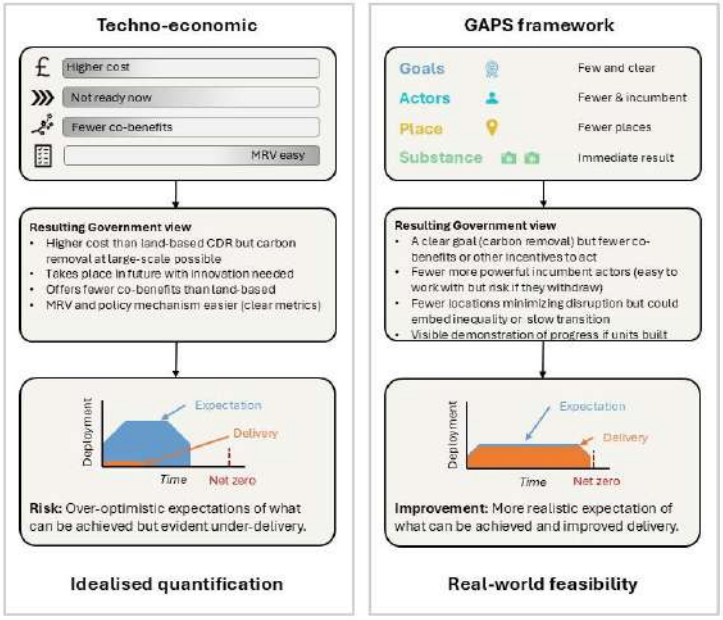


Figure 2: GAPS applied to Bioenergy with Carbon Capture & Storage



Conclusions

The key insight from the application of the GAPS framework is that there are significant risks to delivery for both engineered and land-based forms of CDR. There is no single form of CDR that alone will guarantee achieving net zero. Instead, we can see the importance of maintaining a diverse portfolio of CDR methods and crucially of maintaining impetus on efforts for emissions reduction, without which the task of CDR only increases.

Methods which appear at first glance to offer a 'smoother' pathway to net zero such as BECCS also carry substantial risks. Conversely, methods which appear 'messier' and more complex to implement such as various tree planting schemes may only need better policy mechanisms and resourcing to support their delivery.

Beyond Cost and Carbon Project seeks to improve the assessment of CDR feasibility, by going beyond cost and carbon to include underrepresented insights on the social, political, cultural, and institutional aspects of CDR feasibility – thus capturing the real-world complexities of CDR methods and improving feasibility assessments and associated decision-making.

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MACC Hub: Maximising UK Adaptation to Climate Change

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Who are we?

Our mission is to help the UK adapt and build resilience to climate change by turning challenges into practical solutions that protect our communities, nature, and economy.

How we do it?

We achieve this by combining research, collaboration, and innovation to turn transformation climate knowledge into the meaningful action required to build a more resilient UK.

Exploring the UK ADAPT Map

Case Studies

Delve into innovative insights, evidence-based studies, and expert perspectives.

Tools

Explore toolkits that offer resources and guidance to help understand and assist your climate adaptation efforts.

Research

Explore external adaptation projects that highlight innovative approaches to transformational change.

Climate Platforms

Discover various climate adaptation platforms that provide tools, resources, and networks to support your adaptation efforts.

Events

Find out about upcoming and past webinars and online events on climate adaptation from the MACC Hub community.

Courses

Discover our range of training modules and resources on transformational climate adaptation, vulnerability assessment, and adaptation planning.

Get Involved Today!

01 Register/Sign Up on the website

- Scan the website QR code below to open our website
- Click on the 'Sign In' link at the top-right of the page
- A pop-up window will appear. Click on 'Create New Account'
- Fill in the details requested
- Click on 'Register' and a confirmation email welcoming you to the MACC Hub community will be sent to you.

02 Join the mailing list

- Sign up for the MACC Hub monthly newsletter to stay informed about the latest updates within the hub.
- Receive updates on our progress, key findings, and opportunities to collaborate.

03 Follow us on LinkedIn

- Receive the most updated information by following us on LinkedIn.

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Coordinated by

Using flood risk maps to empower communities

Insights from a systematic review on best practices and barriers

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For more information, view my pre-registration form:

Introduction

Flooding is one of the most devastating natural hazards worldwide and climate change is expected to increase both its frequency and severity.

In the UK, the number of people living in high-risk flood areas is projected to double by 2050, yet only 45% of those at risk are aware of their vulnerability[1].

With current adaptation policies failing to translate into meaningful action[2], increasing responsibility is placed on communities. This makes effective flood risk communication essential.

Flood risk maps are key tools used to raise awareness and enable informed decisions, yet many fail to meet the needs of users.

Challenges include unclear probabilistic information (e.g., "1 in 100-year flood"), failure to communicate uncertainty and maps that are unactionable or untailored[3,4].

This systematic review explores how flood risk maps and visualisations influence comprehension, risk perception, decision-making and usability.

This review aims to:

- Identify best practices
- Reveal challenges and barriers
- Provide recommendations and future directions
- Evaluate the methods used

Methods

Searches were conducted on 2 April 2025 using Scopus, Web of Science and Academic Search Ultimate.

(communicat*) AND (flood*) AND (visuali*ation* OR map*) AND (risk* OR likelihood OR probabilit*)

After screening 567 studies, 41 met the inclusion criteria.

Studies were included if they:

- Focussed on long-term flood risk communication
- Examined maps or visualisations
- Involved user groups
- Measured and/or evaluated comprehension, risk perception, usability or decision-making

Studies were excluded if they:

- Used immersive technology
- Focussed on short-term or emergency communication
- Were review or conceptual papers
- Involved no user groups
- Did not measure or evaluate the relevant variables

Data extraction has captured study characteristics and key findings.

A quality assessment and narrative synthesis are currently underway.

Results

41 studies included

- 8 qualitative
- 10 quantitative
- 23 mixed-methods

Methods included surveys, randomised control trials, eye-tracking, interviews, focus groups, and participatory methods.

Strengths: Participatory research aligned outputs with user needs. Mixed-methods enhanced depth of findings. Studies typically included diverse stakeholders (experts, public).

Limitations: Underrepresentation of Global South and vulnerable groups. Focus on specific regions limits generalisability. Overall lack of psychologically grounded research.

WHAT AFFECTS COMPREHENSION?

- **Language** - Technical terms (e.g., 'return period') reduce understanding. Formats like '1% annual chance' are easier to grasp
- **Design** – Clear legends, fewer classes, minimal clutter, hyperlocal detail and effective colour use improve clarity
- **Realism** - Realistic visuals and showing flood progression aids understanding
- **Backgrounds** – Dense backgrounds (e.g. infrared maps) reduce comprehension

WHAT AFFECTS RISK PERCEPTION?

- **Location** – Being just outside flood zones can create a false sense of security
- **Realism** – Damage depth and realistic imagery heightens concern
- **Probabilities** – Cumulative risk (e.g., '26% in 30 years') raises concern more than annual flood risk and can increase insurance uptake
- **Framing** – Economic impacts increase perceived severity

WHAT AFFECTS DECISION-MAKING?

- **Actionable content** - Lack of guidance reduces usefulness
- **Housing market** – Flood risk disclosure can slow sales and lower prices
- **Climate risk visuals** – Boost policy support and prioritisation of vulnerable areas
- **Framing** – Economic framing can prompt analytical decisions whereas emotional framing can reduce adaptation investments

WHAT AFFECTS USABILITY?

- **Design** – Large, right-positioned legend (<5 classes), simple symbols and simple backgrounds improve usability
- **Colours** – Red for risk, blue for depth and simple colour ranges improve usability
- **Advanced features** – Zoomable, searchable and 3D maps increase engagement but confuse some users
- **Navigation** – Scales, inset maps, roads, landmarks and rivers aid orientation

Conclusions

- Flood maps empower individuals when designed with user needs in mind
- Participatory approaches align maps with user preferences but depend on subjective input
- Empirically grounded psychological research is needed to identify what improves comprehension and motivates protective action
- Communicating uncertainty effectively is key, yet remains underexplored
- Climate risk information can sometimes reduce concern or motivation to act[5]; research should focus on presenting it in ways that empower, not disengage
- Future work should address these gaps, use psychologically grounded methods and engage underrepresented groups

Thank you to my supervisors Dr Jordan Harold, Prof Irene Lorenzoni and Prof Kenny Coventry for their support. Funded by SENSS.

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EVALUATING THE IMPACT OF A GLACIER MELT ART EXHIBITION ON CLIMATE ACTION ACROSS DEMOGRAPHICS

Jessica Turner
Queens University

1 Introduction

An analysis of 819 research articles on climate communication by scientists revealed that only 7 evaluated the actual impact of the reported communication efforts.[1]

Aim

1. **Evaluate to what extent a climate-themed art exhibition increased climate change knowledge and motivation to act,** and compare these outcomes across demographic groups
2. **Examine how emotional responses relate to knowledge gain and action motivation**
3. **Provide insights to inform future exhibitions** on climate themes to encourage climate action

2 Methods

Visitors attended the exhibition Contemplating Glaciers featuring 6 diverse artistic media designed with guidance of curatorial mind-map (Fig. 1)

Adult visitors 18+ (**n = 67**) scan QR code to access and complete survey measuring knowledge gain, motivation to act, and demographics

Collected survey data is analyzed quantitatively (descriptive statistics, chi-square) and qualitatively (thematic coding)

Results integrated with case study insights for evaluation and recommendations

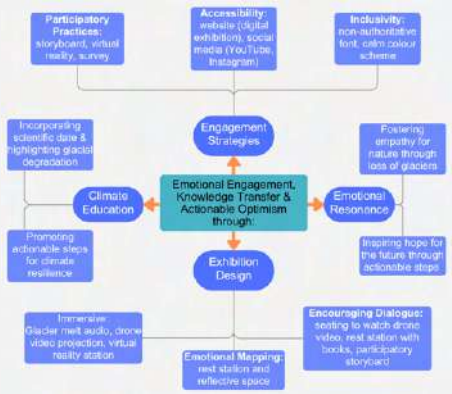

Figure 1. Curatorial Mind Map

3 Results

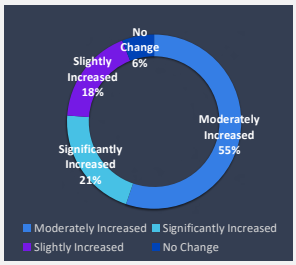

Figure 2. Knowledge Gain Post Exhibition

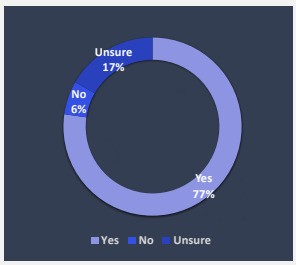

Figure 3. Motivation to Act Post Exhibition

Chi-Square test showed a significant association between Knowledge Gain and Motivation to Act, $\chi^2(6) = 40.86$, $p < .001$.

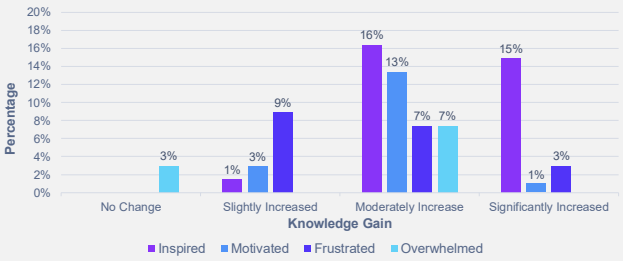

Figure 4. Distribution of Emotional Responses by Knowledge Gain Level

Chi-Square test showed a significant association between Feeling Inspired and Knowledge Gain, $\chi^2(6) = 74.99$, $p < .001$.

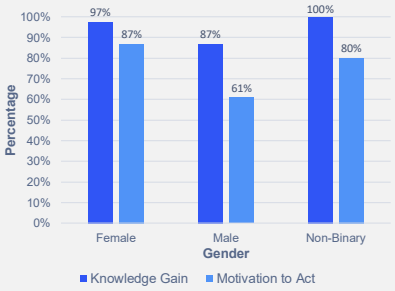

Figure 5. Knowledge Gain and Motivation to Act by Gender

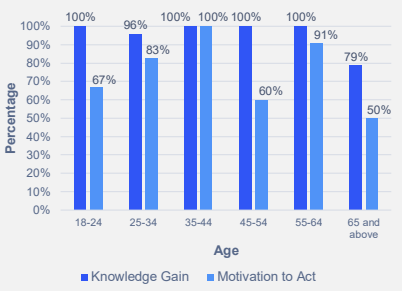

Figure 6. Knowledge Gain and Motivation to Act by Age

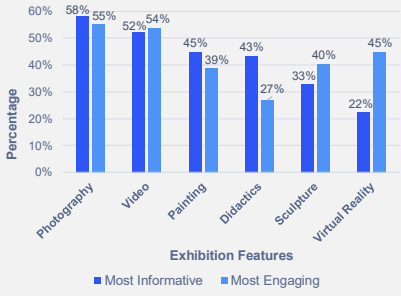

Figure 7. Feature Ratings by Visitors

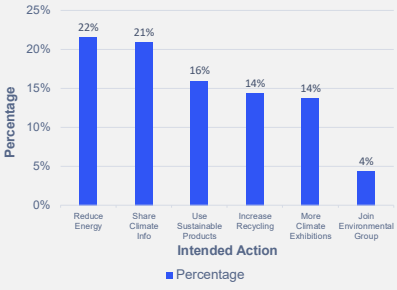

Figure 8. Intended Actions Post-Exhibition

4 Discussion

- **76% reported knowledge gain** and **77% felt motivated to act**, with a **strong association between knowledge gain and motivation**
- **Feeling inspired was strongly tied to learning**
- Knowledge gains were high across all genders and ages, though **motivation was lower among men (61%) and adults 65+ (50%)**
- Photography and video were both **most informative** and **engaging**
- Common intended actions include **reducing energy (22%)** and **sharing climate info (21%)**

Future Work

- Larger and more diverse sample size, and integrate a longitudinal follow-up survey
- Provide an opportunity for visitors to take climate action within exhibition space

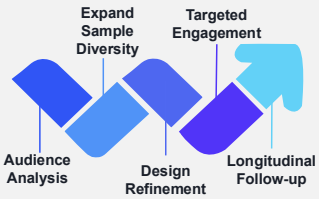

Figure 9. Future Recommendations Diagram

5 Conclusion

- This study provides evidence that climate art exhibitions significantly increase climate change knowledge and motivation across diverse audiences, thereby **supporting stronger funding proposals and strategic partnerships through measurable impact**
- Highlighting demographic differences and engagement barriers enables more inclusive climate communication approaches, **helping better reach under-engaged groups**
- Furthermore, this research supports the scalability of climate communication efforts in cultural institutions by **demonstrating the effectiveness of diverse media use, emotional engagement, and demographic-informed design**

6 References

1. Wijnen, Frances et al. "Evaluating the impact of climate communication activities by scientists: what is known and necessary?" *Geoscience Communication* 7, no. 2 (2024): 91-100.

This study has been reviewed for ethical compliance by the Lindenwood University Institutional Review Board.

Scan QR Code to View Digital Exhibit

CLARE CLIMATE ADAPTATION & RESILIENCE

UK International Development
Partnership | Progress | Prosperity

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Canada

The BASIN Project

BEHAVIOURAL ADAPTATION FOR WATER SECURITY AND INCLUSION

CLARE BASIN Webpage

Enhance capacity & knowledge of researchers, knowledge brokers, policy makers and practitioners to apply behavioural science for adaptation and water security

New conceptualisation of the role for behavioural science in inclusive adaptation

Join our Community of Practice on LinkedIn

Insight briefs and publications

UNU-INWEH Online practitioners courses hosted on the Water Learning Centre @ https://lc.unu.edu/

Students trained on behavioural science for adaptation

Behavioural science for water security training and seminar series

Codesign

Understanding the potential for behavioural science to enhance climate resilience and inclusion

Research Questions

1. What individual and structural determinants influence sustained engagement of community water 'champions/Mashahidi/relays', and how can these be targeted to enhance adaptation outcomes?
2. How do you enhance uptake of community produced water-climate information by national authorities from basin authorities for adaptation planning?
3. What behavioural levers could be used to influence a) the response of local officials to communities' water security and adaptation needs, and b) the accountability of national level decision makers to water and climate related policies?
4. How can uptake and use of climate information be enhanced at community level?
5. What determines adoption of adaptation behaviours by community members, and what behavioural levers might influence these?
6. How can organisational adaptation to climate change be enhanced in development NGOs in the water sector of the Global South?

Method: Discover the problem, define the core challenge, develop, test and deliver solutions

Applied and inclusive adaptation action

Case studies

Understanding and leveraging community behaviours around irrigation practices and innovation in irrigation technologies, in Kondoa and Mbuguni, with Nelson Mandela African Institute of Science and Technology, to enhance climate-resilience in agriculture and health through groundwater resource management — RQ4 RQ5

Specifying and targeting the barriers and enablers to diverse behaviours behind damaging watershed practices around Lake Basotu, Manyara region, with WaterAid Tanzania, to improve water safety for local communities and greater water security and a healthier environment

Tackling barriers to the long-term sustained engagement and retention of water 'champions' (volunteers) in Sangara, Babati District, to support them to better conduct education, advocacy and monitoring on water security and climate resilience practices within their communities, in order to strengthen locally-led community climate resilience and water security — RQ1

Strengthening the long-term sustained engagement of community members and 'relais' volunteers with community-based sustainable water resilience programming in Boromo and Koupela, with WaterAid Burkina Faso, to better monitor local water and climate indicators for enhanced community-level planning and water resource allocation and to bring locally monitored data into higher-level monitoring systems — RQ1 RQ4

Facilitating perspectives and behaviours that underpin the integration of basin-level water and climate information into national-level climate information services, with WaterAid Burkina Faso, to strengthen climate information provision and robustness to provide better climate, weather and early warning information across Burkina Faso — RQ2

Identifying and tackling behavioural barriers to budgetary allocation, proactive planning, and cross-ministry coordination for flood and drought preparedness within national and local-level institutions and Ministries in Malawi and Tanzania, with Water Witness International and Shahidi wa Maji, to unlock deeper political action and accountability on national water security and climate resilience — RQ3

Determining barriers to the long-term sustained engagement of community 'mashahidi' (volunteers) to enhance community water security leadership and grassroots advocacy in Tanzania and Malawi, with Water Witness International, Shahidi wa Maji, and University of Malawi, to build local resilience and hold authorities to account in providing water services and climate change preparedness — RQ1 RQ4

Enhancing climate resilience through organisational changes within WaterAid International — RQ6

Cross-cutting: identifying pathways to enhance gender, equity and inclusion within water security and climate adaptation through behavioural science

WaterAid · Water Witness International · Shahidi wa Maji · UNU INWEH · KULIMA · LSE

Grantham Research Institute on Climate Change and the Environment

General inquiries: gri.basin@lse.ac.uk

Breaking the Climate Deadlock: Understanding Barriers and Enablers to bridge the Ambition-Action Gap

Colina-Calvo, Aaron Omar
The National University of Engineering (UNI)

INTRODUCTION

The persistent gap between ambitious climate commitments and the policies and actions required to achieve them, the ***"ambition-action-gap"***, presents one of the most pressing challenges in global climate governance.

Global climate governance today faces a well-recognised **"ambition-action gap"**, a disconnect between lofty climate goals and the on-the-ground policies and measures needed to achieve them.

Fig 1 Climate Ambition-Action Gap

In other words, many nations' climate ambitions (e.g., net-zero targets or NDCs) exceed the actual policy actions currently in place, and this shortfall puts the world off track from meeting temperature goals.

Scholarly literature highlights a complex web of barriers, including institutional, economic, political, and social, that hinder the translation of climate goals into practical action.

Globally, frameworks underscore that climate outcomes depend not only on having the right technology but also on supportive conditions across society and governance.

Bold pledges stall without delivery. What blocks and what unlocks action?

UK: Ambition ------→ 600K heat pumps installed per year.
Action ---------→ 60k installed in 2024.

Peru: Ambition ------→ 20% of RER by 2030
Action ---------→ 6 % in 2024.

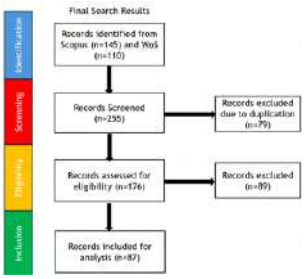
OBJECTIVES

This study offers a systematic examination of the institutional, economic, political, and social factors that either hinder or enable the translation of climate ambition into tangible outcomes, with a particular focus on the clean energy transition.

To determine which subthemes are the most persistent within the dimension identified in the literature.

METHODOLOGY

Fig 2 PRISMA Methodology

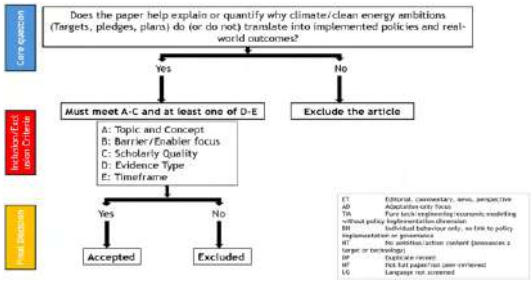


This study employs a systematic literature review. We began by systematically searching major academic databases (Scopus and WoS) for peer-reviewed literature on climate policy ambition, implementation gaps, and clean energy transitions.

Additionally, a set of keywords was considered (climate policy, energy transition, ambition gap, implementation, barriers, and enablers) to capture relevant studies.

TITLE-ABS-KEY (("climate policy" OR "climate action" OR "climate mitigation" OR "clean energy") AND (ambition OR pledge* OR "net zero" OR target* OR commitment* OR goal*) AND (implement* OR "policy implementation" OR action* OR outcome* OR performance) AND (gap OR "implementation gap" OR "ambition action" OR "ambition-action" OR shortfall* OR disparity*) AND (barrier* OR obstacle* OR constrain* OR challenge* OR enabler* OR driver* OR facilitator* OR success* OR failure*) AND ("energy transition" OR "clean energy transition" OR decarbon* OR "renewable energy" OR low-carbon)) AND (DOCTYPE (ar) OR DOCTYPE (re)) AND (LANGUAGE (english)) AND (PUBYEAR > 2012 AND PUBYEAR < 2026)*

This process was documented in accordance with PRISMA guidelines (Fig. 2) to ensure replicability. The collected literature spans roughly the last two decades, capturing both early analyses post-Kyoto and recent findings up to 2025.

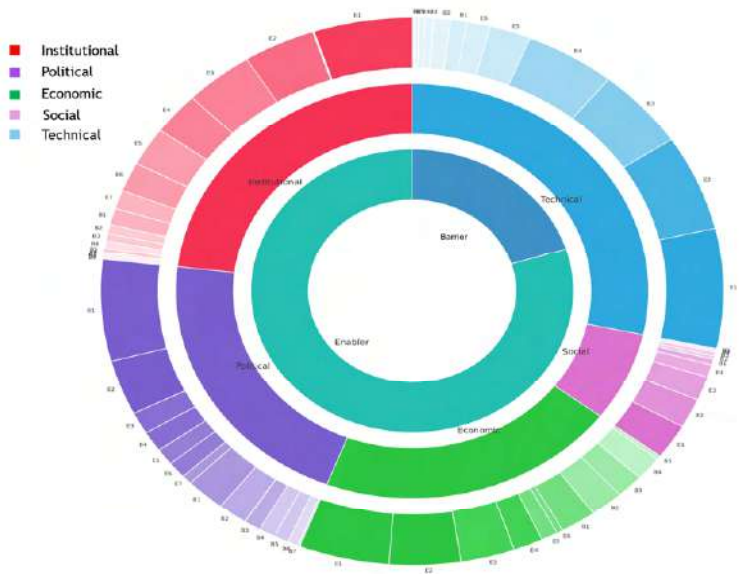


A "Triple CAAG Wheel" is constructed after identifying enablers and barriers (Fig. 3). The outer slice width equals the frequency of each subtheme in the analysis, rather than the effect size. Enablers are labelled with short codes by the letter "E", and barriers are characterised by the letter "B.

RESULTS

- E Strategic planning & targets
  Governance & coordination
- B Weak implementation & enforcement capacity
  Lack of coordination (multi-level/vertical/horizontal)
- E Policy ambition & stability
  International cooperation & geopolitics
- B Public accountability & participation
  Decentralisation
- E Supply chains, trade & investment
  Financing availability & cost of capital
- B Incentives, taxes & carbon pricing
  Affordability & distributional effects

Fig 3 CAAG wheel



- E Equity, justice & inclusion
  Awareness, education & capacity
- B Community engagement
  Community engagement & co-production
  Behaviour & lifestyle change
- E Equity, justice & inclusion
  Awareness, education & capacity
- B Community engagement & co-production
  Behaviour & lifestyle change

LIMITATIONS

Counts measure frequency, not effect size.

Evidence base may be regionally skewed.

CONCLUSIONS

The climate ambition-action gap is essentially an execution gap.

Stability beats novelty; however, finance follows it. Cost of capital is fundamental. The grid is the binding physical constraint.

Social license is an engineering requirement, not a "nice to have".

Several subthemes are the primary focus and carry most of the significance.

Fig 4 Enablers and barriers dimensions share

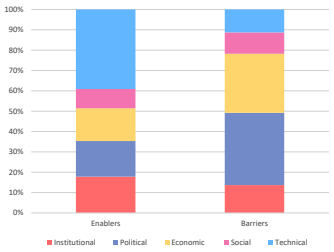
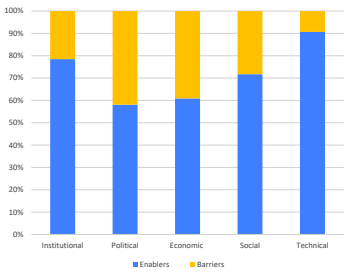


Fig 5 Enablers and barriers detailed by dimension



ACKNOWLEDGEMENT

This work was subsidised by **CONCYTEC** through **PROCIENCIA Programme** under the framework of the contest "Scholarships in education doctorate programmes through inter-institutional partnerships", according to contract PE501094384-2024, and the Interinstitutional Alliances Context for Doctoral Programmes, according to contract PE501084296-PROCIENCIA-BM.

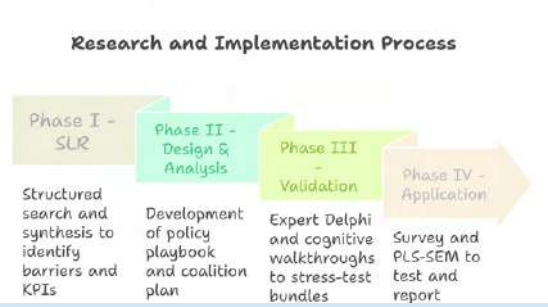
From Collaboration to Tangible Sustainability in Manufacturing SMEs: A Barrier–Lever Playbook and A Coalition Activation Plan

Author: Abdulsalam Alotaibi, (PhD researcher) at NBS-UEA, abdulsalam.alotaibi@uea.ac.uk

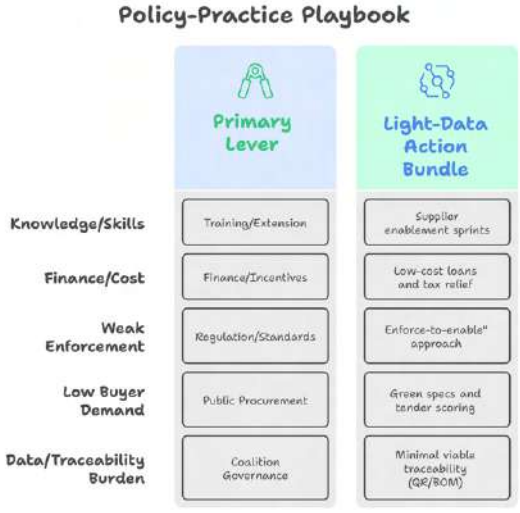
Aim & Rationale

This research aims to show how collaboration with external stakeholders translates into sustainability performance through SSCM and dynamic capabilities, and converts SLR insights into an actionable playbook and a coalition plan.

Study Phases



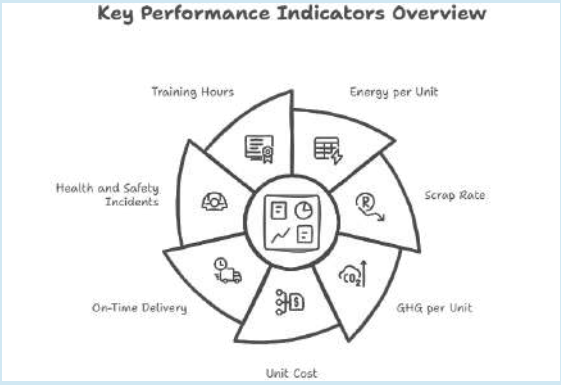
Policy–Practice



Coalition Plan

Contributions

- Theoretical: operationalises EC→SSCM→DC→SP, clarifying the mediating roles of practices and capabilities and specifying concise, testable linkages.
- Practical: Playbook + Coalition Kanban with minimal data burden (≤5 KPIs), clear actor responsibilities, and sequenced steps from diagnose to enable to scale.
- Policy: “enforce-to-enable” regulation—grace periods, templated compliance, light audits—paired with green procurement prompts and weighted tender scoring.

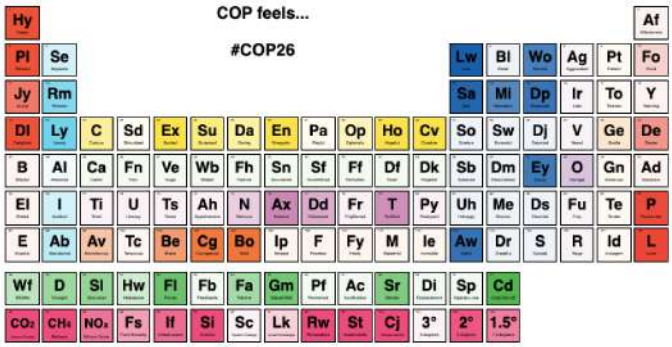


UNDER THE CLOUDS

Aidan Moesby: climate change and mental health at the intersection of Art, Digital and Disability within a weather-based metalogue

My research stems from the notion of emotional meteorology. This uses the metaphor of weather forecasting and weather systems to mediate our internal emotional worlds. Our emotional responses are affected by how we engage with, and our relationship to, the external world - including the climate crisis. My work is not about informing or educating, it is designed to illicit emotional responses. My approach is to embrace those who are often overlooked or excluded from the climate crisis discourse.

Under the Clouds explores the potential of the 'art object' within a holding and containing setting, providing the conditions in which resolution and integration on a psychological level can occur. The potential exists for 'psychological work' to be done relating to uncomfortable emotions resulting from climate change. Creating art that explores the climate crisis through the lens of emotional weather enables me to reflect upon the impact and potential for psychological work to be done by the viewer. For example, the collective oneiric experience of watching a personal theatre performance as opposed to an interactive installation at a climate conference are very different emotional and aesthetic experiences. Creating the same work in different formats enables the viewer to be the co-constructor of their own experience.



Sagacity: The Periodic Table of Emotions (COP26), (Digital interactive Installation) was adapted for COP26 in Glasgow from my original 'emotional barometer'. A visualisation of peoples concerns and feelings during Glasgow COP 26.

I can feel the changing of the seasons (Detail) (2021 Moving image, text, wellingtons. MAC Birmingham commission). A moving image work of children's wellingtons being inundated by the incoming tide. Projected on to a small screen framed by Ash wood which had been burnt to preserve it.

ART
Climate change art can educate, inform, entertain, provoke and shock. It can also be a call to action and mitigate feeling overwhelmed (paralysed or alienated).

Emotional Weather (2023, Neon. Lumiere Durham, The UK biennale of Light). Placed at points of arrival and departure, the neons reflected every day - seemingly mundane – travel, as well as more emotional events such as weddings, births and deaths. Underpinning the work is the relationship between climate change and wellbeing, particularly how the 'well you' can keep the 'unwell you' safe.

MENTAL HEALTH
Natural disasters precipitated by climate change can cause, or exacerbate, poor mental health. Psychological impacts associated with climate anxiety include panic attacks, insomnia, and obsessive thinking often with feelings of grief, sadness, loneliness and loss.

I was Naked, Smelling of Rain. (2022 Performance 50 minutes) A solo performance exploring mental health, emotional weather and climate crisis in a cultural context.

DISABILITY
Disabled people are disproportionately impacted by climate change. For example, heatwaves can impact those with breathing difficulties as warm air holds more particulates impacting lung function. In 2023, a blog on the World Bank website stated people with disabilities 'experience mortality rates up to four times higher in natural disasters than people without disabilities.[1]

1 World Bank Blogs. n.d. 'Climate Change Highlights the Need for Disability-Inclusive Adaptation'. Accessed 27 August 2025.

As curator, artist and researcher Aidan Moesby explores civic and personal wellbeing. His work is playful, intimate, questioning and deeply human and brings a nuanced approach to the emotional context of working with climate change. His work invites reflection on the often invisible but deeply felt intersections of technology, human experience and nature. Find out more through the QR code.

ACCELERATING LOCAL CLIMATE AMBITIONS IN UNFAVOURABLE CONTEXTS

ALFIE GAFFNEY[1,2]

a.gaffney@uea.ac.uk

1. BACKGROUND

- **Local authorities** are **increasingly expected to lead** on net zero delivery, **irrespective of their capacity** to do so.
- The vast majority of existing literature is based on **descriptive accounts of large, highly connected, and well-resourced cities**.
- Little is known about *how* ambitious climate policies take shape in local authorities operating in (relatively) **unfavourable, resource-constrained contexts**.
- Meanwhile, the **agency** of local climate policy actors in accelerating local climate action is also underexplored.

2. THE CASE OF BLACKPOOL, METHOD & THEORY

- Least-likely crucial case study: **Blackpool Council**, a local authority operating in an **unfavourable policy context** that **produced a high-quality climate action plan** in 2021 (see table 1).
- Analysed **35 local climate policy documents** & **9 elite/expert interview transcripts** to examine *who* and *what* shaped local climate action planning processes.
- Probed a theoretical framework of ***motives***, ***strategies***, **and** ***effects*** **to examine local climate policy actors** as potential policy entrepreneurs. Defined policy entrepreneurship as a **specific pattern of agency** adopted by a policy actor to promote new ideas and policy innovation as they seek to navigate a specific policy context and achieve their objectives.

Table 1: Blackpool Borough Council: an unlikely pioneer?

Spending power (2021)	Bottom 20%
Socio-economic deprivation (2019)	Top 10%
Political control (2021)	Labour minority
Climate action plan quality (2021)	Top 30%

Please note: (1) percentile scores are relative to other single-tier local authorities only; (2) Between 2015 and 2019 Blackpool Council was under Labour majority control.

3. SUMMARY OF FINDINGS

MOTIVES

Local inter-party consensus & political will for climate action

Perceived climate injustice

Post-industrial place-based revitalisation

STRATEGIES

Ideational agency: climate action framed by several actors as a justice issue *and* route to economic growth.

Embraced different 'ways of knowing' climate action & identified climate action plan as a viable 'boundary object' to articulate an ambitious vision

EFFECTS

Created high-quality climate action plan in a timely, effective & innovative way.

Wider normative & governance effects: climate action legitimised & institutionalised.

4. CONCLUSIONS & FUTURE RESEARCH DIRECTIONS

- While 'lone wolf' explanations – centred around heroic individual actors that favour pet policy solutions – might resonate in favourable contexts, they have less resonance in unfavourable contexts where the complementary actions of a collective of local climate policy actors is key.
- More research is required to explore the extent to which local climate policy entrepreneurship (1) can be cultivated; (2) shapes local climate ambitions across an even broader range of (un)favourable contexts; and (3) helps close the gap between ambitious climate rhetoric and policy action.

Scan to read the paper!

Acknowledgements:

[1]School of Environmental Sciences & Tyndall Centre for Climate Change Research, Norwich Business Park, University of East Anglia, Norwich, NR4 7TJ, UK.

[2]Centre for Climate Change and Social Transformations (CAST), School of Environmental Sciences, Norwich Business Park, University of East Anglia, Norwich, NR4 7TJ, UK.

Spreading like a Wildfire:

The Importance of Outreach in Fire Management

Alice Hsu | School of Environmental Sciences, University of East Anglia

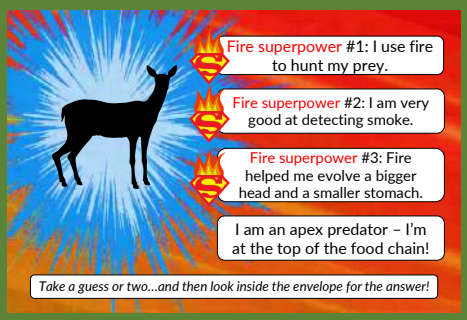
Fire is a wicked problem in many parts of the world.

Mitigating the harmful effects of **uncontrolled fire** requires effective **fire management**.

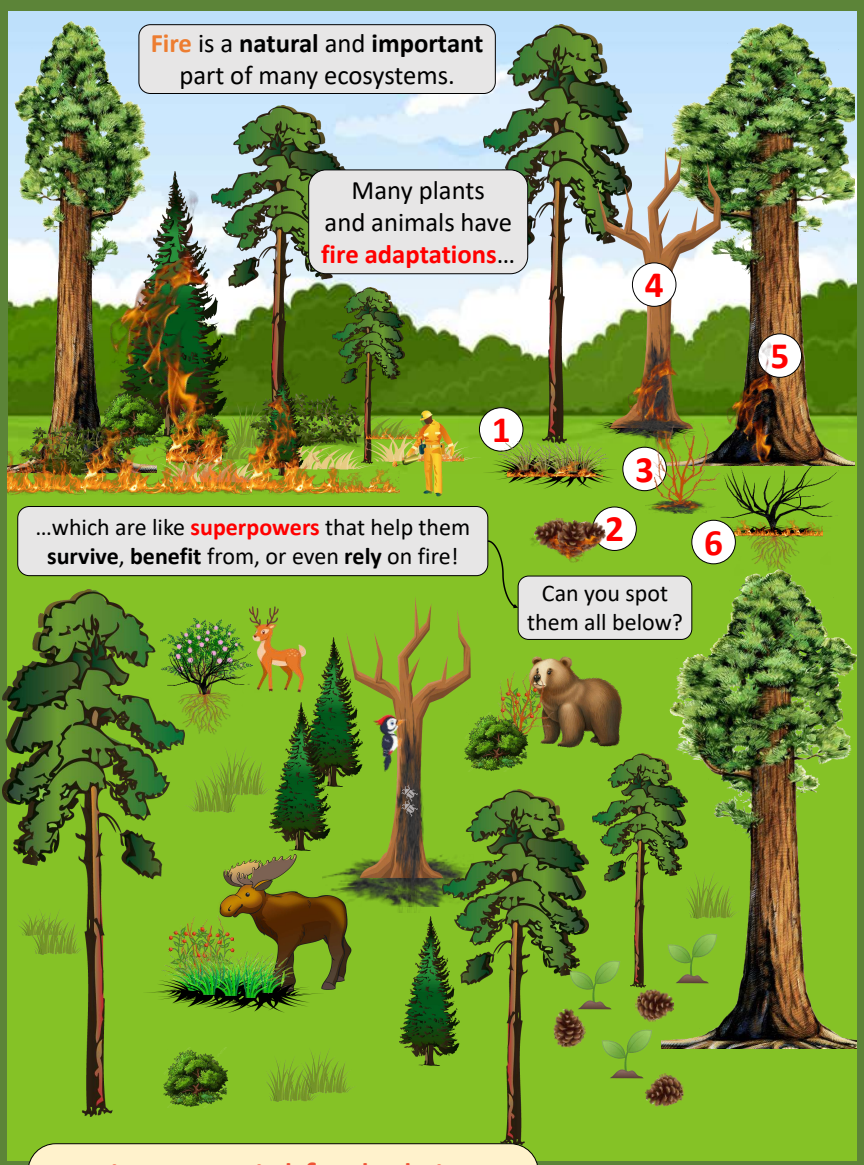
Effective fire management requires **public outreach and participation.**

Key message 1:
Fire is a **natural, inevitable, and important** part of many landscapes.

Key message 2:
Humans are a part of the landscape.



Hint: I am in the poster!



...is essential for helping people recognize their role in landscape management.

Dispelling the **nature-culture divide...**

Sample 1	Sample 2	Sample 3

Sometimes it's hard, being the world's biggest tree,
There's not a lot of us left, so huge, like me.
Can you believe I was once just a tiny seed,
Hatched from an egg-shaped cone, just 2-5 cm each?
My leaves, I'd say, are more like bristles than leaves,
And hang like fingers from all the branches of me.

Can you guess who I am?

Read me!

Predicting the determinants of Climate Change adaptation among Irish Farmers using Hierarchical Modelling

Ammara Batool[1], Daniel T. Burke[1,2], Maria Markiewicz-Keszycka[3], Elodie Ruelle[4], Paul Hynds[1]

[1] Environmental Sustainability & Health Institute, Technological University Dublin, Dublin, Ireland
[2] School of Business, Maynooth University, Maynooth, Co. Kildare, Ireland
[3] School of Agriculture and Food Science, University College Dublin, Belfield, Dublin, Ireland
[4] Teagasc Animal & Grassland Research and Innovation Centre, Moorepark, Fermony, Cork, Ireland

Background

- Climate change poses urgent risks to agriculture, food security, and rural well-being.
- In Ireland, farming communities are highly vulnerable to climatic shocks such as unseasonal rainfall, flooding, and drought.
- Farmer knowledge, attitudes, and practices (KAP), along with behavioural intentions, are as critical as technical and financial capacity for successful adaptation.
- Understanding how farmers perceive climate risks and translate knowledge into adaptive practices is essential for effective policy design.
- Policy frameworks (e.g., Climate Action Plan 2023, European Green Deal) emphasise the importance of enhancing climate resilience in agriculture.
- Behaviourally informed approaches can guide targeted interventions to improve adaptation uptake and support sustainable farming outcomes.

Objectives

- Classify farmers' adaptation orientations based on KAP and behavioural intentions
- Identify key predictors of adaptation using hierarchical logistic regression
- Understand drivers of farmers' adaptation behaviours
- Inform tailored, behaviourally grounded policy interventions

Information

- Contact Paul Hynds at: paul.hynds@tudublin.ie

Methodology

① Survey Design
- Cross-sectional survey
- Duration Oct 2024 – Feb 2025

② Data collection
- Sample 369 Irish Farmers
- Structured Questionnaire

③ Data Processing
- Coding of responses
- Categorisation of adaptation orientation (Positive, Negative, Neutral)

④ Statistical analysis
- Bivariate analysis
- Principal Component Analysis
- Hierarchical logistic regression model

Results

Table 1: Principal Component Analysis (PCA): a) Farmers' climate-related concerns regarding farm productivity and risks, and b) Farmers' recommended government support measures for climate adaptation.

Table 1 a)	Climate concerns			
	PC1	PC2	PC3	PC4
Farmers' concerns about the changing weather impacting their farms and productivity	**High Meat productivity**	**High Crop productivity**	**Less animal disease**	**High Financial productivity**
Concerned about finances	0.055	-0.052	0.037	0.897
Concerned about meat production	0.670	-0.222	0.051	0.149
Concerned about crop production	0.012	0.648	0.418	0.016
Concerned about animal diseases	0.125	0.016	-0.886	-0.038
b)	**Government support groups**			
	PC1	PC2	PC3	PC4
Farmers' recommended support from the government	**Repairing damage infra**	**Improve coastal resilience**	**Reduce GHG**	**Boost renewable energy investment**
Repairing damaged farm	0.769	0.151	-0.106	-0.435
Coastal Resilience	0.043	0.768	-0.383	0.010
GHG reduction	-0.058	-0.039	0.936	0.070
Renewable energy investment	0.019	0.067	0.062	0.948

Figure 1: Hierarchical Logistic Regression Results Explaining Farmers' Positive Adaptation Responses

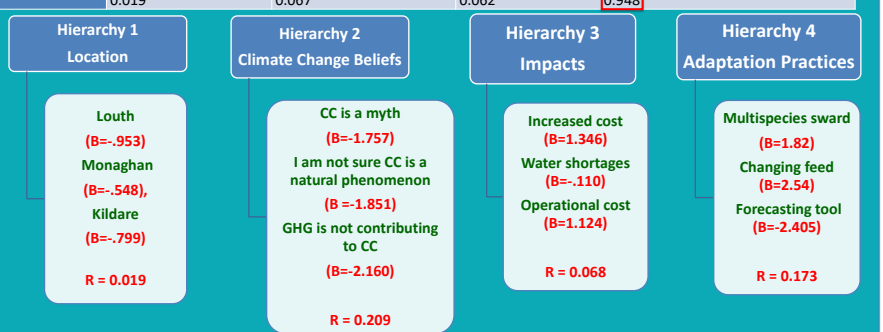


Figure 2: Hierarchical Logistic Regression Results Explaining Farmers' Negative Adaptation Responses

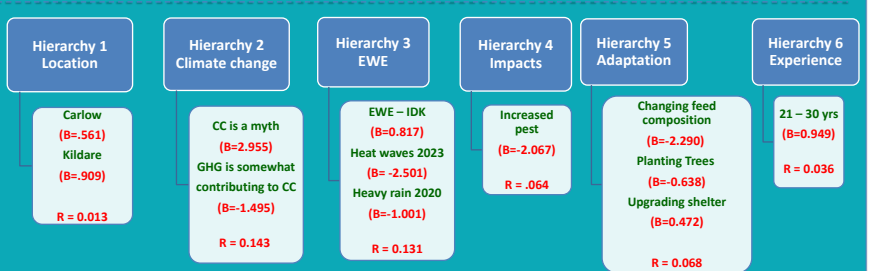
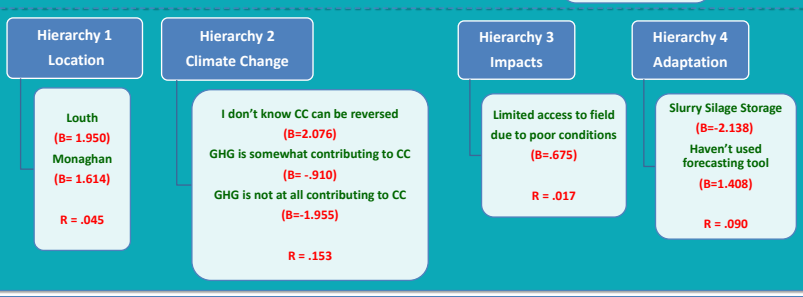


Figure 3: Hierarchical Logistic Regression Results Explaining Farmers' Neutral Adaptation Responses



Findings

Positive adaptation orientation
Location effects (Kildare, Louth, Monaghan) were associated with positive adaptation.
Rejecting climate change denial (acknowledging GHG role) predicted positive adaptation.
Impacts such as increased costs and operation costs drove adaptation.
Key adaptive practices: **multispecies sward** and **changing feed composition** increased positive orientation, while lack of forecasting reduced it.
KAP link: Stronger climate knowledge and adaptive practices translated into *proactive behavioural change*.

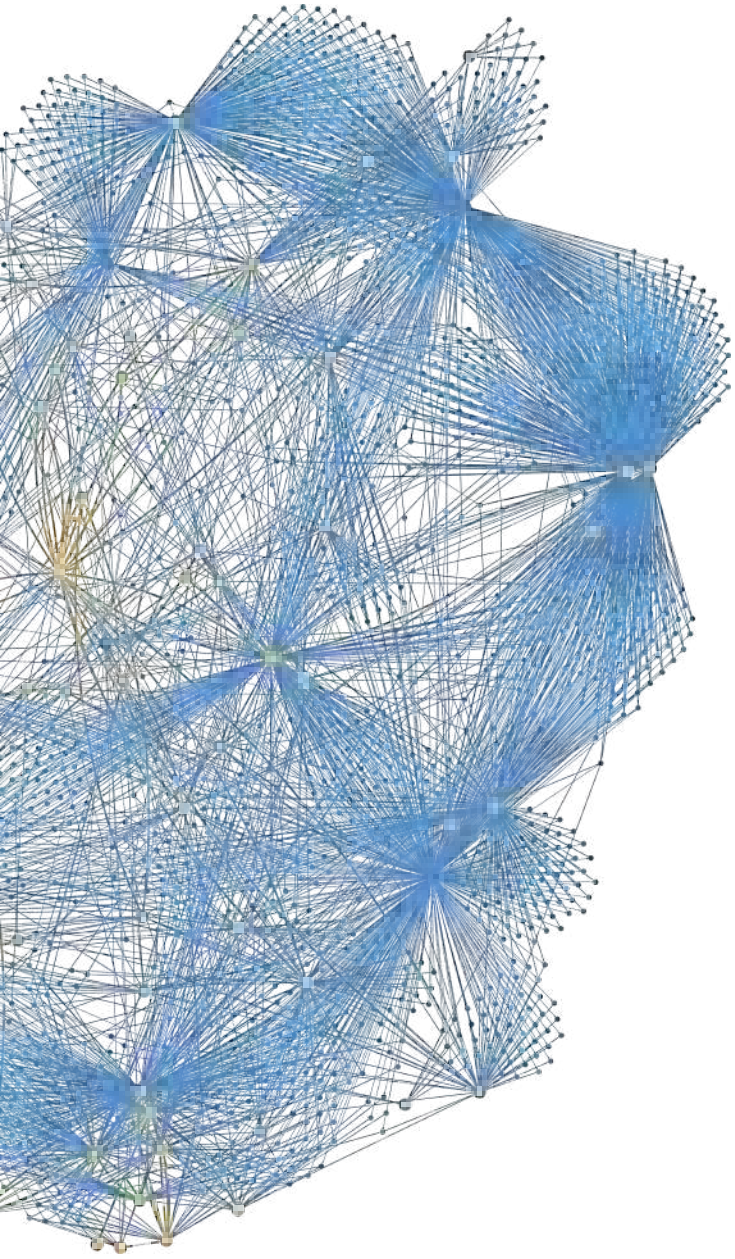
Negative adaptation orientation
Farmers from Carlow and Kildare showed higher odds of negative orientation.
Climate change denial (*"CC is a myth"*) strongly predicted negative adaptation.
Experience (21–30 years) was linked with negative orientation.
Extreme weather (heat waves, heavy rainfall) and pest concerns reduced adaptation
KAP link: Negative orientation associated with *knowledge gaps and resistant attitudes* towards climate change.

Neutral adaptation orientation
Location (Louth, Monaghan) significantly influenced neutral responses.
Beliefs such as *"I don't know if climate change can be reversed"* increased likelihood of neutrality.
Lack of forecasting tool use and slurry silage storage were key predictors.
KAP link: Limited knowledge and uncertainty about climate drivers reflected neutral behavioural responses.

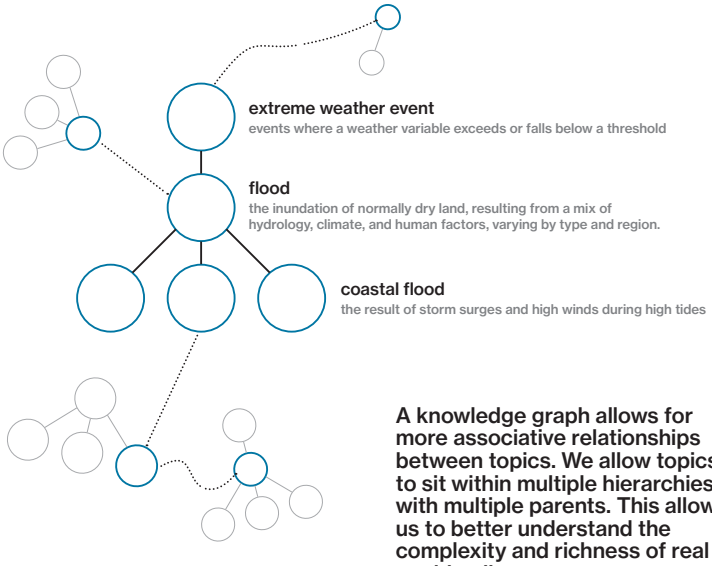
Making Sense of Global Climate Policy Using Knowledge Graphs

Climate Policy Radar

Arminel Lovell
Harrison Pim
Anne Sietsma

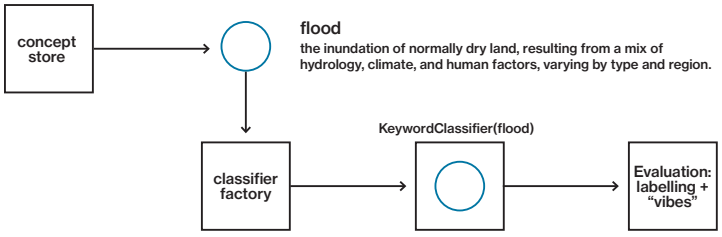


Our policy team builds ontologies, defining climate topics and their relationships, based on literature reviews and expert interviews. But hierarchies are limited. The policy world has multiple, messy perspectives which are not easily represented by a strict hierarchy.



A knowledge graph allows for more associative relationships between topics. We allow topics to sit within multiple hierarchies with multiple parents. This allows us to better understand the complexity and richness of real world policy.

We build and evaluate classifiers for key topics so we can find them in our documents. Even 70 classifiers across 10 documents already gets messy. And we have over 1500 topics with thousands of documents...



Climate Policy Radar is a non-profit organisation building open databases and research tools so people can discover and understand complex information, in particular long-text documents, on climate, nature and development. Our data and tools help governments, researchers, international organisations, civil society, and the private sector to understand and advance effective climate policies and deploy climate finance. Harnessing data science and AI, and pioneering the application of natural language processing to this domain, our work renders previously unstructured, siloed data more readable and accessible.

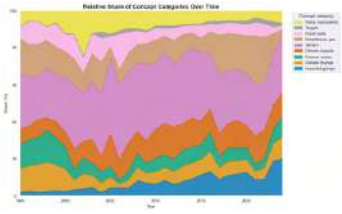
Coming soon
New topics: fossil fuels, renewables, just transition, adaptation, climate finance
New documents: litigation

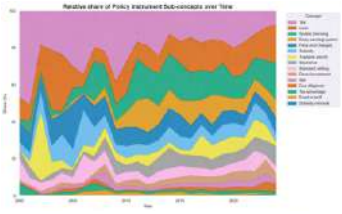
Our App:

Wikibase:

Hugging Face:

One thing we can then do is pull out the high-level classifiers and see how topics gain prominence in the discourse over time. In the graphs below, the spike in policy instruments, for example, is notable. Because of the hierarchical nature of the graph, we can zoom in easily: let's look at policy instruments. Around the time of the Kyoto Clean Development Mechanism, there was a big discussion on tradable permits.





The impact of occupant behaviour on energy demand in UK buildings: A systematic review

Assia Chadly[1], Maria Sharmina[1], Mohamed Abadi[2]

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Introduction

40% of the total energy consumed

40% of the total carbon emissions

Fig.1: Buildings' contribution to energy consumption and carbon emissions

- Buildings are responsible for high energy consumption and emissions (See Fig.1), making them a critical focus to improve energy efficiency.
- To enhance energy efficiency in buildings, it is crucial to understand the different energy consumption patterns by generating accurate energy demand forecasts
- The complex and nonlinear interactions between different factors, including occupants' behaviour, building design and components, and social practices, make the prediction and optimization of energy in buildings challenging.
- Understanding occupant behaviour can help understand inconsistencies in domestic energy demand, and understanding the societal structures, norms, and routines of individuals can help uncover the source of common habits among people.

Aim and Objectives

The aim of this SLR is to unpack the interplay between energy demand in buildings, machine learning, behavioural interventions, and social practices. It explores how these components intersect by examining how behavioural interventions and social practice theory contribute to a better understanding of domestic energy demand, and how machine learning can accurately predict it.

Considering those aspects, this SLR has the following objectives:

- To evaluate the different machine learning techniques used to predict energy demand in buildings
- To identify the different behavioural interventions or social practices that influence energy demand in buildings
- To list the key challenges and opportunities of combining machine learning with social practice theory to reduce energy demand within the built environment.

Methods

- A systematic literature review based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methods was conducted (Page et al., 2021).
- The sample was collected based on three specific aspects: energy demand in buildings, social sciences, and behavioural interventions, and it contained records until February 2025. See Fig. 2 for the methodology followed.
- The final sample size contained **95** eligible articles.

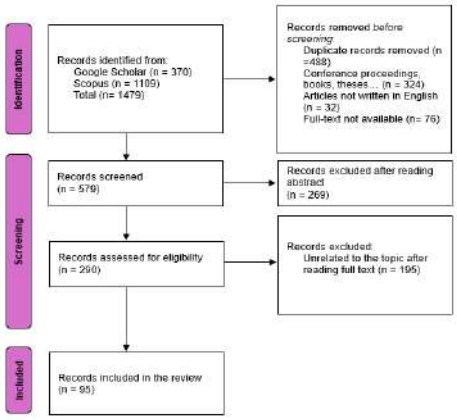


Fig. 2: PRISMA flow diagram reporting the number of articles identified, screened, and included in the study

Results and Discussion

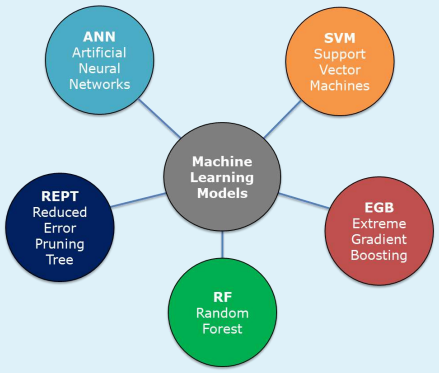


Fig.3: The different Machine Learning models used for building energy forecasting

- Different machine learning models are used to predict energy demand in buildings with high accuracy (See Fig. 3). Yet, there is still a difference between the actual and the predicted energy consumption due to the impact of occupant behaviour.
- Occupants' behaviour in residential energy consumption falls into six categories: production of heat, lighting and solar shading, HVAC usage and setpoint temperatures, hot water usage, appliances usage, and window opening (Delzendeh et al., 2017)
- There is also a set of social practices, ranging from social norms to the normal daily activities, such as cooking or watching TV, that influence energy demand in buildings.
- There are different barriers to behavioural interventions that cause occupants to consume more energy despite the implementation of the interventions (See Fig. 4):
  - People resist change by nature, making them reluctant to invest in energy-saving measures, although well aware of them and their implications
  - Monetary and financial incentives are not enough to influence people and encourage them to spend energy more sustainably.

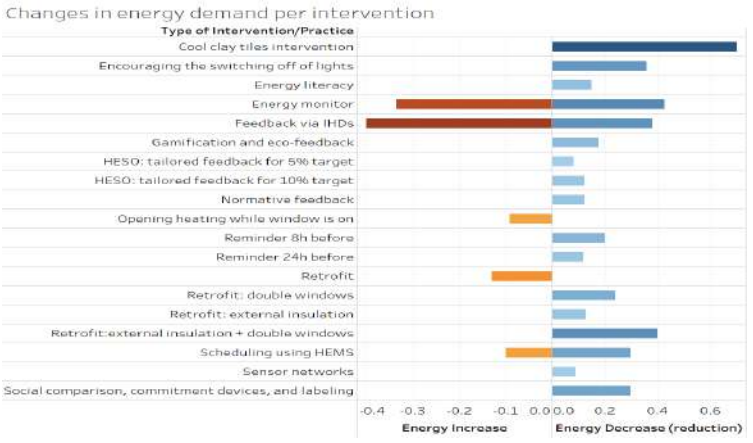


Fig.4: Impact of interventions on energy demand

Conclusion

95 articles were reviewed to better understand building energy demand, how machine learning can accurately predict it, and how occupant behaviour influences it. The existing **challenges** to incorporating occupant behaviour in machine learning models are:

- ML models still don't fully capture the effect of occupant behaviour
- Occupant behaviour is still not totally studied in literature since it is still considered "fixed" or "scheduled"
- There is a lack of follow-up after the intervention are implemented

Therefore, the following **opportunities** are presented:

- Including socio-physical, social, and psychological factors, as well as the different domestic activities in ML models
- Investigating the impact of building and household characteristics
- Designing interventions based on social practices, and assessing their long-term impacts

References

Delzendeh, E., Wu, S., Lee, A., & Zhou, Y. (2017). The impact of occupants' behaviours on building energy analysis: A research review. Renewable and Sustainable Energy Reviews, 80, 1061–1071. https://doi.org/10.1016/J.RSER.2017.05.264

Page, M. J. et al. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*, n71. https://doi.org/10.1136/bmj.n71

The Roles of Culture and Creative Dialogue in Lifting Barriers and Enabling Climate Action

BRIDGET McKENZIE

QR Code to access this poster online

ABSTRACT

There is an emerging body of research and experimental practice on Culture-led public engagement aiming to activate people in response to climate change. There is also a range of outputs - such as exhibitions, courses, books, films, art-science and community projects - on climate issues. These outputs are arising dynamically rather than as a result of goal-driven strategy, quality standards or targeted funding, which correlates to a lack of impact evaluation, practitioner training or consensus on quality practice. Practitioners in Arts, Heritage and Communications who engage the public on climate face challenges such as apathy, disinformation, managerial resistance, limited perceptions of climate engagement, and short-term funding. These barriers prevent them from fulfilling their potential to develop engagement that might activate publics at scale, or to create transitions in institutions, governments or professional sectors. However, Culture-led practice affords opportunities for creative, interdisciplinary and dialogic participation, which could be supported to have greater impacts for truth-telling, community safety and systemic change.

In 2019, I founded both Climate Museum UK and Culture Declares Emergency, practitioner communities that aim to overcome these challenges and realise these possibilities of engagement for public activation. I have developed a range of conceptual frameworks and practical methods for artists, curators and educators to learn together about environmental issues and collaborate to deliver more impactful and trauma-sensitive programmes in their communities. I convey these through training and resources for Culture Declares Emergency and Climate Museum UK.
This work has provided insights into the professional development needs of Cultural and public engagement practitioners, which I summarise in my conclusion.

1 THE REALMS, POTENTIAL & BARRIERS OF CULTURAL PRACTICE FOR PUBLIC ENGAGEMENT WITH CLIMATE ACTION

THE REALMS OF CULTURAL PRACTICE

Discussions of Culture's value in this crisis typically limit their framing of its realms of practice to the **storytelling dimension of the Arts,** with hopes of an emotional punch to change behaviours.
These limited framings undermine Culture's value and exclude several realms from involvement, such as Intangible Heritage, creative forms of enquiry, or participatory conservation of the built environment.

THE BARRIERS FACED BY PRACTITIONERS & ORGANISATIONS

- Apathy and backlash in society against eco-action, manipulated by extractive lobbies.
- Lack of equipped readiness and risk awareness of impacts in civic & business sectors. They aren't setting examples by shifting mode of response.
- Funding is in silos and short-term.
- The UK Cultural defends its value based on pre-crisis framings of Culture.
- Culture sector is entangled with systems that promote or benefit from harm.
- Duties & standards focus on CO2 footprints in existing activity, not shifts to focus on truth, care & change. Power-holders resist radical approaches.
- Lack of diversity in the Cultural sector e.g. to voice experience of systemic injustice.
- Precarity for individual artists & low-paid sector workers.

THE POTENTIAL OF CULTURE TOWARDS A REGENERATIVE SYSTEM

The necessary response to the Earth Crisis is to deploy assets and expertise to help efforts:

- To shift framing of human-nature relations to create conditions that will restore carbon sinks & biodiversity
- To collaborate for community safety in face of impacts
- To transition to regenerative industry, agriculture and economy.

There is great potential for the Culture sector to contribute to this by leading:

- Active participatory dialogue with diverse voices
- Place-based engagement with heritage to stimulate stewardship
- Imagination of possible alternative futures.

2 EARTH TALK FRAMEWORK FOR CREATIVE DIALOGUE

Earth Talk is a course, a community of practice and a playbook that offers a rich set of 135+ tools that I have developed to hold effective conversations and creative activities about the Earth Crisis. These activities are designed to take people on an Earth Talk journey, an integrated response that includes the elements of:

- Sensing (embodied response, emotions, individual framings),
- Sense-making (investigating science, histories and systems)
- Meaning-making (exploring impacts and relevance for lives)
- Imagining (anticipating, dreaming futures, inventing)
- Activating (collaborating, movement-building, sustaining action).

The community of practice comprises over 50 people. I hope that this community will grow to support the leadership of practice described above. A small number of core tools are shared in this poster.

3 TOOLS TO HELP PUBLIC UNDERSTAND & ACT ON THE EARTH CRISIS

These are two of around 135 frameworks, slide-sets, games, workshop templates and other resources, which I have developed for use and adaptation by the Earth Talk & Climate Museum UK communities of practice.
These are examples of how we aim to broaden understanding of climate change, and how we emphasise potential actions available to people.

This model is part of a set to expand people's awareness of the causes, impacts and potential solutions of the Earth Crisis - or ecological overshoot.

This model is used in a workshop called People Take Action, providing information and inspiration to develop a plan for inner work and outward-facing actions (in eight pathways).

4 THREE PRINCIPLES OF CULTURAL ENVIRONMENTAL RESPONSIBILITY

There are three dimensions to Environmental Responsibility in the Cultural sector, currently not reflected in most organisations' sustainability policies:

FACING RESPONSIBILITY AND TELLING TRUTHS

Be part of a commitment to learn about the Crisis and to reduce harm, engaging with the public as part of this. e.g.

- Reflect on your past responsibilities and potential contributions
- Declare a climate & ecological emergency
- Make pledges to lighten your footprint in terms of CO2, biodiversity, pollution and social injustice
- Conversations & experiences to deepen learning
- Enable truth to power, from diverse perspectives
- Face uncertainty and possibilities of collapse.

CENTRING CARE AND TRANSFORMATIVE ADAPTATION

Anticipate and prepare for risks and impacts of environmental harms that are inevitable, in inclusive and caring ways. e.g.

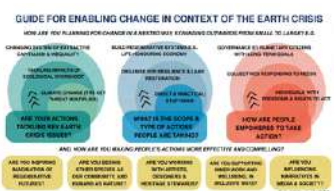
- Integrate a crisis-response frame into 'People Care' work, e.g. support resilience in face of losses
- Include environmental impacts in your risk assessments
- Anticipate primary & secondary impacts, and protect buildings, natural sites & cultural artefacts
- Make decisions for the future based on care for others, including future generations and more-than-humans.

CHANGE-MAKING FOR A REGENERATIVE SYSTEM

Be an agent for systemic change for the sake of all affected people, species and future generations. e.g.

- Decolonise: commit to ending practices that are exploitative & unjust, sensitive to 'trauma culture'.
- Help people imagine and build alternatives to extraction, to transition to regenerative industry, agriculture and economy.
- Promote eco-innovators & regenerative designers.
- Support programmes for mutual aid, reparations, peace, and restoration of the living world.
- Advocate for and partner with campaigns for changes to ecocidal laws, policies and practices.

This model suggests a dashboard for organisations to increase their adaptation & regeneration work



This model offers a guide for enabling change with a nested approach, expanding outwards from small to a larger systemic scale.

5 AREAS TO SUPPORT CULTURE SECTOR LEADERSHIP ON

BETTER KNOWN AREAS OF RESPONSE

Public Cultural sector & artists could be more involved, valued and funded in these areas, often led by commercial, academic or environmental sectors:

- Enhancement of public communication of environmental research e.g. through art & science collaborations.
- Experiences of wild green or blue spaces, combined with heritage conservation, adventure play or arts activities.
- Ecocentric architecture & landscape design that creates more regenerative and resilient places.
- Circular-economy enterprises: ecocentric design of products, materials, and systems of waste and production.
- Galvanisation of movements through group identification, graphic messaging, and artistic protest.
- Pro-environmental attitudinal and behavioural shifts are generated through powerful narratives e.g. in TV or games.
- Future world-building and democratic understanding through speculative participatory activities and game-play.

LESS WELL KNOWN AREAS OF RESPONSE

Public Cultural sector & artists could be supported to lead work in these areas:

- Support inner work integrated with challenging 'outer work' or activation.
- Play significant roles in regenerative place-making (not growth-driven 'regeneration').
- Help communities protect heritage from harmful development & climate impacts.
- Help people cope with the loss and collapse of thriving livelihoods, places and ecosystems.
- Enable imagination and planning for transformational adaptation.
- Culture-led uses of tech to enrich 'knowledge commons' for regenerative outcomes, enable dialogue vs misinformation, defend creativity, and create platforms for conservation.
- Improve physical skills and well-being as environmental impacts affect health.
- Change systems for food, energy or clothing for local sufficiency & global sustainability.
- Inspire imagination of visions of future lifeways and uncertain scenarios of the Earth Crisis.
- Support larger-scale, ambitious, systemic change e.g. champion the Ecocide Law.
- Cultural sites for activation e.g. for assemblies, eco-innovation labs, or artful rewilding of land.
- Decolonise institutions to resist the extractive economy and support community safety.
- Further critical discourse & systemic analysis, providing intellectual leadership and forums.
- Professional development of capacities to respond to and cope with the Earth Crisis.

BIOGRAPHY

Bridget McKenzie is a researcher, trainer and artist working to engage people with the Earth Crisis. Her career includes being Tate's Education Manager and the British Library's Head of Learning. In 2006, she founded Flow Associates, a research consultancy in cultural learning, through which she has carried out a large number of audience research, horizon-scanning and evaluation projects, on environmental and cultural learning. Since 2019, she has developed resources, training, collectives and campaigns that push at the radical edges of this field. This includes founding Climate Museum UK, a creative collective helping people make sense of environmental issues, and she runs training programmes such as 'Earth Talk' under this umbrella. She also co-founded Culture Declares, an international movement of cultural workers declaring a climate and ecological emergency. She experiments with creative activism in her local city of Norwich, UK, using visual arts, music, heritage interpretation and creative writing in participatory ways.

SELECTED PUBLICATIONS

- 'The Roles of Culture in Response to the Earth Crisis', self-published, 2024 https://tinyurl.com/yc7fsh96
- 'How can artful learning help young people in the context of the Earth crisis?', in 'Ecologies in Practice', Palgrave Macmillan, ed Miranda Matthews. 2025
- 'Collecting as emergency response to the Earth crisis', in 'Ethics of Contemporary Collecting', Routledge, eds Ellie Miles & Jen Kavanagh, 2024
- 'The Emergency is an Octopus! Museums activating the public in a planetary emergency', in 'Museums and the Climate Crisis', Routledge, Nick Merriman, 2023
- 'Case Study 8: Climate Museum UK: Practices in Response to the Traumasphere', in Toxic Heritage, Routledge, eds E. Kryder-Reid & Sarah May, 2023
- 'Time to Mend: rewilding museums', in Museums and Social Issues, Vol 16, 2022
- Museums in an Earth crisis: a conversation on museums, collecting and radical change', in 'Reimagining Museums for Climate Action', UCL, ed. Colin Sterling, 2021.

LINKS

https://bridgetmckenzie.uk/
https://climatemuseumuk.org/
https://www.culturedeclares.org/

Beyond techno-modernist interventions: Climate adaptation and water governance transformations in rural China

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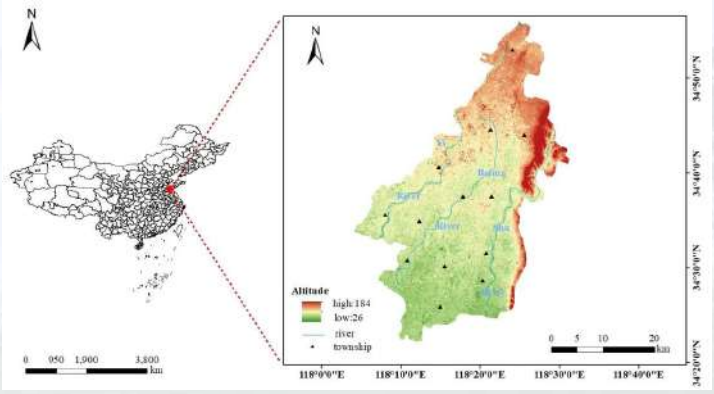
INTRODUCTION

Water is crucial for agricultural production. Climate change intensifies both successive droughts ("too little" water) and summer floods ("too much" water), profoundly impacting irrigation practices and agricultural livelihoods across rural China. While modernist-oriented, techno-centric state interventions aim to address climate challenges, their socio-institutional and environmental implications remain underexamined. This study adopts a climate-water-agriculture nexus lens to investigate how infrastructural and institutional development has reshaped grassroots water governance and resulted in uneven climate adaptation.

METHODS

I conducted nine months of fieldwork in a major grain-producing county in Shandong Province between 2023 and 2024. I facilitated 6 focus group discussions, conducted 51 semi-structured interviews as well as casual talks, and had several site visits for participant observations. I engaged with a range of stakeholders, including county and township government officials, village cadres, water companies, large producers, and smallholders.



➢ Map of the case study area

FINDINGS

While state-funded irrigation advancements help combat drought-induced water constraints, they have unintendedly:

1. recentralized government control of irrigation commons by marginalizing and bureaucratizing water user associations;
2. amplified competitive strengths between large producers and smallholders in access to water, with smallholders bearing higher irrigation costs and labor burdens during water scarcity;
3. inversely increased flood risks in poorly drained farmland due to land subsidence from excessive groundwater use.

In response, peasant households have developed climate-adaptive strategies to sustain agricultural livelihoods:

1. established informal well-drilling investment partnerships;
2. relied on individualized irrigation solutions: carrying water tanks and hand-pumping through diesel or gasoline engines;
3. altered and diversified crop patterns.

➢ The electromechanical well built by the governmental high-standard farmland project

➢ A female irrigator and her water tank

CONCLUSION

This study unpacks the dynamic interplay of climate change, agrarian transitions and water governance transformations, exploring the paradox of techno-modernist development interventions that exacerbate socio-ecological vulnerabilities and identifying barriers and enablers for grassroots climate resilience.

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A review of planned relocation costs

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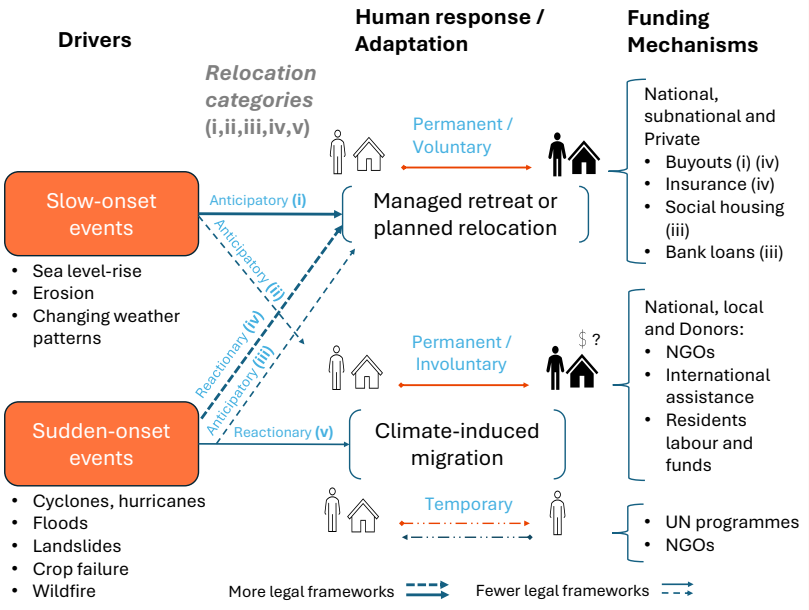
Adaptation to climate-induced hazards, including sea-level rise (SLR), is essential to reduce risk and enhance resilience. A broad array of coastal adaptation strategies include protection, accommodation, advance and retreat but choosing the most effective strategy requires careful analysis of their costs and benefits. Cost-benefit analyses (CBA) have become a common way to evaluate these adaptation options, aiming to identify the most economically efficient option. Managed retreat or planned relocation is the least understood and most complex to cost, given its multidimensional social, cultural and psychological impacts which standard economic models rarely capture. This study seeks to identify the main relocation costs from empirical cases and theoretical SLR models to better inform future adaptation assessments.

Objective & Methods

Understand relocation costs to inform coastal adaptation models to SLR using an extensive literature review. We identify the main relocation cost components and funding mechanisms. An analysis of the costs from relocation cases and those employed in theoretical SLR adaptation models is conducted.

Framework



Relocation cost components

Direct and tangible *(Market value)*	Financial	Loss of land House material Businesses Demolition Critical facilities Cultural heritage Natural restoration
Indirect and intangible *(Non-market value)*	Social	Traditions and cultural heritage Wellbeing Health Livelihoods Attractiveness Social networks Place attachment
	Environmental	Ecosystems/ Environment
Indirect and tangible *(Market value)*	Financial	Loss of productivity Disruption (e.g. healthcare, schooling) Planning, management, monitoring and legal Income

Relocation cases and associated costs

Categories	Example	Costs	GDP factor
(i) US Buyouts – Indigenous communities	Isle of Jean Charles - Lousiana (US)	• New land • House	6.5
(ii) Pacific Islands - Fiji and Solomon- and Artic villages	Vunidogoloa Village (Fiji)	• House • Labour	1.2
(iii) South America - Colombia, Argentina, Brazil – and Vietnan	Nueva Esperanza - Bogotá (Colombia)	• House • Habitat/land restauration • Productive activities	0.5
(iv) Europe, US, and Australia Buyouts	Eferdinger Becken – Danube River (Austria)	• New land • House	2.9

Theoretical SLR models and costs

SLR models	GDP factor	Costs	Authors
FUND	3		Tol (1995)
DIVA	3	• Land loss • Demolition	Lincke & Hinkel (2021) Ballesteros et al. (2025) Völz et al. (2025)
CIAM	1-10	• Land loss • Demolition	Diaz (2016) Rennert et al. (2022)
pyCIAM	8	• Land loss • Demolition • Social costs	Depsky et al. (2023)

Findings

This study demonstrates that planned relocation costs vary significantly across countries and regions, depending on local geographic and socio-economic conditions. Although limited documented information is available, it has been possible to assign a GDP factor per migrant for relocation. The models studied offer reasonable approximations when compared with costs derived from empirical cases. Relocation has significant social costs that are rarely included in CBA which new assessments should explore.

This work is funded by the CoCliCo Project (101003598) European Union's Horizon 2020 research and innovation programme

Quantifying global wildfire impacts to physical assets and population under hazard uncertainty

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[1]Institute for Environmental Decisions, ETH Zurich; [2]Federal Office of Meteorology and Climatology MeteoSwiss; [3]Department of Mathematics, ETH Zurich; [4]Department of Earth System Science, University of California Irvine, [5]School of Sciences and Engineering, Universidad del Rosario.

I. Motivation

- Wildfires increasingly impact **economies** (LA 2025)**, health (**Canada 2023), and **ecosystems** (Australia 2019–20).
- Insured wildfire losses are rising sharply: 70% of historical claims (1980–2020) concentrated in 2016–2020.[1]
- Yet, open-source global impact records show considerable reporting biases[2], e.g. only registering economic damages in the Global North (Fig. 1a,b) and wildfire risk remains an **"understudied area of global disaster risk assessment"**.[3]
- Satellite fire products offer a consistent global basis for fire impact assessment, but data suitability and **uncertainties must be analysed**.

II. Impact records vs. modelled exposed population and assets

We compare impact records (Fig. 1) to modelled exposure estimates (Fig. 2). The latter are computed with the open-source risk assessment platform CLIMADA[4], assuming

- Hazard: seasonal MODIS burned area fraction (March 2001 – February 2025), aggregated on 150arcsec
- Exposure: spatially explicit population and asset distribution (LitPop[5])

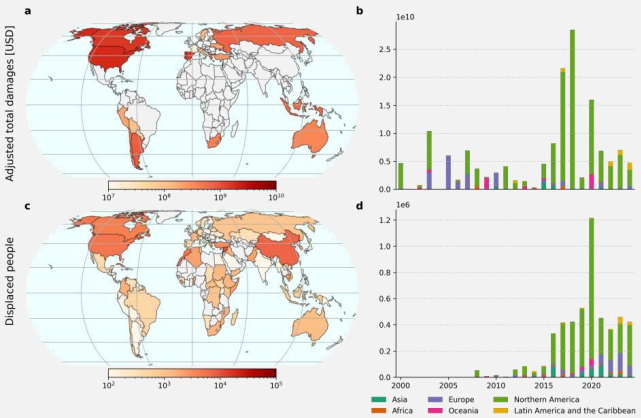

Figure 1 Global impact records: (a,b) Total adjusted economic damages from the Emergency Events Database EM-DAT[2] (2000-2024) and (c,d) registered displacements from the Internal Displacement Monitoring Center IDMC[6] (2008-2024).(a,c) Average impact per year per administrative region. (b,d) Time series of annual sum per continent.

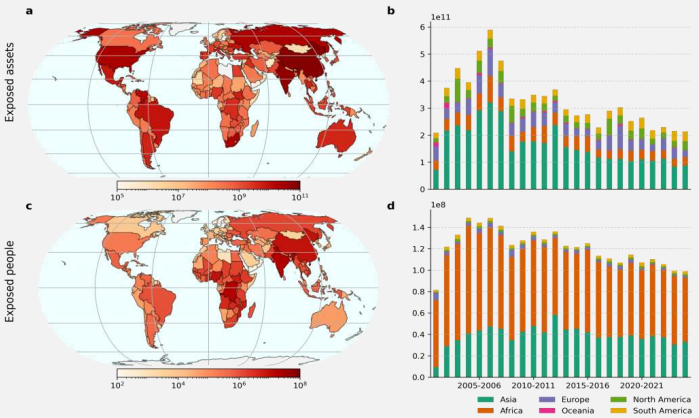

Figure 2 Modelled assets (a,b) and population (c,d) exposed to wildfires in the seasons 2001—02 to 2024–25 (Mar—Feb). (a,c) Average seasonal exposure per administrative region. (b,d) Time series of seasonal sum per continent. Exposure estimates are based on data generated for the State of Wildfire Report 2024-25.[7]

Results

- Exposure highest in Asia (assets, Fig. 2b) & Africa (people, Fig. 2d)
- Total global exposure declining (Fig. 2b,d)
- These patterns conflicts with impact records (Fig. 1)

Possible explanations

- Reporting biases[2]
- Hazard limits: agricultural fires included; missed urban fires; intensity/vulnerability unquantified (upper-bound estimate)
- Exposure limits: static exposure; underestimated values in the wildland-urban-interface and exceptionally high-value structures (e.g. Palisades during the LA fires[7])

III. Next steps: Alternative hazard sets and their effect on vulnerability estimates & impact uncertainties

We calibrate impact functions (vulnerabilities, mean damage ratios) using spatially explicit exposed assets/population and impact records.[8]

Preliminary results show that modelled global economic impacts based on burned area, fire line intensity (95th percentile in fire radiative power) and their intersection (BA ∩ FRP). show agreement within a factor of 2 (Fig. 3).

Next steps

- Including land cover information to exclude agricultural burnings
- Analysing regional differences between hazard sets

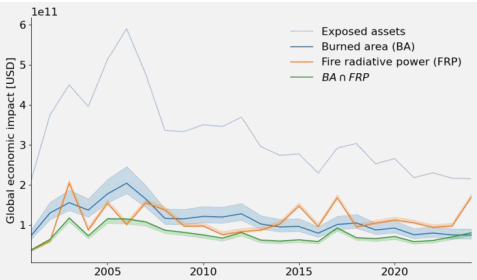

Figure 3 Time series of MODIS-based wildfire impact estimates using impact functions calibrated on EM-DAT economic damages and three hazard sets (Mar 2001–Feb 2025).

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DEVOLVED CLIMATE ACTION
THE CARBON AND CO-BENEFITS TOOL

MANCHESTER

- The Carbon and Co-Benefits Decision Support Tool was co-produced, piloted, and launched alongside a working group at GMCA in 2021
- The tool uses a focus on co-benefits to ensure carbon is a central part of decision making in every aspect of the Combined Authorities work
- The co-benefits included in the tool are:
  - Equalities
  - Health
  - Resilience
  - Housing
  - Adaptation
  - Mobility
  - Connectivity
  - Nature
  - Environment
  - Consumption
  - Production
  - Economy

ONLINE

- The Tool was adapted for online use in 2023 and since then ~75 authorities have accessed the tool
- It explicitly flags where trade-offs have to be considered, using colour-coding to drive commentary and iterative project improvements
- The Tool establishes transparency for the inclusion of climate action in decisions, enabling both external and internal scrutiny.
- Results form the Tool are made publicly available in decision forms and aim to explicitly place climate action at the same level of scrutiny as other statutory policy areas (e.g. Equalities)

WALES

- The Carbon and Co-Benefits Decision Support Tool was adapted for Wales in 2022-24 to include the seven goals included in the Well-Being of Future Generation Act (2015)
- It aims to decentralise the climate action agenda shifting requirements for action on all departments to consider their own roadmaps to reach organisational climate goals
- The use of co-benefits acknowledges the impact on and of carbon across the portfolio of the work at Welsh authorities and across other local authorities in the UK

LONDON

- The Carbon and Co-Benefits Tool was adapted and officially adopted by the GLA in 2023-24
- London is using the tool to understand how their Net-Zero plan can be achieved across individual teams and directorates.
- There wasn't a standardised vocabulary for climate action across the organisation, so the Tool enabled officers at the GLA to understand their own impacts and capacity for action, as well as creating an opening for integrated climate literacy training across the organisation

ONGOING CHALLENGES

Creating Hooks

Intervention in the decision making process necessitates the creation of some kind of 'hook' or decision point at which the tool can be used. Ideally this would be early in the process to guarantee maximum impact and enact change to project design.

Ensuring Oversight

There is a need to add capacity within the senior leadership, or as a new position/responsibility of the environment team to oversee and scrutinise use of the tool to ensure the thoroughness of responses is of a high standard to maximise tool impact

Transparent Assessments

Proposal leads understandably want to create a positive narrative to support their projects. It is important to create a culture of honest acknowledgement of trade-offs and impacts so these can be mitigated where possible, critically engaged with and monitored.

Tyndall Centre for Climate Change Research
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Enhancing climate education: CPD

Craig Robson[1] & Hannah Bloomfield[2]

Coming to terms with climate change and creating a more aware and resilient society requires greater education on the subject.

CPD is an effective option for those already in employment and moves beyond typical higher-education pathways which are unsuitable for the modern workforce.

We have developed and evaluated how to create effective asynchronous online CPD offers which facilitate accessible climate education, using existing university level courses as templates.

Two offers are now available.

Process and outcomes:

Informed through industry workshops, surveys.

Evaluative process:

- Taster: 1-week free course
- Pilot: full 8-week free course
- Full release

Evaluation with:

- Course attendees
- Creators
- Administrators

Explored:

- Learning needs, formats, length
- Workplace applicability
- Employer v individual requirements

Outcomes for preferred learning:

- Methods: reading, exploring, watching
- Format: Short chunks with mixed learning methods

Climate risks and resilience in a warming world

Details & to sign-up:

Average rating:

★★★★½

Based on diverse learners across 14 sectors

Digital skills for exploring climate data

Details & to register for pilot:

Full report and outputs expected summer 2026.

Contact us for more information.

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Investigating the benefits and challenges of co-locating BECCS supply chains in the NW of England

Diarmaid Clery, Abhilasha Fullonton, Muir Freer, Sarah Mander and Clair Gough.

The University of Manchester

Introduction

- Bioenergy with carbon capture and storage (BECCS) covers a range of technologies that utilise biomass to remove CO_2 from the atmosphere and store it, to mitigate climate change.
- The UK industrial clusters are currently implementing carbon capture and storage (CCS) networks that will be utilised by BECCS facilities. At the global level, the IPCC's AR6 report, estimates that a >50% of limiting global warming to 1.5°C would require 30-780 $GtCO_2$ removals from BECCS.
- This project examines the practical challenges and benefits of implementing a BECCS hub through an interdisciplinary lens.
- This builds on previous research on social licence to operate for industrial decarbonisation but further explores the BECCS supply chain including the logistical, policy, regulatory and community perspectives (Gough and Mander, 2022; Clery et al., 2025).

Project aims

- What are the logistical implications of deploying multiple BECCS supply chains at a single location in the UK?
- What are the impacts of regulatory and policy environments on the deployment of BECCS supply chains?
- How do local community representatives perceive the governance and deployment of BECCS supply chains in the Northwest region?
- What are the implications of co-deployment within BECCS hubs to embedding BECCS within the UK's net-zero framework?

BECCS supply chain variants

- The project provides a detailed assessment of 5 prospective supply chains (Figure 1) co-located in NW England.
- The supply chains connect to the CCS infrastructure planned within the UK Cluster Sequencing Process.
- The supply chains all exploit local feedstocks using waste and residues to generate a variety of energy vectors.

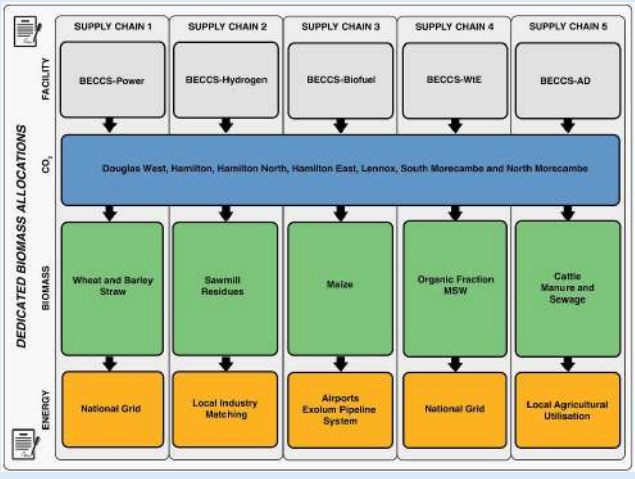

Figure 1. Schematic overview of the 5 prospective BECCS supply chains used in the study (Freer et al., 2024).

Methodology

- Through the integration of three assessment methodologies (Figure 2), this study provides comprehensive understanding of the challenges and opportunities associated with supply chains for various types of BECCS.

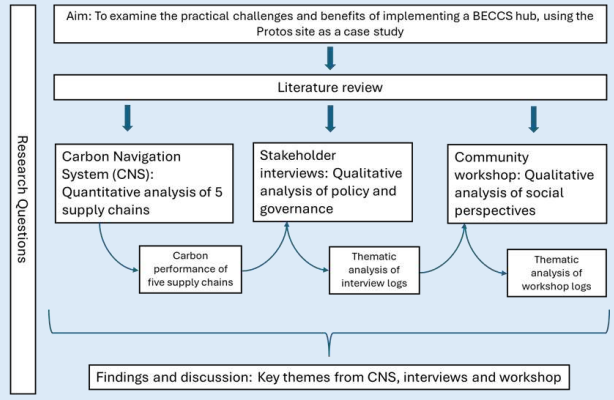

Figure 2. Research framework for the interdisciplinary approach taken to assess the practical challenges and benefits facing co-located BECCS

Results

- Supply chain configuration is shaped by spatially constrained feedstock availability, with biomass competition potentially restricting the scale of CDR (Freer et al., 2024).
- Policy and regulatory assessments findings show that scale of biomass facility will dictate demand supply dynamics, long-term funding is uncertain specifically for smaller scale or alternative BECCS pathways.
- Community perspectives highlight trust gaps: concerns over perceived greenwashing, uneven distribution of benefits, and limited transparency in engagement efforts.

Conclusions

- BECCS implementation must navigate key tensions between technical feasibility and social acceptability.
- Feedstock flexibility would improve long term supply security as competition for biomass increases and availability is uncertain.
- The NW cluster illustrates both the potential and the barriers to BECCS deployment in the UK, offering lessons for scaling carbon removal technologies nationally and internationally.

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Tyndall Centre for Climate Change Research

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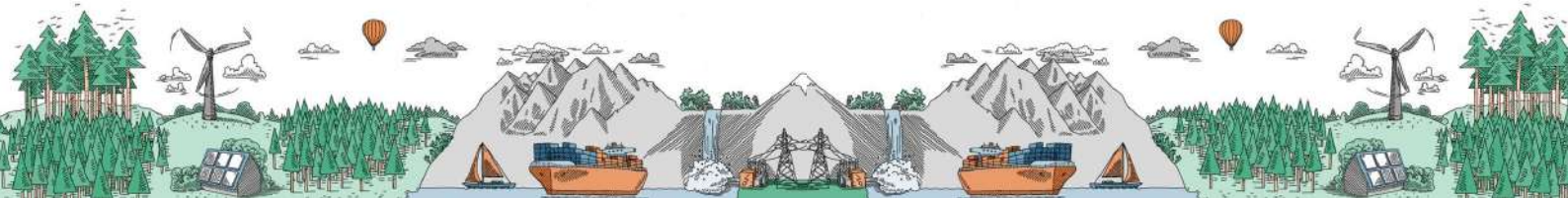

Meat eater identities: A Latent Profile Analysis to identify different types of meat-eater

Emelie Chard, Professor Wouter Poortinga, Dr Katharine Steentjes
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Centre for Climate Change and Social Transformations

Aims

- To identify distinct types of meat-eaters based on their motivations for food choices and meat consumption, using segmentation analysis
- To assess the differences between the different types of meat-eaters in terms of demographics, attitudes, and behaviours
- To develop a concise segmentation screening tool that can reliably identify the different types of meat-eaters

Background

- Most interventions for meat reduction use a "one size fits all" approach
- However, as shown in a prior qualitative study, individuals vary greatly in their reasonings for eating meat
- This study aimed to identify and understand different types of meat-eater using Latent Profile Analysis (LPA)
- This understanding could help to develop tailored interventions for meat reduction that focus on what is important to consumers

Group 1: Highly-attached meat-eaters — 22%

- 66% male
- M_{age} = 46
- Strong meat-eater identity
- Negative attitudes to meat-reducers
- View meat as necessary and natural

Group 2: Unengaged meat-eaters — 43%

- 47% male
- M_{age} = 48
- No strong scores on any variable
- Low scores for both ideological and practical reasons
- No strong attachment to meat
- Suggest meat consumption is more habitual

Group 3: Conscious reducers — 24%

- 39% male
- M_{age} = 49
- High environmental and animal welfare concerns
- Receptive to meat reduction
- More knowledge of meat-free cooking
- Strong negative meat-eater identity

Group 4: Tradition-driven consumers — 11%

- 48% male
- M_{age} = 39
- Strong impact of religion and culture
- Influenced by childhood diet
- Most ethnically diverse group

Table 2. Shortened segmentation screening questionnaire

Question
Please rate to what extent you agree or disagree that these reasons impact your own meat consumption.
It could be unnatural not to eat meat.
It is human nature to eat meat.
I want to be sure I get all of the vitamins and minerals I need.
It is in all of the best tasting food.
It has good flavour.
To what extent do you agree or disagree with the following statements
My diet is shaped by my religious beliefs
I would be willing to change my diet for religious reasons
I am not the type of person to become vegetarian
Eating meat is an important part of who I am
There is nothing morally wrong with farming animals for food
Reducing my meat intake would be too restrictive
A meat reduced diet would limit my choices too much
I get pleasure from eating meat-free meals
Eating less meat can help the environment.

Note. All questions scored on a scale from (1) Strongly disagree to (5) Strongly agree

Methods

- Survey with nationally representative UK sample (N=1,000) on Prolific
- Final sample of 871 participants after non-meat eaters excluded
  - N_{female} = 432; N_{male} = 432; M_{age}(SD) = 46.88 (15.58)
- Survey measured 39 variables identified from previous research and a prior qualitative study to influence food choices and meat consumption
  - Including items from the Food Choice Questionnaire (FCQ; Steptoe et al., 1995), the Motivations to Eat Meat Inventory (MEMI; Hopwood et al., 2021), the Schwartz values inventory (Schwartz; 1992), as well as new measures
- Analysis:
  1. Latent Profile Analysis (LPA) was used to identify whether there were distinct types of meat-eater
  2. ANOVAs to explore differences between types of meat-eater
  3. Discriminant function analyses and variable selection by random forest were used to identify the most important variables for assigning group membership

Table 1. Summary of group characteristics, relative to sample mean

	Group 1	Group 2	Group 3	Group 4
Meat-eater identity	++		--	
Religion on diet				++
Culture on diet				++
Environmental concern of meat consumption	--		+	
Animal welfare	+		-	
Attitudes to meat-reducers	++		--	
Meat-free cooking knowledge	+		-	
Pleasure in meat-free meals	--		+	
MEMI Natural	++		--	
MEMI Necessary	+		--	+
MEMI Normal			-	++
MEMI Nice	++		--	
FCQ Health				+
FCQ Price				
Time for cooking				
Perceived cost of meat-free diet	+		-	

Note. +/– = 0.5-1 SD above/below, ++/-- = >1 SD above/below

Conclusion

- LPA identified **four types of meat-eater** which vary in their reasons for meat consumption
- These groups differ in their **identity as meat-eaters, cultural background, and moral beliefs** (see Table 1), supporting the view that meat consumption is a complex behaviour and that a single intervention to reduce it is unlikely to resonate across all groups
- A **shortened 14-item segmentation screening tool** was developed (see Table 2), which assigns group membership with 86% accuracy. This tool enables researchers to identify distinct meat-eating groups using only a brief questionnaire
- The next study will **test the application of this segmentation screening tool**, by exploring whether these types of meat-eater vary in their responses to different messages for meat reduction

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Competing priorities, finite land: Can local government deliver?

Emily Cole, Robert Holland, Felix Eigenbrod, Rebecca Collins

ERGO ID: 100341

Background

Global climate and biodiversity targets drive national priorities that could potentially create competing demands on finite land

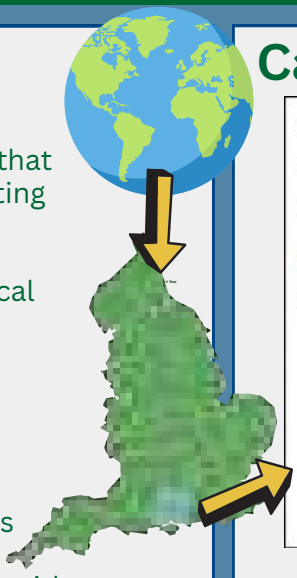
Little research examines how local governments balance land-use decisions to ensure compatible implementation

Method

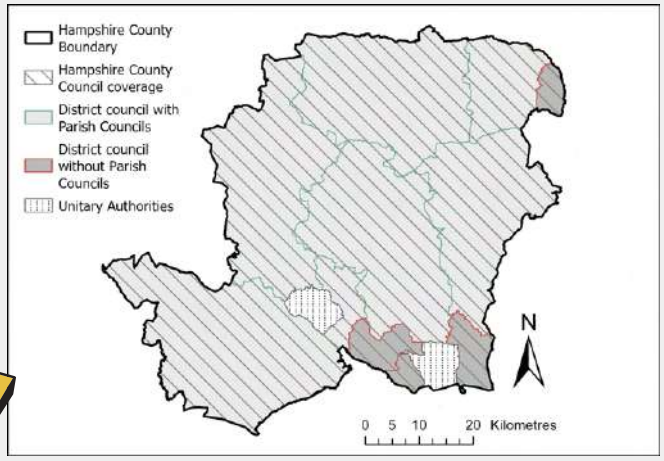
How: Semi-structured interviews

Who: Local government officials with biodiversity, climate or related focus

What: How do local governments make land-use decisions for climate change and biodiversity targets?



Case study: Hampshire



Top tier	2 Unitary Authorities	Hampshire County Council
Lower tier		11 District Councils; 269 Parish Councils

Collective local government outputs are piecemeal due to systemic barriers to implementation

Lack of finances

"You've got to prioritise just statutory services, not net zero, which is obviously unfortunate but that's just the way it goes"

Risk averse councils prefer low impact wins

Lack of legislation

"I do wonder if we'll ever see that clarity really or it'll just carry on being various authorities sort of buggering on doing the best they can"

Fear of making the wrong decision means limited action

Lack of land

"I think influencing is probably the best we can do. Alongside maintaining what we've got is then influencing"

Limited understanding of collective impact

What are realistic opportunities for policy implementation?

Future research

1. Use Q-methodology to understand policy priorities for local government
2. Map realistic scenarios based on policy priorities using systematic conservation planning

University of Southampton
INSPIRE DOCTORAL TRAINING PARTNERSHIP

Supported by the Natural Environment Research Council grant number NE/5007210/1

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- Tingey and Webb (2020) Governance institutions and prospects for local energy innovation: Laggards and leaders among UK local authorities. *Energy Policy*
- Garvey et al., (2025) "How could it be our responsibility?" The equity of Local Authority climate action in England. *Local Environment*

Unsung Heroes of Climate Action –

Environmental Human Right Defenders Under Threat

Fariborz Zelli, Lund University

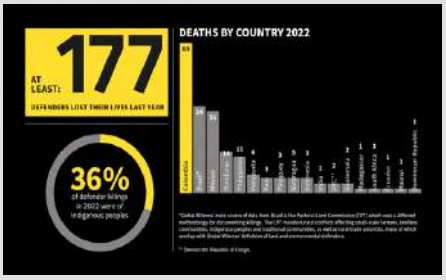
Indigenous peoples and local communities play crucial, but largely unnoticed roles in climate mitigation and adaptation – e.g. by safeguarding carbon sinks like tropical forests or ecosystems that limit erosion and storm damage.

Until present, the UN climate regime – unlike the Convention on Biological Diversity – does not include a comprehensive legal recognition of such "environmental human rights defenders" (EHRD) and their critical roles.

➡ Striking as these land-defending communities are often exposed to intimidation and violence.

➡ **Example: Colombia = country with most assessinations of EHRD worldwide;**
Over 1,600 killings from January 2016 to June 2024

➡ *Major drivers*: concentration of land ownership, drug cartels, old & new extractivism, illegal logging, agriculture business expansion, hydropower, etc.



Source: globalwitness.org

Project & Goals

7-year interdisciplinary *research programme* (2019-25) on EHRD:

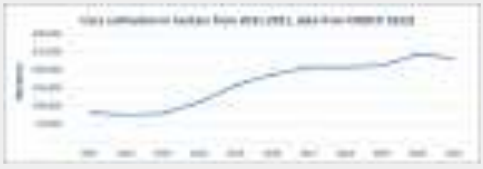
- successes, obstacles and risks
- motivations and goals
- main practices, strategies and impacts
- lessons learned for protection and support

Mixed methods: field work, policy & legal analysis, participant observation, interviews

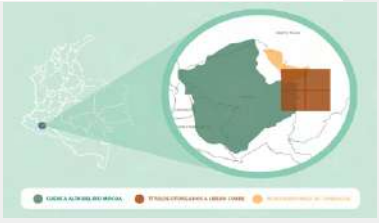
A Situation Beyond Control

Source: globalwitness.org

Colombian EHRD between Illicit Crops ...



.... and Extractivism



Sources: mongabay.com & ElEspectador.com

What to do?

We need integrated solutions across
- international, national and local actors
- political levels
- spheres and forms of justice
- structures of violence

We plan to meet further environmental human rights defenders in Colmbia and other countries. We will tell their stories and communicate their needs for stronger recognition and support to decision-makers, stakeholders and researchers.

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LUND UNIVERSITY

Challenges in decarbonising Indonesia's electricity sector: a systematic review

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1. Introduction

- Indonesia has long relied on fossil fuels for generating electricity, from oil, gas, to coal.
- Fig. 1 shows electricity transitions in Indonesia: from oil-heavy to gas in 1995, and gas to coal in 2000.
- Indonesia intends to decarbonise its electricity sector by 2060, but only around 12% renewable electricity in 2023[1].
- Our study aimed to identify the current challenges of Indonesia's electricity transition through a systematic review.

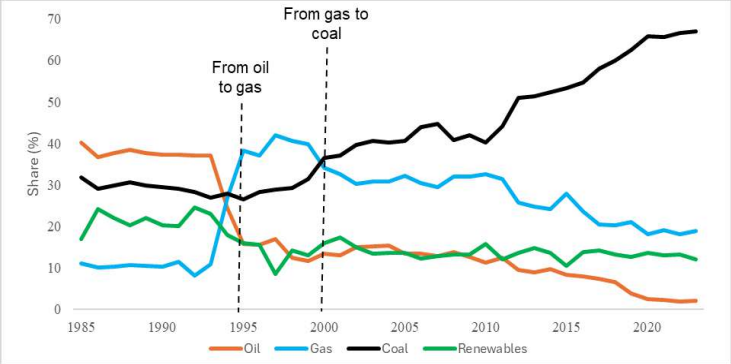

Fig. 1 Electricity production proportion (%) from oil, gas, and coal (1985 – 2023)[1,2,3,4].

2. Search strategy

- We used the Scopus database for selecting academic literature, combining keywords like 'energy transition', 'electricity generation'; and 'Indonesia'.

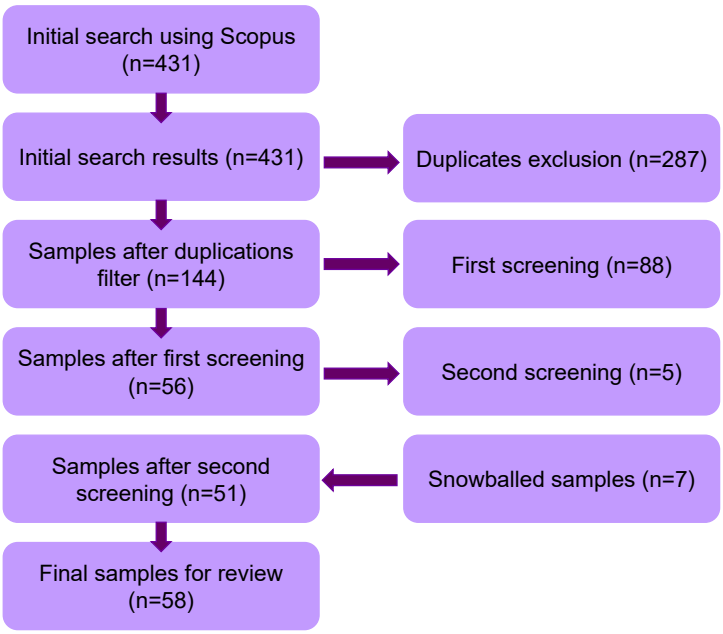

Fig. 2 Flowchart of the screening process.

- To gather grey literature, we applied snowballing (n=8), web searches (n=14), and an online database (n=4).
- In total, we looked at 84 literature in our review.

3. Results

- Three key challenges: public policy contradictions, coal hegemony, and bureaucracy complexities.

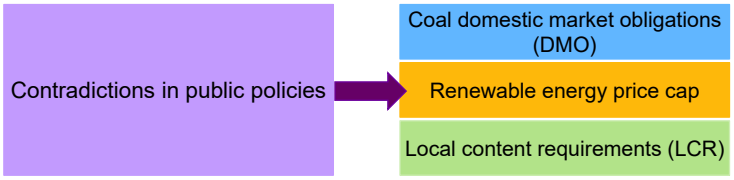

Fig. 3 Contradictions in Indonesia's public policies

- The coal DMO caps domestic coal prices, cutting fuel costs for coal power plants and lowering overall production costs.
- For now, the LCR increases the cost of some renewable power plants, especially solar.

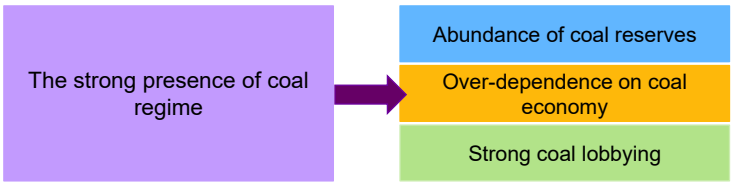

Fig. 4 Coal hegemony as one of the challenges in electricity decarbonisation

- Over half of the power plant added under the '35 GW project' were coal-based, largely due to lobbying efforts[7].

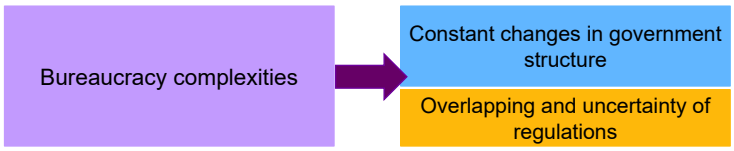

Fig. 5 Complexities in Indonesia's bureaucracy

- Frequent institutional changes disrupt electricity transition efforts.
- Regulatory uncertainty discourages investors from investing in renewable projects.

4. Conclusions

- More financial and non-financial support and a review of conflicting policies are necessary for the transition.
- Gradual changes, such as phasing out the coal price cap, are key to decarbonisation with minimal socio-economic impact.

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The Role of Social Capital in the Efficacy of Climate Change Farming Programmes

Gracie Horton[1], Ailish Craig[2], Craig Hutton[1] and Justin Sheffield[1]
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2. School of Geographical Sciences, University of Bristol, University Rd, Bristol BS8 1SS

1. Aims and Objectives

Aim: To understand how farmers use **social capital** to adapt to **floods and droughts**, both before and as a result of **farming programmes**.

Objective 1: To identify changes in each form of **capital**, comparing resources **before and after** the implementation of a **farming programme**.

Objective 2: To determine how **post-farming programmes' capital stocks** are impacted by **floods and droughts**.

Objective 3: To ascertain if the relationship between **farming programmes** and the **capitals** varies in a **spatially coherent way.**

2. Importance

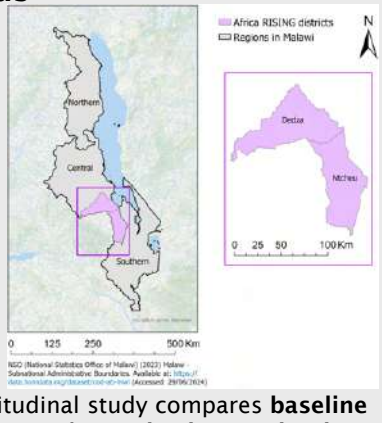
The literature suggests that **without resources**, such as support networks (**social** capital), base-level skills (**human** capital), marketing (**financial/ physical** capital) and biophysical factors of influence (**natural** capital), the benefits of **farming programmes** can only stretch so far[1, 2, 5, 7].

The farming programmes assessed in this study employ a **bottom-up approach** that aims to improve agricultural practices, enhance food security and help farmers adapt to **climate change.** This approach centres **around farmer cooperatives** and agricultural extension workers, thus requiring **planning and cooperation** between different groups. This study aims to understand these processes better and publish these results to **improve farming programme efficacy**.

3. Quantitative methods

Analysing a sustainable intensification project called **Africa RISING (IFPRI),** which aims to improve food, nutrition and income security[6].

Techniques:
- Data cleaning
- Descriptive statistics
- Regression modelling
- Geographic information systems

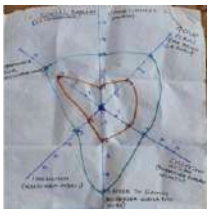


Expected outcomes: This longitudinal study compares **baseline** and **follow-up data,** utilising the FAO's **monitoring, evaluation and learning framework**[4] to address **Objective One and Three**. Results will reveal how/if **capital stocks** changed over the duration of the programme. These results will help to develop the **fieldwork questions** for the qualitative data collection in Malawi in 2026.

4. Qualitative methods

Using the FAO's **monitoring, evaluation and learning framework**[3] which incorporates the Sustainable Livelihoods Framework to analyse the efficacy of **farming programmes**.

Spider diagrams

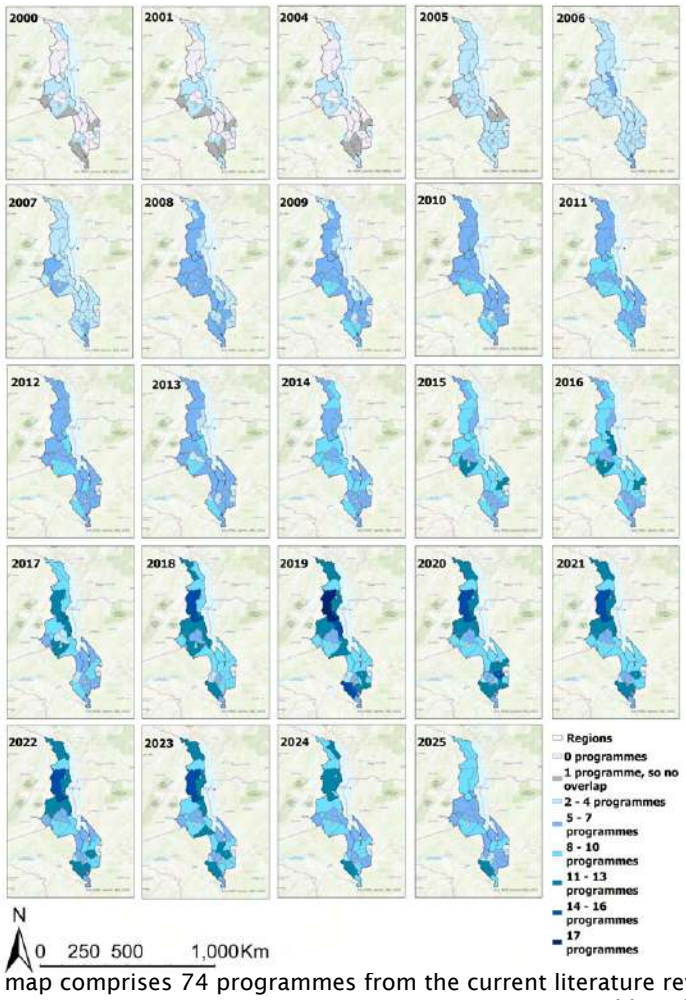


Focus groups

Direct observation[4]

Expected outcomes: The **qualitative analysis** will research how different communities have used the **programme techniques** and their **capital stocks** after programme completion. Results will demonstrate if farmers can **continue the practices** they learnt and whether they rely on their capital stocks to do so. This will help to answer **Objectives Two and Three**.

5. Results



This map comprises 74 programmes from the current literature review, FAO, GCF, USAID, GIZ, NORAD, IDRC, IFAD, IFPRI, CARE, World Bank, UNDP, CLARE, EU, African Development Bank, AGRA, SAIRLA, ADRA, DFID/FCDO, WFP, Adaptation Fund and the Malawi Government (See references).

Researching overlapping programmes helps contextualise, locate areas with numerous programmes, and choose potential fieldwork areas. These maps demonstrate that some communities may have multiple programmes which will impact their capitals and ability to adapt.

6. Discussion and Future Work

Floods and droughts adversely affect **agricultural productivity** and **food security**, thus highlighting the need to implement adaptation initiatives. **Farming programmes** and **social capital** appear to help farmers mitigate the impacts of hazards, and now there is a **framework** which can analyse their **effectiveness**[3].

Future work:

1) Analyse the data through descriptive statistics, regression modelling and mapping the outcomes.

2) Work with The International Food Policy Research Institute (**IFPRI**) and the International Fund for Agricultural Development (**IFAD**) to plan, prepare for and conduct the fieldwork in Malawi.

3) Clean, transcribe, analyse and map the qualitative data to compare with the quantitative findings.

7.

LinkedIn

References

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NORFOLK NET ZERO

friday 13 June, 2025

what is... COMMUNITY?

1

BARRIERS

- local leaders
- case studies
- events

2

- myth busting
- focus groups

COST
- local champions
- grant eligibility

Language

? what is NET ZERO

↓ POSITIVE

- Re-frame
  - 'comfortable homes'
  - environment
  - individual
- community focus
  - forest or beach
  - coast
  - heritage

Leadership

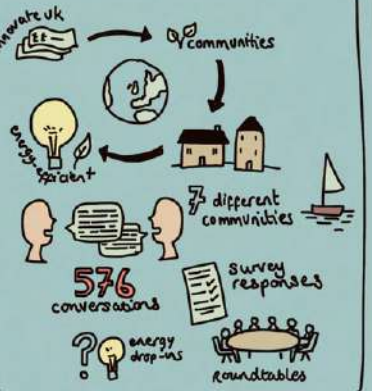
- case studies
- local leaders

Negativity Bias

- evidence
  - thermal imaging
- case studies

WHAT IS THE PROJECT

PROJECT BACKGROUND

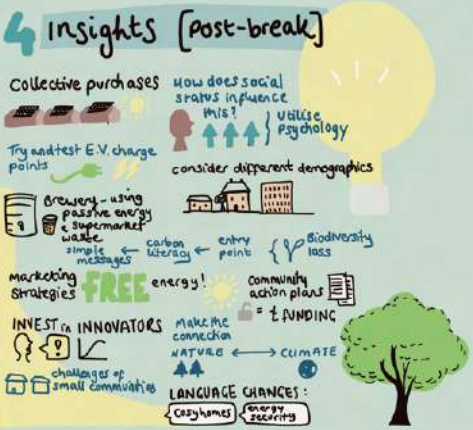


Discussions [post-presentation]

3

- ↓ climate priority ↓ COST OF LIVING
  - change focus of conversations!
- lots of confirmation bias
  - mindset change needed
  - + bring NEW elements
- Renewable energy
  - community benefits
  - show people this!
  - develop conversation
  - takes time
- country wide issues
  - intervention points
  - air-dryer phenomenon!

4 Insights [post-break]



6 TOOLS GOING FORWARD

City-to-city learning: accelerating city-level decarbonisation

PhD researcher: Harry Barton, Tyndall Centre for Climate Change Research, University of Manchester
Supervisors: Dr Claire Hoolohan, Dr Chris Jones, and Professor Carly McLachlan
Funders: The University of Manchester School of Engineering and the Greater Manchester Combined Authority

Research aim

Enhance city-to-city learning and knowledge transfer in the design and delivery of climate action projects.

Methods

- Collated city-level decarbonisation projects case study list (~200).
- Designed a practical method to prioritise these cases based on the best opportunity for learning.
- Conducted semi-structured interviews with cities that had completed similar projects.
- Used participant observation to see if cities learn what they say they want to learn in practice.
- Tested an intra-organisational knowledge transfer framework in an inter-organisational setting (Argote, 2024).

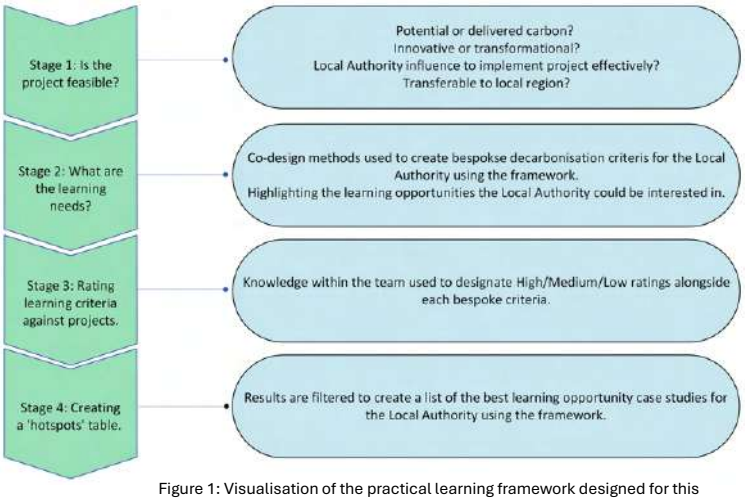


Figure 1: Visualisation of the practical learning framework designed for this research with a brief description of each stage of the process (Barton et al., 2025).

Practical contributions

Empirical:

- Highlighting barriers and opportunities for city-to-city knowledge transfer and learning for decarbonisation.
- Observe whether cities learn what they say they want to learn in practice.
- Examine how concepts of place and co-production are used in practice for city-level decarbonisation projects.
- City-level decarbonisation case study list (Barton, 2022).

Methodological:

- Empowering city decision-makers: A practical guide to learning for decarbonisation at the city-level (Barton et al., 2025).

Theoretical:

- Testing whether intra-organisational knowledge transfer mechanisms and characteristics can be applied to inter-organisational settings.

Context

Cities produce >60% of global emissions (UNFCCC, 2021).

Around 56% of the world's population live in urban areas, with this number predicted to more than double by 2050 (World Bank, 2022).

Rapid decarbonisation is essential to meet environmental targets. Many cities are have already begun this process, and thus have a wealth of knowledge about what went well and what did not - knowledge that is currently not shared effectively with others.

Effective knowledge transfer and learning from past projects could help speed up climate action at the city-level.

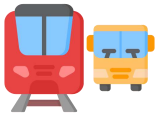
Case studies

Energy: Switching to LED streetlighting and incorporating smart technology (Bury Council, Regional).

Buildings: Social Housing Decarbonisation Fund (GMCA, National).

Transport: Moving to an electric bus fleet (TfGM, International).





Results

Similarities across case studies

- Impact of team changes and disconnects between teams causing a loss of knowledge was common between the case studies.
- Pilot projects were used across all.
- Varied approach to working with communities on projects but this could encourage better acceptance of these projects.
- Views of those implementing the projects were impactful across all cases.

Differences across case studies

- Self-preservation of the organisation running the project was most extreme at the international level.
- Outcome interdependencies seemed to lessen as the cases moved from international to national to regional.
- Age of the technology was different in each case study and it was interesting to see similar learning issues in both the newer projects and older projects. For instance, housing insulation vs electric bus roll out.

Methods paper

Case study list

Contact information

Multi-Objective Spatial Optimisation of Catchment-Scale Natural Flood Management Strategies

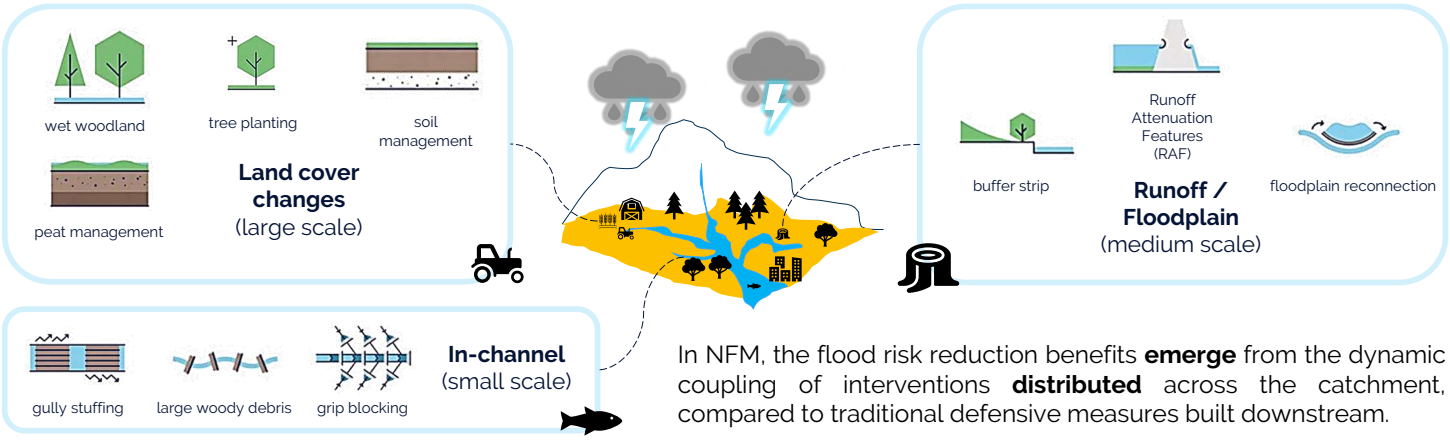
Henry Rong[1], Richard Dawson[1], Caspar Hewett[1], David Hetherington[2]

[1] Newcastle University, [2] ARUP

h.rong3@newcastle.ac.uk

There is a growing interest in the UK in upscaling Natural Flood Management (NFM) strategies to catchment-scale. However, there are multiple challenges with tailoring strategies to the unique characteristics of each catchment...

1) Complex interactions between multiple interventions

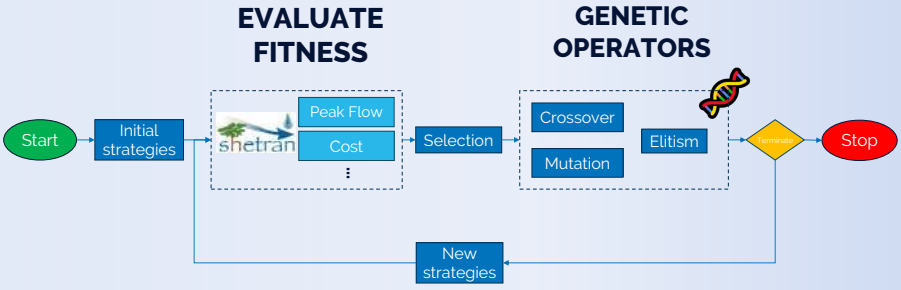


In NFM, the flood risk reduction benefits **emerge** from the dynamic coupling of interventions **distributed** across the catchment, compared to traditional defensive measures built downstream.

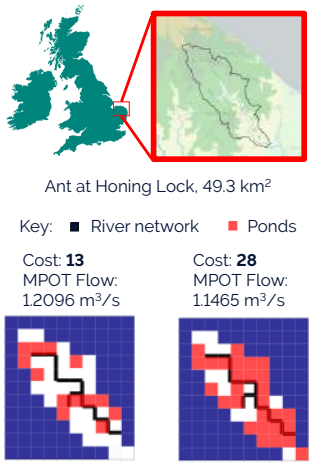
2) High dimensionality in optimisation problem

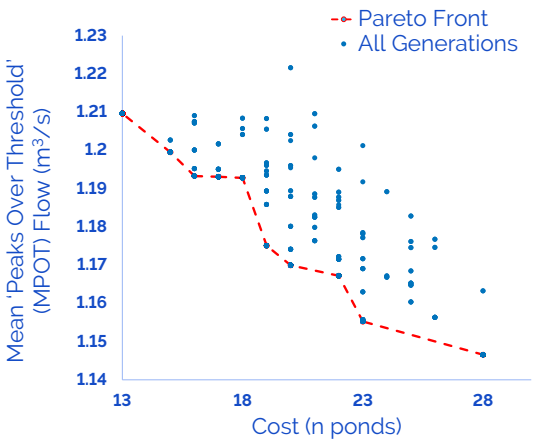
There are **multiple interventions** to use, numerous possible placement **positions** and many **arrangement** permutations toward different objectives. This is a huge **search space** that cannot be evaluated using brute force.

Using techniques such as **Multi-Objective Optimisation (MOO)** can effectivley navigate and map out **Pareto-optimal solutions.**



3) Balancing stakeholder needs





*This project is developing a **Multi-Objective Spatial Optimisation framework** to explore relative merits and understand **trade-offs** between different catchment wide NFM strategies.*

*To examine **cost-benefits** holistically, the **performance** of interventions should be examined through multiple lenses beyond flood risk reduction, including **carbon sequestration**, **habitat creation** and **water quality**.*

*This framework aims to **bridge** the gap between rapid optioneering to detail design, facilitating higher resolution **co-design** for catchment stakeholders.*

NFM intervention icons from ARUP x SCALGO NatureInsight whitepaper (available https://www.arup.com/services/digital-solutions-and-tools/natureinsight/)

SHETRAN hydrological model logo (available https://research.ncl.ac.uk/shetran/)

MOO Genetic Algorithm schematic adapted from Introduction to Evolutionary Computing, 2nd Edition, Eiben and Smith, 2015

NRFA 34008 - Ant at Honing Lock map and flow data (available https://nrfa.ceh.ac.uk/data/station/info/34008)

Newcastle University FLOOD-CDT ARUP UKRI Natural Environment Research Council

Global Human Exposure to Sea Level Rise to 2300

Authors: Jack Heslop[1], Robert J. Nicholls[1], Daniel Lincke[2], Caridad Ballesteros-Martinez[1], Jochen Hinkel[2], Maarten Pronk[3], Samir K.C.[4], Aimee Slangen[5], Tim Hermans[5], Katherina Seeger[6], Philip Minderhoud[6]
1 – Tyndall centre for climate change research, University of east Anglia; **2** – Global Climate Forum, Berlin; **3** – TU Delft; **4** – IIASA, Vienna; **5** – NIOZ; **6** – University of Wageningen

The Problem

Sea-level rise (SLR) is a millennia-scale threat, locked in by current warming. Yet, most impact studies stop at 2100, ignoring the critical interplay between long-term SLR and major demographic shifts over the coming centuries.

The Assessment

We provide a first global analysis of coastal population exposure to 2300, integrating probabilistic SLR projections with long-term population pathways to reveal the evolving relationship between the coast and its inhabitants.

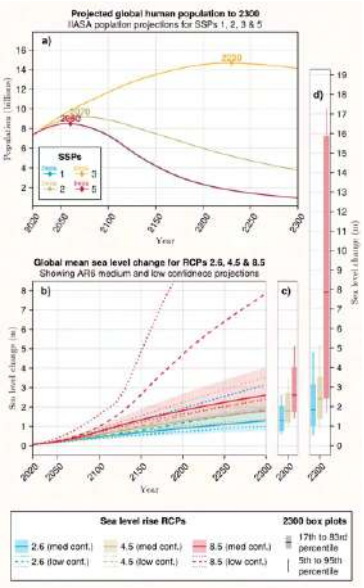
Definition: Exposure

We calculate the population living below the high-tide line, *assuming no protective defenses*. This measures the inherent risk a region faces, providing a crucial baseline for understanding the scale of the challenge and the need for coastal adaptation.

Methodology

- Aligned population grids with terrain data and corrected vertical datums.
- Used a probabilistic bathtub model (accounting for coastal hydro-connectivity) to calculate inundation.
- Ran a massive Monte Carlo simulation (~35 million runs) to propagate uncertainty from SLR and terrain error.
- Combined results with population pathways.

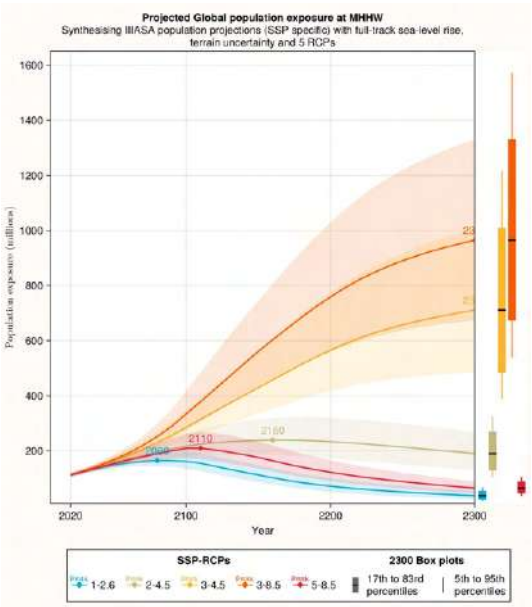
Projection datasets



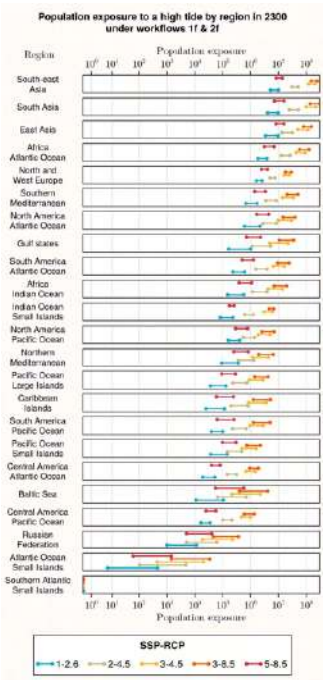
Panel a) Global population projections to 2300 (Samir, K.C., IIASA, 2025)
Panel b) Global mean sea level rise projections (Garner et. al 2021), panels c) and d), boxplots of global mean sea level change in 2300 under medium confidence and low confidence results, respectively.

Samir, K.C. IIASA (paper in preparation)
Garner, G. G., Hermans, T., Kopp, R. E., Slangen, A. B. A., Edwards, T. L., Levermann, A., Nowikci, S., Palmer, M. D., Smith, C., Fox-Kemper, B., Hewitt, H. T., Xiao, C., Aðalgeirsdóttir, G., Drijfhout, S. S., Golledge, N. R., Hemer, M., Krinner, G., Mix, A., Notz, D., ... Pearson, B. (2021). *IPCC AR6 Sea Level Projections*

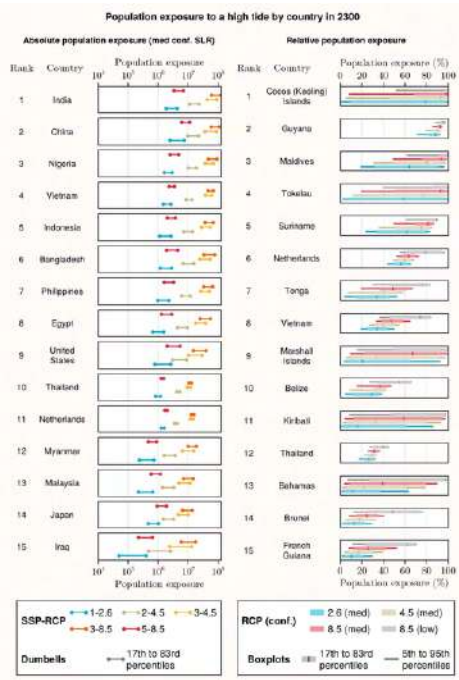
The Global picture



Regional rankings



National rankings



Key findings:

- **Demographic change is a more powerful driver of population exposure than sea-level rise**:
  - By 2300, a high-population pathway (SSP3) leads to a median exposure approximately ten times greater than low-population pathways (SSP1 and SSP5),
  - Whereas the difference between high- and low-emission scenarios (RCP8.5 vs. RCP2.6) yields a 2- to 3-fold increase.
- Major regional shifts are projected, with Africa's share of global population exposure rising significantly
- SIDS face existential threats, with near-total exposure to a high tide under high-emission scenarios by 2300.

Tyndall Centre for Climate Change Research

University of East Anglia

ARIES DOCTORAL TRAINING PARTNERSHIP

Scaling Climate Resilience through Indigenous Knowledge
Lessons from Kutubdia, Bangladesh

Jakiat Jitu

Introduction

The Paris Agreement (2015) and the Sendai Framework for Disaster Risk Reduction (2015) recognise the essential role of indigenous knowledge in building climate resilience. This poster showcases Kutubdia, a remote island in Bangladesh, as a case study to demonstrate that indigenous knowledge is present even in places with the most limited resources and infrastructure. Integrating these local methods into national frameworks can serve as a pathway for communities facing similar hazards to become more resilient.

Methodology

Profile and Disasters of Kutubdia

Kutubdia, a small island off the southeastern coast of Bangladesh, faces increasing climate vulnerability. Poor infrastructure and a shrinking mangrove forest weaken its natural defences.

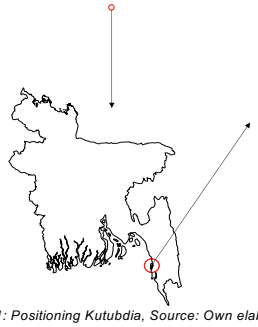


Figure 1: Positioning Kutubdia, Source: Own elaboration.

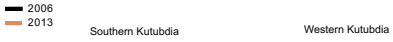


Figure 2: Coastal Erosion 2006 vs 2013 (Navera, 2012, redrawn by author).

The island is highly susceptible to natural hazards, including cyclones, storm surges, and coastal erosion. These disasters, along with rising sea levels and saltwater intrusion, lead to devastating consequences. The population experiences significant land loss, disruption of fishing and agriculture, and forced migration to the mainland, further compounding their vulnerability and poverty.

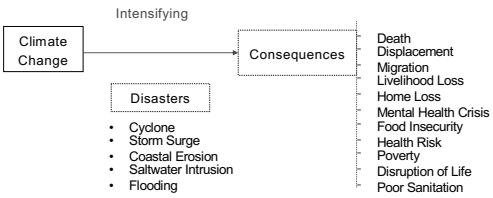


Figure 3: Intensified disaster consequences, Source: Own Elaboration.

Climate Resilience through Indigenous Knowledge

Kutubdia residents employ a range of indigenous coping strategies to build resilience. Physical practices are central to this, evident in traditional housing typologies. These homes are often oriented east-west to minimise wind damage, featuring hipped roofs secured with ropes and weighted with bricks for stability. The design, known as "Pashchati," includes a surrounding balcony that acts as a barrier against rain.

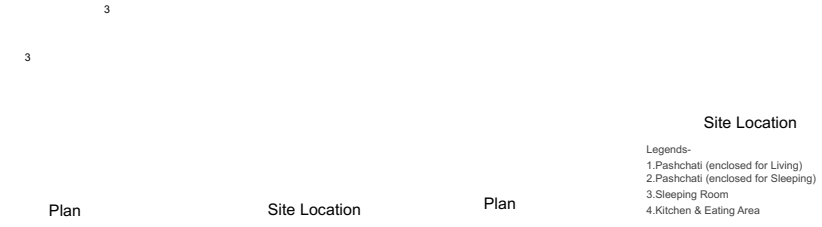


Figure 4: House layout following indigenous knowledge, Source: Own elaboration.

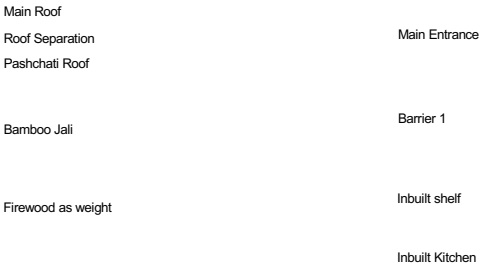


Figure 5: Roof details (left), and adjusted ergonomics (right), Source: Own elaboration.

Community members also utilise salvaged materials from damaged homes as a part of their collective rebuilding efforts. While these methods are effective against seasonal storms, they are becoming inadequate to address the heightened impacts of climate change.

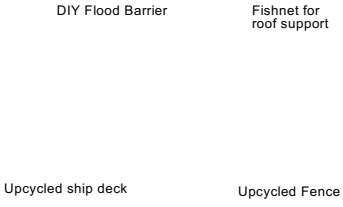


Figure 6: Upcycled water-resistant wood board as a construction material, Source: Own elaboration.

Additionally, non-physical strategies are vital. The community collaboratively repairs embankments and public structures, fostering a strong sense of collective action. After a disaster, residents prioritise rebuilding, often using salvaged materials to patch damaged homes. However, financial constraints and the island's disconnection from the mainland limit exposure to external knowledge and innovation, hindering the enhancement of these indigenous practices.

Conclusion

While these indigenous practices have been a lifeline for the people of Kutubdia, ensuring their survival in the face of intensifying climate change, they are not without limitations. The lack of infrastructure and institutional support hinders its long-term sustainability, creating a disconnect between top-down policy and on-the-ground reality. The erosion of this knowledge further threatens the community's adaptive capacity, posing a significant social and cultural cost beyond just physical vulnerability. The case of Kutubdia demonstrates that for indigenous practices to be scaled up, they must be integrated with external support and formal strategies, ensuring a cohesive and sustainable approach to climate adaptation.

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Funded by:

DRR Fellowship

Environmental Impacts of Downstream Natural Gas Development as a Climate Action Policy

R.T. MACALINO, B.N. SUBOSA, J.M. ABERILLA | UNIVERSITY OF THE PHILIPPINES DILIMAN | JOABERILLA@UP.EDU.PH

BACKGROUND

The Philippines enacted the **Natural Gas Industry Development Act** (R.A. 12120) to "promote the role of natural gas as an additional energy source and a **transition fuel to variable renewable energy**". The intended effect is to **replace coal and oil** in the energy mix with natural gas. This displacement reduces but does not eliminate GHG emissions. Given this context, this study investigates the **environmental impacts of LNG use scenarios** in the Philippines to elucidate risks and inform policy.

METHODOLOGY

Goal and Scope Definition

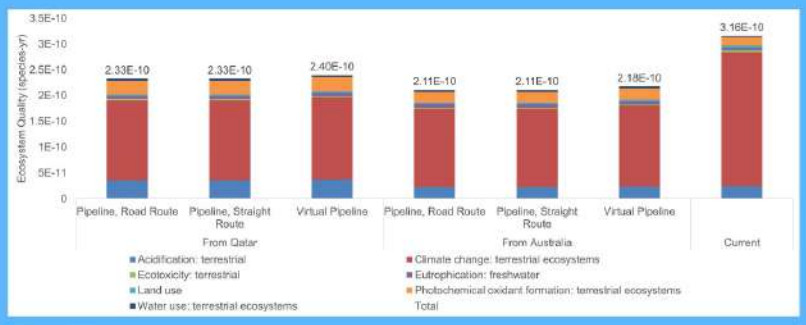
- Functional unit: 1 m^3 natural gas, at use
- LNG sourced from (a) Qatar, (b) Australia
- Regasification with seawater in floating units
- Distribution by (a) physical, (b) virtual pipeline
- End use for (a) power, (b) heat

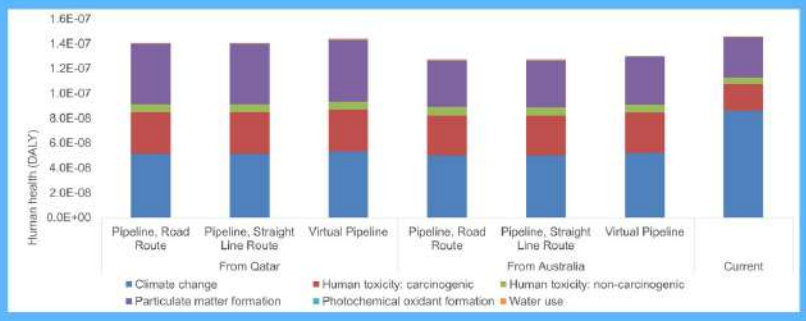
Life Cycle Inventory

- Ecoinvent 3.10 for upstream and background processes
- IMO emission factors for transportation
- Aspen Plus simulation for downstream processes
- Implementation in openLCA software

RESULTS

- Up to 71% lower impacts by designing a supply chain that (1) imports from Australia, (2) distribution by physical pipeline, and (3) use in combined cycle gas plants
- Up to 13% reduction in human health impacts and 26% in ecosystem quality impacts by switching industrial fuels to LNG
- A 'clean energy scenario' with LNG will emit 28-47 MMt CO_2-eq./yr, down from 76 MMt/yr in 2021





POLICY RECOMMENDATIONS

- Minimize transport distances → Develop centralized power and heat networks
- Minimize fugitive emissions and NOx formation → Regulate and monitor emissions from NG use
- Maximize heat and power extraction from natural gas
  - Invest in high-efficiency equipment; apply integrated maintenance procedures
  - Develop markets for power and heat

This work is part of the Gas Policy Development Program Phase 3 funded by the Economic Research Institute for ASEAN and East Asia (ERIA). Support for the presentation of this poster from the UPD Office of the Vice Chancellor for R&D is gratefully acknowledged.

CENTERING MARGINALISED VOICES TO 'BUILD BACK BETTER' AFTER A DISASTER IN MALAWI

John Aubrey Chirwa, Postgraduate Researcher, University of East Anglia (UEA)

Background

- Tropical Cyclone Freddy of 2023 killed 679 people and 537 are still missing in Malawi.
- This is one of the five disasters in a space of four years.
- Cumulatively, total loss and damage is estimated at $921 million; recovery and reconstruction needs amount to $1.4 billion (GoM, 2023).

Problem Statement

There are concerns with distribution of environmental costs and benefits; participation and representation of local communities in policymaking processes for inclusive post-disaster recovery frameworks.

Methodology

Participatory Action Research:

Pre-workshop knowledge gathering
(transect walk, FGDs, interviews)

↓

Filmmaking training workshop
(camera operation, scripting/diagramming)

↓

Film shooting and collaborative editing

↓

Film screenings: local and national
(Facilitated dialogues, evaluation questionnaires)

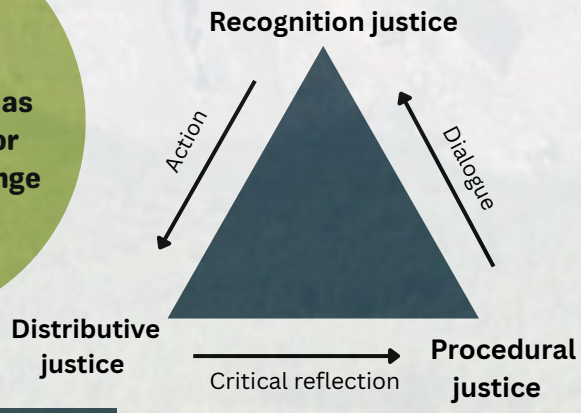
↓

Action plans and follow-ups

Objective

To explore the effectiveness of participatory video as an inclusive tool for transformative change in post-disaster recovery.

Freirean & Environmental Justice Theory



Results

Opportunities

- The filmmaking process empowered participants to represent themselves; to critically reflect on post-disaster recovery, preparedness and mainstreaming of DRR
- The film screenings enhanced dialogue and recognition justice
- Outcome? Policy makers listened and responded to participants'concerns; action plans were drawn

Challenges

- Product or Process? vs resources/time constraints/quality
- The illusion of voice amplification
- The extent to which participation challenges social structures
- Sustainability

Conclusion

Participatory video as a process is a powerful inclusive tool for transformative change in post-disaster recovery: empowering, emancipatory; enables dialogue for local voices to be valued for response, action and justice.

Key Sources

1-Freire, P. (1970). *Pedagogy of the Oppressed*. Bloomsbury Publishing Inc.
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Reimagining a Resilient Clyde: Climate Adaptation and Spatial Justice in Glasgow's Estuary

multi-level governance
conflicting priorities
spatial justice

GALLANT

Scan me to learn more about our work

Research Team

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Building an adaptation roadmap for the Clyde

Figure 1: Research Design GALLANT "WP1": Implementing coastal adaptation for Glasgow City Region

Multi-level governance

We aimed to understand how Scottish climate adaptation policy is implemented in local land-use planning, focusing on how projected sea level rise is considered in development consent processes. Our analysis began with the view that development management practices are 'nested' within multiple layers of policy—planning, environmental, and administrative—at local and national levels.

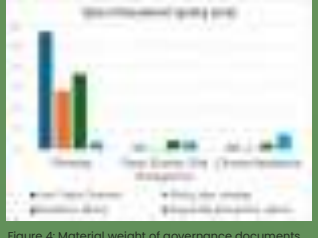

Figure 4: Material weight of governance documents by policy area (Scotland)

These policies operate within a broader legislative framework that sets the remit for policymakers (see Figure 4).

We reviewed nearly 300 national and regional documents, including legislation, policies, and guidance related to land-use planning, climate adaptation, and coastal flood risk. Our analysis highlights the dominant 'material weight' of planning law over flooding and climate adaptation policy. Although climate adaptation laws and policies are comprehensive, the majority of actual documents are non-statutory guidance with limited legal authority.

This underscores a key challenge: the sheer volume of existing planning law and policy already occupies much of the decision-making space, leaving little room for newer policy, and non-statutory guidance—like climate adaptation—to meaningfully influence outcomes.

Conflicting priorities, spatial justice and Aarhus

Spatial justice explores the explicitly *spatial* notions of justice and injustice. Building on the ontology of the social production of space[1], which defines beings as inherently spatial, social, and temporal, spatial justice considers how our actions change space—and how we, in turn, are changed by it.[2,3,4]

Spatial justice combines the distributive (equal/equitable allocation) and procedural (fair and accessible decision-making processes) aspects of social justice.

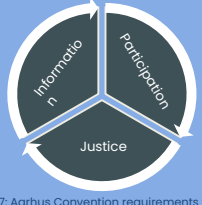

Figure 7: Aarhus Convention requirements for public access to environmental decision making3

To adhere to the Aarhus Convention[5] land-use decisions must follow a process through which the public has access to information and the ability to meaningfully participate in decision-making. Furthermore, access to justice—through means of appeal or redress—must also be available.

Decisions about how to adapt to a changing climate, and where to focus adaptation efforts, are filled with spatial and temporal complexity. Making intergenerationally just land-use decisions requires agreeing on the future we are aiming for, and the impacts that we are prepared to accept today.

The spatial justice lens reveals the productive power of these decisions: whose future land-uses are we protecting through adaptation, and whose values and priorities are being included in decisions about how we adapt?

Clyde Estuary 2100 Adaptation Challenge

By 2100, predicted sea level rises of up to 1 meter will significantly impact Glasgow's riverside, with low-lying land along the river edge across the city region at risk of inundation or erosion (Figure 2). As part of the GALLANT project (Glasgow as a Living Lab Accelerating Novel Transformation), our team is working with regional partners to explore options for coastal adaptation within the context of the Glasgow City Region.

However, adaptation only contributes to climate resilience if it is implemented—and implementation depends on elevating the priority of climate resilience within a complex social and political system.

Figure 2: Sea level Rise considerations for Clydeside redevelopment[6]

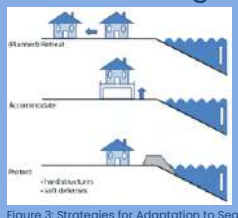

Figure 3: Strategies for Adaptation to Sea Level Rise (simple version)[7]

While acknowledging the urgent need to adapt, our work focuses on empowering local decision-makers to identify and implement solutions that are appropriate at both local and regional scales (Figure 3). These solutions aim to meet the needs of communities today, while avoiding costly lock-ins and mitigating long-term impacts for Glasgow's residents in 2100 and beyond.

There are no simple solutions: Balancing the needs of present and future generations of Clydesiders requires careful deliberation. In a context of resource constraints and housing shortages, allocating land for adaptation measures may not align with local community expectations.

Navigating the roadblocks to implementing climate adaptation

In June 2025, we held a workshop with stakeholders from local authorities, regulators, statutory advisors, and the Scottish Government. The aim was to understand their experiences with climate adaptation in land-use planning, identify key implementation barriers, and co-develop actions to support more effective integration into decision-making.

We introduced a "catalogue of possibilities"—developed from academic and grey literature—offering examples of how adaptation can be embedded in planning. Actions were grouped into five themes: process/structural mechanisms, data, consensus, ability/confidence to act, and engagement.

Participants highlighted the need for strong leadership and increased resources—both financial and human. They also called for cultural shifts away from siloed working. Intergenerational justice was a key theme throughout.

Figure 6: Stakeholder engagement workshop prioritisation of adaptation actions, June 2025, University of Glasgow (Photo: K Fradera)

Discussions about the feasibility and desirability of actions revealed both a strong ambition to accelerate adaptation and a clear desire to collaborate on climate risk reduction. However, analysis of workshop outputs shows a lack of consensus on the best way forward—likely due to differing stakeholder remits and priorities.

In the coming months, we will continue discussions with individuals to better understand the nuances of this challenge.

Two participant comments capture current regional perspectives:

"We need less talking and more action."
"We let perfect get in the way of the good."

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University of Glasgow, charity number SC004401

Bridging the Climate Resilience Divide

A data-driven strategy for aligning the DfE's Climate Ambassador Scheme with social and climate vulnerability within England's education settings

Kit Marie Rackley[1,3], Ruth Green[2,3], Asher Minns[1,3], Amanda Maycock[2,3]

[1] UNIVERSITY OF EAST ANGLIA TYNDALL CENTRE FOR CLIMATE CHANGE RESEARCH
[2] UNIVERSITY OF LEEDS SCHOOL OF EARTH AND ENVIRONMENT
[3] DEPARTMENT FOR EDUCATION (DfE) CLIMATE AMBASSADORS SCHEME

1. INTRODUCTION

The national Climate Ambassador Programme is a key pillar of the DfE's Climate Change & Sustainability Education Strategy, designed to support education settings with climate action planning. Effective scaling requires identifying where engagement is weakest and need is highest.

This gap analysis integrates national engagement data with DfE school characteristics and climate vulnerability indices. We ask: does support reach the schools and communities most at risk?

2. THE VULNERABILITY GAP

To ensure equitable and effective support, the Climate Ambassador Scheme requires a dual understanding of both **engagement vulnerability** (where support is lacking) and **climate vulnerability** (where need is greatest). Progress can be achieved by analysing:

1. **The Ambassador Network (Supply):** The capacity for support, defined by programme data on Ambassador location, expertise, and skills. Mapping this reveals "hot spots" vs potential "cold spots" where support may be scarce.
2. **Engagement Vulnerability (Demand):** Current demand, measured through active engagements mapped against key DfE school characteristics to identify under-engaged settings, such as the proportion of pupils eligible for **Free School Meals (FSM)**.
3. **Climate Vulnerability (Context):** the urgency of need is assessed by overlaying school locations with a **Vulnerability Index** from *Sayers et al. (2025)*, which synthesises environmental risk factors (e.g., flood and heat risk) and social determinants of community resilience.

Hypothesis: *A significant misalignment exists—the most vulnerable schools are the least engaged, creating a critical "vulnerability gap".*

3. METHODOLOGY

Engagement Analysis: Calculated cumulative engagement rates (% of settings) to June 2025 across DfE and Sayers et al. (2025) strata:

- **Socio-economic:** DfE FSM% measure categorised into quantile bins; Special Educational Needs (SEN) settings vs 'mainstream'.
- **Climate-Environmental:** Social Susceptibility index derived from components of Flood and Heat Risk.

Supply-Demand Mapping: Geospatial analysis of Ambassador coverage (location, reach) vs. locations of high-vulnerability schools (high flood and heat risk, high social susceptibility and high %FSM).

7. KEY SOURCES

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4. CORE ANALYSIS: MAPPING THE GAP BETWEEN SUPPORT AND NEED

National analysis of engagement data reveals a complex pattern of equity and disparity across different vulnerability measures.

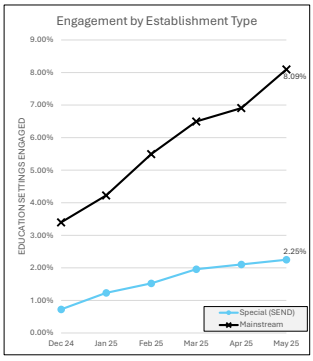


Fig.1a: An institutional engagement gap. *Special Educational Needs (SEN) settings are significantly less likely to be engaged by the programme than mainstream schools, highlighting a key equity concern.*

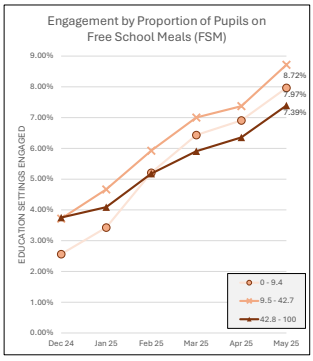


Fig.1b: An inverse equity gap. *Schools with the highest levels of economic disadvantage show a consistently lower cumulative engagement rate than less disadvantaged schools, indicating a critical priority for intervention.*

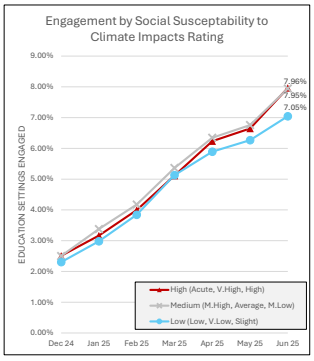


Fig.1c: An insufficient equity response. *While a small gradient exists, engagement rates for the most socially susceptible communities remain virtually parity with less vulnerable ones.*

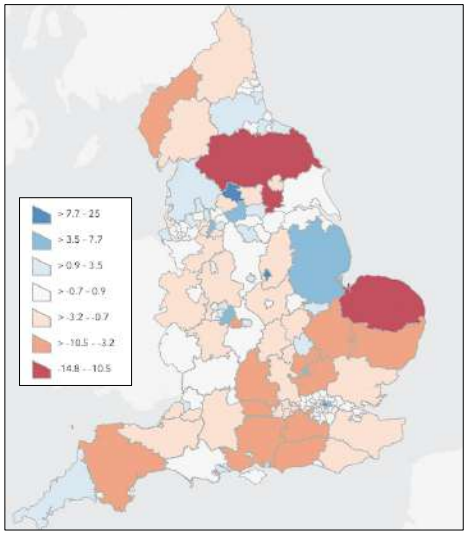


Fig.2: *This map reveals stark regional inequity in programme engagement. Local Authorities are coloured by their* ***Deprivation-Adjusted Gap****—a negative score indicates fewer engagements in high-FSM schools relative to low-FSM schools, weighted by local deprivation levels. Dark red areas (e.g., Norfolk, North Yorkshire) indicate most severe underservice of deprived communities. Blue areas indicate relative equity or better service for high-FSM schools.*

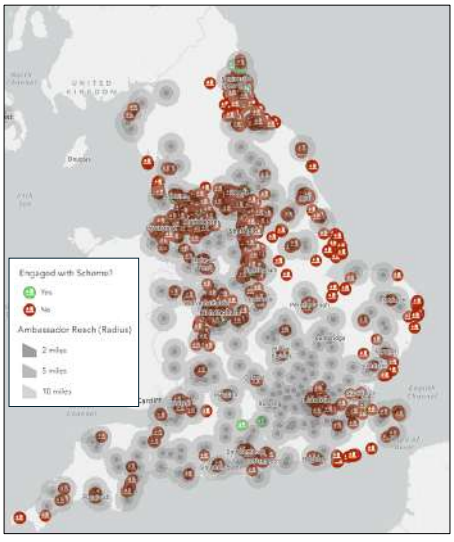


Fig.3: Supply-Demand Mapping. *Mapped are the 1378 schools in England which are most vulnerable. Only 60 have engaged with the scheme. Grey radii represent Climate Ambassador reach up to 10 miles visualising geographical gaps between 'supply' and crucial 'demand'. Large clusters of highly vulnerable schools currently without support (in red) are mostly found in coastal areas particularly in the East, East Midlands and Southeast.*

5. CONCLUSION

A significant climate resilience divide exists. Despite successes, a critical socio-economic gap persists. **1,378** schools at the nexus of high risk and deprivation remain largely unengaged (Fig. 3).

Recommended Next Step: Conduct qualitative research in priority areas (e.g., Norfolk, coastal East Midlands) and success areas (e.g., Tower Hamlets) to understand the barriers and enablers to engagement.

6. SOLUTION: A DATA-DRIVEN TARGETING STRATEGY

TARGET COLD SPOTS — Direct support & resources to **high-gap Local Authorities**

→ **PRIORITISE SCHOOLS** — Execute proactive campaign for the **1,378 most vulnerable schools**

→ **DEPLOY STRATEGICALLY** — Recruit or 'nurture' Ambassadors in cold spots with SEN/resilience expertise

→ **MONITOR & ADAPT** — Track progress with a live equity dashboard

Lead analyst and author: Kit Marie Rackley, UEA Tyndall Centre for Climate Change Research – k.rackley@uea.ac.uk

A SOCIAL PRACTICE PERSPECTIVE ON FUTURE WATER DEMAND CHALLENGES IN ENGLAND 2038 AND 2050

Leilai Immel-Parkinson
Supervisors: Dr Claire Hoolohan and Professor Ali Browne

INTRODUCTION

Water stress is an immediate and urgent problem in England

4.8 billion
litres **per day** expected shortfall in England's water supply by **2050**[1]

65%
of **short-term** activity to resolve deficit from **demand reduction**[1]

20%
Defra **statutory** demand reduction **target by 2038**[1]

70%
more water used per person in the UK **today than in 1985**[2]

Understanding social change

- What are the **everyday practices** that drive water demand? How might they **change in the future,** and with what impacts on demand?
- **Existing studies** that examine future water demand tend to focus on **quantitative forecasting**[3]**.**
- This PhD will add a **complementary perspective,** seeking to understand the social processes **behind the numbers.**

PhD AIMS

1. Enhance understanding of the processes by which domestic water demand changes, with a focus on **contemporary societal trends** in daily life.

2. Generate a range of **possible future scenarios** with the potential to inform **effective policy and innovation pathways** and support contingency planning.

METHODOLOGY

Practice-Oriented Horizon Scanning

- **Horizon scanning** is the systematic scanning of content sources to identify **signals of change** that could indicate nascent **developments or trends** in a particular field[4].
- **Practice-oriented horizon scanning** is a **novel adaptation** of horizon scanning, developed for this PhD. It identifies **signals of change** in the way that **everyday practices** (e.g., cooking, cleaning, showering, gardening) are undertaken.

Case Study: Showering and alternatives

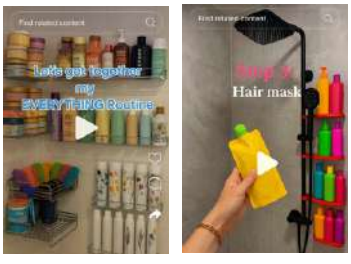
- Showering accounts for 25% of household water use[5] and **29% of water-related CO_2 emissions**[5]**.**
- The way we wash ourselves has **changed significantly** over time. Showering has a high potential for **temporal change.**
- **Showering alternatives** include bathing, sponge/flannel washing, waterless cleansing.

Data Source: TikTok

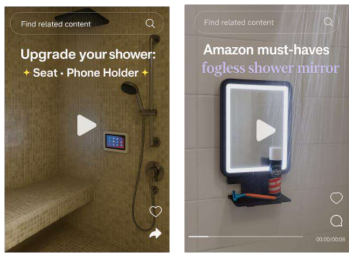
- **High-quality data,** API access for researchers.
- Content about **everyday life.**
- Large, growing user base – **43% of UK population**[6].
- Aspirational content is **relevant for futures research.**
- Evidence of social media data being **successfully** used to **anticipate trends** in other sectors[7].

EARLY RESULTS

Example signal 1: Extended grooming routines



Example signal 2: DIY shower additions



*Images have been AI-generated to protect users' anonymity

Signals can provide **early warning of societal trends** that may influence water demand, indicate the **scale and direction of change,** and **provide intelligence** to inform interventions and contingency planning.

Next steps

Co-develop possible **future scenarios,** and linked **policy and innovation pathways**, during a **participatory workshop.**

Upcoming publications

- 'Demand thinking in household water futures: Characterising assumption of domestic water use' – In review.
- 'Can people more-than-talk about their practices on social media? The possibilities of using short-form video content as an ethnographic data source' – In preparation.

Let's stay in touch... Email LinkedIn

Tyndall Centre for Climate Change Research · Manchester 1824 The University of Manchester · NWG living water

References: 1. Defra 'Plan for water' (2022); 2. Waterwise (2022) 3. Immel-Parkinson et al. 'Demand thinking in household water futures: Characterising assumptions of domestic water use' (In review); 4. Bengston et al. 'Horizon Scanning: A Process for identifying emerging signals of change shaping the future of natural resources management' (2024); 5. Waterwise 'Net Zero and the role of water efficiency' (2021); 6. TikTok (2025); 7. Kalamkopis et al. 'Understanding the predictive power of social media' (2013).

What Does It Take to Lead Climate Adaptation Research?

What systems support or stand in the way of universities and research institutions in Africa in leading climate adaptation research?

Rethinking Research Capacity

- Climate research capacity is often treated as a technical issue.
- But the real constraints are systemic: shaped by leadership, alignment, and long-term support.
- CO-CAT is a tool being co-created with 20+ African institutions to understand and strengthen those systems.

It is not just about gaps. It's about shifting how climate adaptation research capacity strengthening is led from within.

The Challenge

- Africa contributes just 1–2% of global scientific output (UNESCO Institute for Statistics, 2018).
- In some African countries, there are fewer than 50 researchers per million people (HPSR, 2020; IJHPM, 2024).
- Climate change has no borders:
- → 7.7 million people in Africa were displaced by climate-related disasters in 2023 (IDMC, 2024)
- → Over 110 million people in Africa are projected to be at risk from coastal exposure by 2030 (WMO, 2023; IPCC, 2023)

Structural change is urgent and long overdue.

Invitation to Engage

We are co-creating CO-CAT, so we need you.

This poster invites you to help shape the questions we are asking. Your insights can help us surface blind spots, test assumptions, and enrich the work.

This is a shared agenda across sectors, disciplines, and geographies.

What Questions Should We Be Asking?

In whatever role you hold - researcher, policymaker, funder, practitioner, student, educator, parent, or community member:

What should we pay attention to if African universities and research institutions are to lead climate adaptation research that is visible, resourced, grounded, and sustainable?

Your perspective matters - help shape this agenda, starting right here at the conference.

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Scan to explore the project.

DISPOSITION AND DISPOSSESSION:
CONSERVATION-INDUCED LAND RIGHTS INFRINGEMENT OF MARGINALISED COMMUNITIES IN POST-WAR SRI LANKA

University of East Anglia
SCHOOL OF GLOBAL DEVELOPMENT

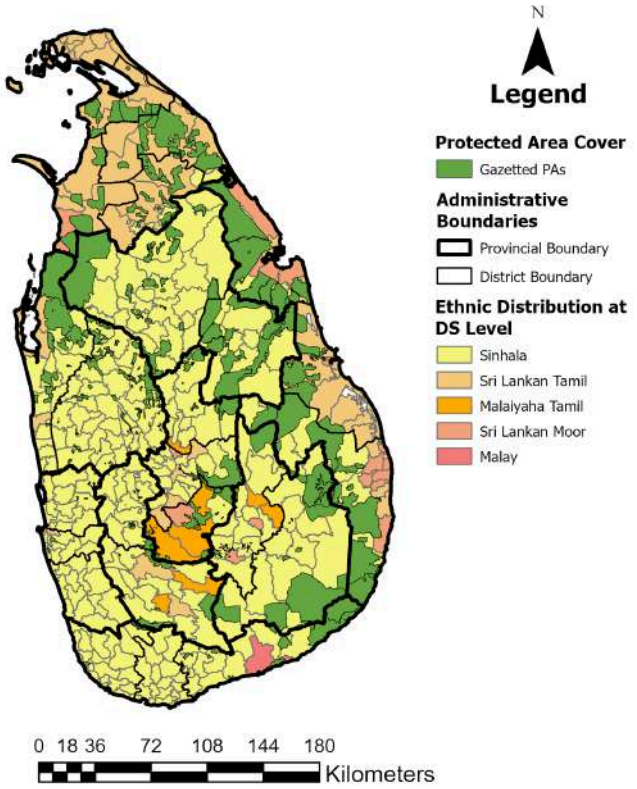
Minuri Perera
School of Global Development, University of East Anglia
Supervisor: Prof Adrian Martin

Introduction

- The state continues to hold its control over post-war Northern and Eastern provinces of Sri Lanka.
- A lesser investigated form of **territorial control** is **through environmental conservation initiatives**, including **Protected Area (PA) Declaration**.
- Post-war PA declaration adds to the **layered experiences of displacement** faced by minority ethnic communities.

Methodology

1. **Spatial analysis** of the PA cover against Sri Lanka's ethnic distribution using ArcGIS Pro
2. **Thematic analysis** of qualitative data from:
    - 10 Key Informant Interviews
    - 4 Focus Group Discussions



Sri Lanka's Ethnic Distribution Against PA Cover

Findings

- The post-war boom in development, and the resultant deforestation, required to be offset by **declaring ecosystems and habitats protected**, with the **easiest to do so being post-war Northern and Eastern provinces** of Sri Lanka.
- A **three quarter of Sri Lanka's PAs** are hosted by Divisional Secretariat Divisions with a **dominant minority ethnic presence**.
- Communities that were once **displaced by the war**, have been **displaced once again from their ancestral lands**, including lands distributed to them through various land alienation schemes.
- The **incoherence** between regulatory frameworks for **land alienation** and **conservation** is a key driver behind conservation-led land conflicts endured by the communities.
- **Grievance redressal mechanisms** available to communities remain **sporadic and expensive**, with communities often receiving poor solutions.

Recommendations

- Develop a **comprehensive land use policy** supported by a set of comprehensive land use maps.
- Follow **participatory approaches** and include communities in identifying landownership and land use patterns prior to PA demarcation.
- Incorporate **social criteria** when designing PAs, including residential areas, farmlands, livelihoods, and customary laws.
- Allow communities to enjoy benefits of conservation by facilitating an **enabling environment for eco-tourism**.

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Greenhouse Gas Emissions Inventory for a Large UK Military base

Tyndall, UEA, Sep. 2025

Oliver Heidrich and Chris Hicks

ROYAL AIR FORCE

Tyndall Centre for Climate Change Research

NATO OTAN

Newcastle University

ViTAL Living Lab

Conducting experiments towards net zero

CRITICALLY GREEN

Tracing the geographical, social and environmental footprint of military decarbonisation

Carbon Accounting Methods

The UK has the fourth-largest defence budget in the World. In 2022/23 the Ministry of Defence (MOD) expenditure totalled £52.8bn. The MOD is led by the Secretary of State for Defence. It includes the Royal Navy, Army and Royal Air Force as well as Strategic Command, the Defence Nuclear Organisation, Head Office and various enabling organisations.

The MOD publishes energy and carbon emissions data since 2009-10. However, the data is based on spending, which is less accurate than activity-based measurement based on meter readings or direct measurement.

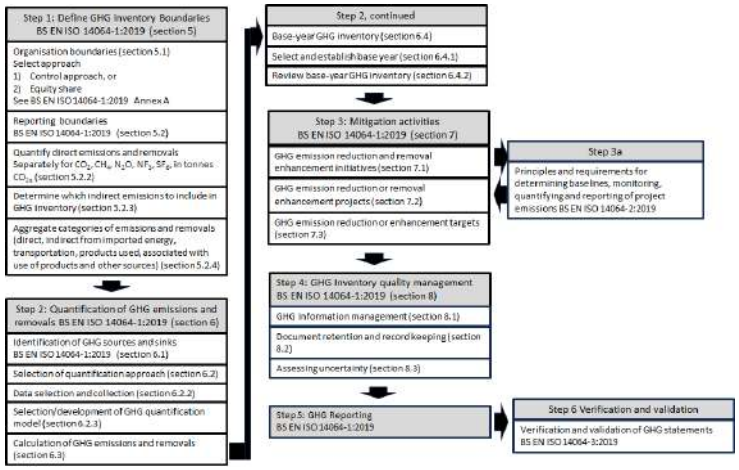

Figure 1. Carbon accounting methodology (based on British Standards Institution)

Benchmarking Emissions

GHG inventories are based on fuel use, waste and energy consumption. The data collection and analysis is essential to enable militaries to set targets and develop/implement climate change mitigation strategies. Some Governments including the UK have introduced environmental criteria into public and military procurement processes to reduce supply chain emissions. To improve the energy efficiency of equipment and estates, smart energy management systems and increase the use of renewable energy is important.

Figure 2. RAF Leeming estate

Future work

Estates across the MOD differ in size, function, infrastructures and operational requirements. This impacts their energy regimes and carbon emissions. It is important to understand the whole life cycle of renewable energy options, fuels and materials supplies used by the MoD (Scope 3 emissions). We recommend to develop a holistic carbon accounting software package that works across the MoD. This comprehensive and dynamic model monitors progress towards Net-zero and selects the best strategy for each estate.

Emission inventories

Emission sources included primary fuel sources (gaseous, liquid and solid), bioenergy (biofuel, biomass and biogas), refrigerants and other products (Kyoto Protocol products, blends, Montreal protocol products, fluorinated ethers and other products), as well as electricity, heat and steam (onsite and district heating). The CO_2 emissions for each facility were calculated from sources, conversions and emission factors (Table 1).

Table 1. Breakdown of energy usage in the financial year 2021-22

Facilities	Emissions kgCO_2eq	
	Electricity (non-heating)	Heating
Hangers	206,925	696,618
Fire services	12,076	19,367
Educational and training facilities	137,681	202,418
Utility supply facilities	11,685	3,828
Accommodation	475,601	871,950
Healthcare/medical facilities	98,357	73,419
Sports and recreational facilities	155,735	238,252
Stores and/or warehouses	267,183	620,609
Food courts & supermarkets	150,198	388,491
Transportation services	69,660	93,455
Staff/crew/changing rooms	57,277	50,690
Support services	68,929	104,564
Waste management facilities	20,213	0.00
ICT facilities	190,756	435,692
Security services	13,694	21,874
Station workshops and mechanical facilities	17,034	36,963
Others	47,281	51,076
Subtotal	**2,000,292**	**3,909,273**
Total		**5,909,566**

Conclusions

The RAF Leeming estate generated 5.9 kt of CO_2eq. in 2021. If no action is taken, GHG emissions will only decrease to 4 kt of CO_2eq. by 2040, due to projected decarbonization of the electricity grid. RAF Leeming needs to implement significant decisive measures to achieve its ambitious target of Net Zero by 2040.

Our results show that RAF Leeming could achieve Net Zero by 2040 if it follows the recommended management, operational, and maintenance actions, employs solar PVs for electricity generation, geothermal heat pumps for heat generation, and ERW carbon capture to balance carbon emissions. This requires decisive action, including infrastructure development for renewable energy production on the base, starting as soon as possible.

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Building adaptive capacity through collaboration: A Transport for London (TfL) case study

Sarah Greenham[1], Nicolas Vecchione[2], Katherine Drayson[2], Emma Ferranti[1], Friederike Holz[2], Rebecca Powell[2], Andrew Quinn[1]

[1] Department of Civil Engineering, University of Birmingham, United Kingdom | [2] Transport for London, United Kingdom

Context: Climate change and transport

Extreme heat events are increasing in frequency and intensity due to climate change[1]. Annual average temperatures have increased in London, shown in the warming stripes[2] below. 40°C was first reached in July 2022[3].

Past studies on railway infrastructure in the UK during extreme heat events identified impacts such as **track buckles**[4-7], delays to services due to **speed restrictions** to reduce track buckle risk[6], and **"failure harvesting"** – where high temperatures earlier in the season lead to failures, assets being replaced, and the network gradually being able to withstand higher temperatures during the hottest parts of the summer[5,7]. The relationship between temperature and impacts on transport systems is therefore complex but crucial to address. As such, infrastructure owners and operators periodically report on progress in responding and adapting to climate change via UK Government's Adaptation Reporting Power (ARP)[8].

PhD and beyond: Knowledge transfer with TfL

This project extends the research conducted for a PhD project, titled *Quantifying the impact of heat and climate change on London Underground's infrastructure*[9]. This study produced **fault exposure rates** for temperature across the network by synthesising weather and climate data with TfL points, crossing, and train stop asset fault data. Key findings include:

- **Fault exposure rates across the network vary** in response to temperature.
- Some assets are particularly vulnerable to heat and in some cases, **potential failure thresholds could be** identified.
- There are **indications of failure harvesting**, which may impact future heat risk management of assets in the transition from spring to summer.
- Heat is experienced differently across the network, and it is possible to **estimate tunnel temperature** using surface temperature measurements as a proxy.
- Climate change is likely to **increase future points-related failures**, by up to 10%.

There is interest from TfL to apply the methodological approach to other assets and transport modes. This project comprises three workstreams to build TfL's adaptive capacity via stakeholder engagement and collaboration.

1. Dissemination of PhD findings

A range of material was prepared for internal use at TfL that summarised different parts of the PhD project, including:

- A **comprehensive report**, a **briefing note**, and **presentation slide decks** that highlighted key findings.
- A **methodology guide** on fault exposure rates.
- Presentations **and follow-up engagement** with Track Asset Management and Data Science teams at TfL.

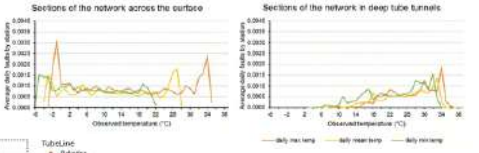
The study findings also feature in TfL's latest ARP report[10].

Presentations were delivered at events and conferences:

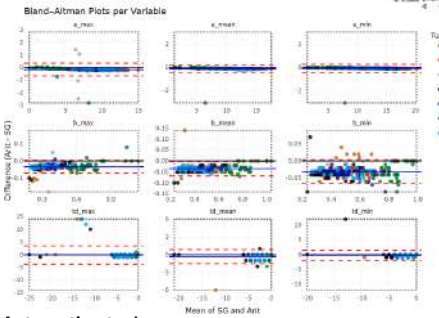
- Transport Adaptation Steering Group (online), March 2024.
- IGSNRR, IWHR, and NINH (China), May-June 2024.
- Transit Data (UK), July 2024.
- UNECE Group of Experts (Switzerland), May 2025.

2. Scaling-up analysis with TfL Data Scientists

TfL Data Scientists are advancing the PhD methodology for the benefit of TfL activities. The current aim is to replicate the PhD results with the same data, while developing reproducible code and scrutinising current and potential alternative datasets for future uptake by the team. Therefore, the PhD project carried out initial exploratory analysis, and the TfL Data Science team are validating, automating, and ultimately, scaling up and extending analysis.



Right: Total fault exposure rates of points assets for the surface and deep tube tunnel parts of the London Underground network, from the period 2006-2018. These are the results that the Data Science team aim to reproduce in future.



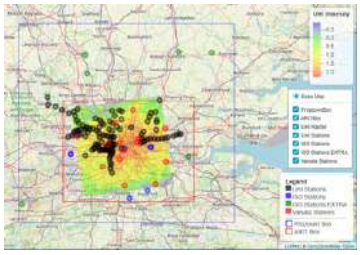
Left: Comparison of tunnel temperature model equation variables between PhD project (SG) and TfL validation exercise (Arit).

Validation tasks:

- Testing tunnel temperature estimation model from surface air temperature and with PhD results (in good agreement).
- Comparing surface temperatures adjusted for the urban heat island (UHI) effect with alternative weather stations and with PhD results (in progress).
- Replicating fault exposure rates for the same study period (next planned activity).

Automation tasks:

- Code brought into repository, refactored for replicability and documented. Tools: Git, Github Codespaces, Databricks, Azure DevOps, R, Python, Arrow, Spark.
- Alternative weather data investigated: ISD, Vaisala.
- Databricks Delta tables created for:
  - UHI register by London Underground segmentation codes for all stations.
  - Tunnel temperature model parameters fitted.
  - Historical surface temperature observations.
  - Historical tunnel temperature observations.
- Next steps: arrange a pipeline for tunnel temperature data ingestions and determine best surface air temperature source(s) considering the UHI adjustment.



Above: Site locations and boundaries for UHI comparison analysis. ISD = Integrated Surface Database, compiled by National Oceanic and Atmospheric Administration (NOAA).

Potential use cases:

- Fault exposure rate analysis study extension for various asset categories e.g. track, signalling.
- Adopting the methodology to investigate weather impacts on passenger behaviour/complaints.

3. Stakeholder interviews

A survey and optional follow-up semi-structured interviews with asset managers across TfL were conducted in June-July 2024. The aim was to identify if there are any knowledge gaps between empirical analyses presented in literature and stakeholder experiences related to the impacts of extreme temperatures and climate change across London. Key findings include:

- A **good awareness of climate change** exists, but operational actions focus on reacting to extreme weather.
- Extreme heat is often the **"straw that breaks the camel's back"** and is thought to bring forward failures that were likely to eventually occur.
- Systematic data capture of weather-related incidents and other climate impacts across asset management is limited/informal; there is a **reliance on tacit knowledge**.
- **High daily minimum temperature** is a challenge for some assets throughout the summer, where they cannot sufficiently cool down overnight.

Conclusions and forward look

TfL has substantially advanced adaptation action in recent years. It is crucial that momentum continues, to build knowledge and adaptive capacity in resource-constrained environments. This project highlights the benefits of a collaborative approach and offers thoughts on future research directions.

- Resource- and time-constrained decision-makers benefit from academia scoping initial exploratory analysis.
- There were unrealised benefits of sharing data with stakeholders beyond its existing/typical use.
- The methodology validation added scientific robustness from impartial experts familiar with TfL data.
- Automation improves transparency and efficiency of procedures for future iterations of analysis at TfL.
- Stronger partnerships and increased levels of trust formed from across all stakeholders engaged.
- More and improved results for interpretation are anticipated to feed into TfL's ARP5 submission.
- Climate awareness raised across TfL asset managers can support TfL's increased data collection ambitions.
- Future studies should investigate the impact of high daily minimum temperatures and consider using statistical techniques that capture more nuanced temperature-asset failure relationships (e.g. lags).

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[7] Fu *et al.* (2018). *A prototype model for understanding heat-related rail incidents: a case study on the Anglia area in Great Britain.* 8th International Conference on Railway Engineering (ICRE 2018).
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[9] Greenham (2023). *Quantifying the impact of heat and climate change on London Underground's infrastructure.* PhD Thesis, University of Birmingham.
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UNIVERSITY OF BIRMINGHAM
TRANSPORT FOR LONDON
UKRI Engineering and Physical Sciences Research Council

Scaling Nature-Based Defences: Modelling Surge and Wave Attenuation by Saltmarshes and Mangroves

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Tyndall Center, ENV
University of East Anglia

BACKGROUND

This research is part of a large EU Horizon funded REST-COAST project where main objective is finding the ecosystem benefits from restoration of coastal wetlands.

Research Gap

- Wide range of research but very much site specific
- No generalize framework for quantifying wave and surge reduction

REST-COAST

Global coastal protection benefits from restoration coastal wetlands

Global assessment of waves and surge attenuation by wetlands

AIM

To evaluate and quantify the protective benefits of saltmarshes and mangroves as nature-based solutions (NbS) for mitigating coastal flood risks under climate change using process-based numerical modelling across diverse environmental conditions.

OBJECTIVES

- To develop and apply a process-based numerical modelling framework for simulating surge and wave attenuation by saltmarshes and mangroves.
- To assess the influence of cross-shore slope, vegetation roughness, tidal range on surge and wave reduction.
- To generate transferable insights that can inform practitioners, policymakers and planners on the effective restoration of saltmarshes and mangroves as nature-based solutions.

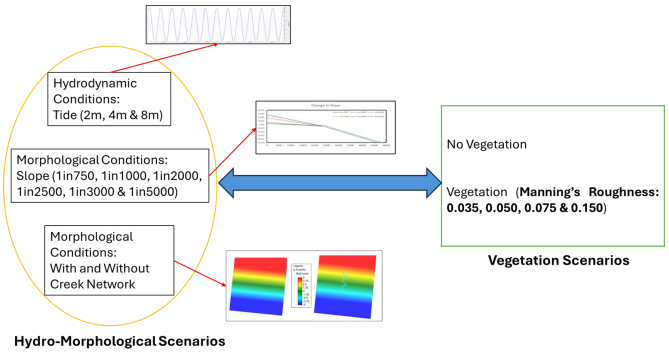
METHODOLOGY

Literature Review to understand physical processes → Develop synthetic flood plain model to assess surge attenuation → Analyze model results to understand surge reduction and develop general relationships → Validation model for three test cases
1. The Wash, UK **(Saltmarsh)**
2. Sundarbans, Bangladesh **(Mangrove)**
3. Beijia, China **(Mangrove & Saltmarsh)**

Bed Roughness: Manning's Number (for saltmarsh and mangroves)

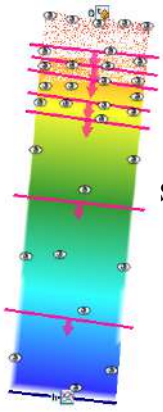
Global Topographic Dataset (DeltaDTM)

Synthetic Flood Plain Model

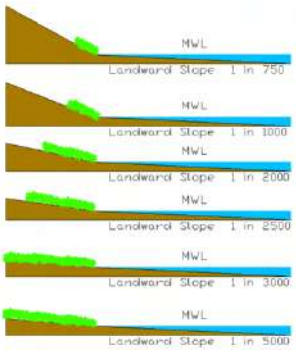


FUTURE WORK PLAN

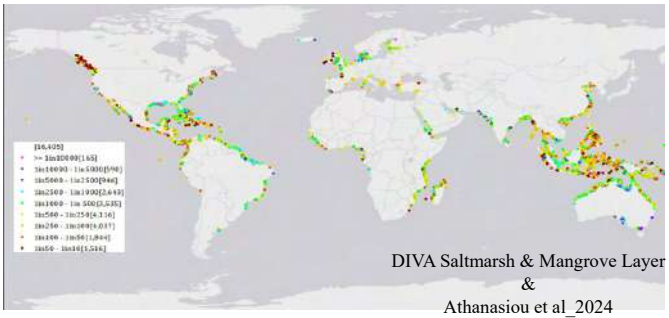
- Validation of surge attenuation on the study sites
- Global assessment of wave attenuation rate for saltmarsh and mangroves
- A Map based output for Global Surge on the basis of Coastal Slopes and Tidal Range



Synthetic Flood Plain Model Delft3D FM

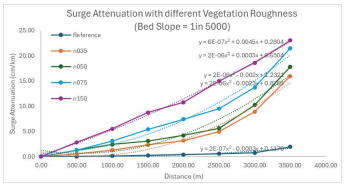


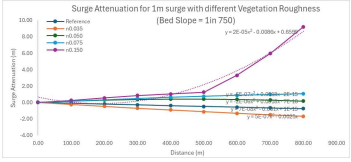
Coastal Slopes



DIVA Saltmarsh & Mangrove Layer
&
Athanasiou et al_2024

RESULTS





Surge Attenuation, DS = S' – S
Normalization = DS (cm)/distance (km)
S' = Surge height at the vertical location
S = Surge height at the start of vegetation

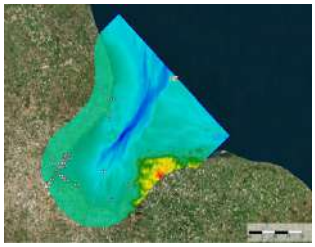
WAVE AND SURGE ATTENUATION FUNCTIONS

Surge attenuation function: (s, slope, width) -> s´

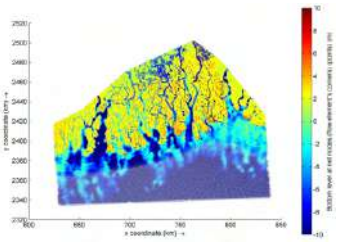
Wave attenuation function: (h, slope, width) -> h´

- s initial surge height
- h initial wave height
- s´ attenuated surge height
- h´ attenuated wave height
- $width_{t-1}$ = the wetland width at time t-1 (km)
- $slope_{t-1}$, = the wetland slope at time t-1 (dimensionless)

Validation Sites



The Wash (Saltmarsh)



Sundarbans (Mangrove)

FROM SCARCITY TO CRIME: A SYSTEMATIC LITERATURE REVIEW OF WATER THEFT DEFINITIONS.

CONTRIBUTING PAPER TOWARDS PROJECT: ILLEGAL WATER USE: ASSESSING THE EXTENT, DRIVERS AND SOLUTIONS IN IRRIGATED AGRICULTURE.

TARA TAYLOR-DEACON
SUPERVISORS: DR TIMOTHY FOSTER & DR CLAIRE HOOLOHAN

1.INTRODUCTION

Unregulated water abstraction rates take up a significant share of global water use [1]. Despite this, there is no universal definition of water theft, which leads to often inappropriate policy instruments [2]. This systematic literature review examines how illegal water use is characterised in academic literature and how this shape policy responses. Findings highlight water theft as a socio-political, institutional, environmental, and economic issue, driven by diverse motivations.

2. RESEARCH QUESTIONS

1. How is water theft defined and conceptualised across disciplines?
2. What challenges arise when definitions are applied across diverse contexts?
3. How do these framings shape policy and enforcement strategies?

3. METHODOLOGY

- Systematic literature review conducted using PRISMA framework [3].
- Search strategy: Boolean strings targeting illegal/unauthorised water use/ water theft (time horizon 2004–2024).
- Screening: Title, abstract, and full-text filtering with 64 articles (of 2,320) accepted.
- Analysis: Deductive thematic coding.
- Quality assessment: Hawker et al.'s quality assessment criteria applied [4] [5].
- Data management: Microsoft Excel and Zotero.

4. ANALYSIS

Informality Vs Illegality

- Informal systems vary from small-scale businesses to larger networks such as 'water mafias'.
- Urban informal markets dominate existing 'water theft' literature; yet the existence of both urban and rural informal networks provide essential water accessibility.
- Labelling informal water use as 'illegal' can criminalise survival-driven water use practices that are conducted outside of legal parameters.

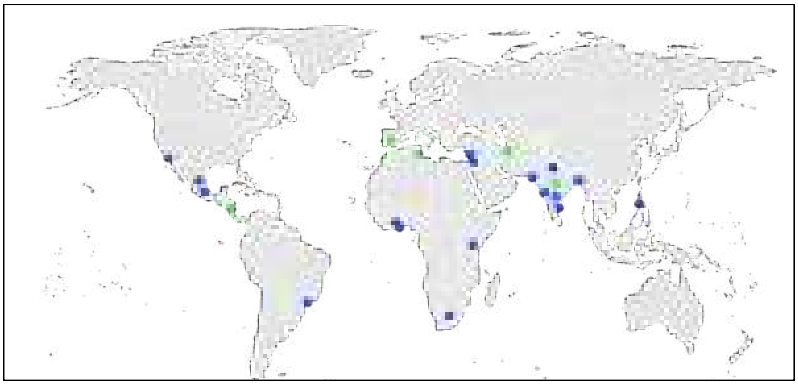


Figure 1. Scatter map displaying the distribution of informal water market legality debates documented within the accepted sources across urban (blue) and rural (green) contexts.

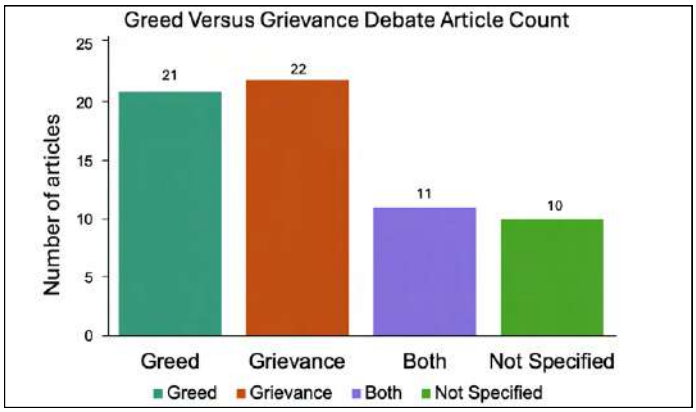


Figure 2: Bar graph evidencing frequency of accepted sources referencing debates between greed verses grievance motivated water theft.

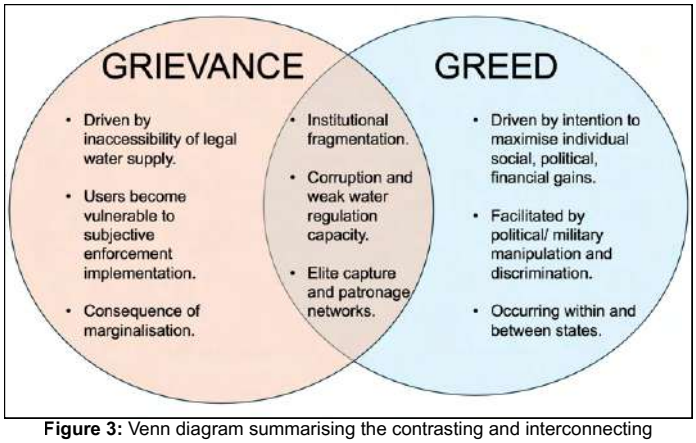


Figure 3: Venn diagram summarising the contrasting and interconnecting charactreisations of greed-driven and grievance-driven illegal water use.

5. RESULTS/ POLICY IMPLICATIONS

- Contextual-sensitivity is essential to equitable water management: avoid sanctions that criminalise survival-based illegal water use.
- Strengthen institutional capacity: improve monitoring, transparency, and accountability in global water governance.
- Address corruption: prevent the exploitation of water via elite capture.
- Recognise water as a human right: balance water conservation with accessibility.

6. CONCLUSION

Water theft is a symptom of governance failures. Definitions that criminalise informal water systems risk punishing vulnerable communities. Water management policies must address infrastructural underinvestment, corruption, and selective implementation of water regulatory measures. Recognising water as both a finite resource and a fundamental human right is essential for designing sustainable and inclusive water governance frameworks.

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** This project is part-funded by and conducted in collaboration with Greater Manchester Combined Authority (GMCA)

A New Framework for Urban Climate Action

'Improving Private Sector Engagement in Greater Manchester's Climate Action Framework'

What is this about ?

Greater Manchester (GM) has an ambitious goal to achieve carbon neutrality by 2038,

-- *via Five-Year Environment Plans and the mission-based approach.*

But they are **NOT** on track!!!

Wait a minute.. What is a mission-based approach?

Ambitious goals → Collaborative action → Innovative solutions → Long-lasting transformation

(Mazzucato & Dibb, 2019)

Okay, so what ?

Cities → Biggest emitters and are highly vulnerable to climate change.

City authorities must ramp up climate action fast.

This project is looking at how exactly cities can do this by engaging the private sector.

Great! What's the Plan ?

This project will compare how cities worldwide engage the private sector and the challenges they face,

-- *to design a new governance model for cities to engage the private sector in climate action.*

WHAT HAVE BEEN DONE SO FAR?

Comparative Case Analysis

Analysed how Valencia, Camden, and Greater Manchester implemented their net-zero '*missions*'.

What were the lessons from Greater Manchester, Valencia, & Camden?

Greater Manchester has detailed action plans, but the scale and pace of delivery was not enough.

Why?

València has a comprehensive stakeholder engagement structure.

What can GM learn from that?

Camden has an iterative evaluation framework that feeds learnings back into the mission design.

How would that work in GM?

Stakeholder Map

Mapped the '*missing*' private sector organisations from GM's climate governance structure, creating a 'how-to-do' framework that other cities can use.

1. DECONSTRUCT the policy
2. IDENTIFY who's relevant
3. CATEGORISE by the role
4. PRIORITISE using an impact-interest matrix
5. RINSE AND REPEAT to identify 'Who else is missing'

WHAT'S NEXT ?

Multi-Site Case Study Analysis

2 Themes of Case Analysis

Theme 1

Case analysis on implementation of mission-based approach in different cities for a net zero goal

Theme 2

Case analysis on different urban climate governance mechanisms and how cities mobilise private sector

Interviews and Workshops

2 Phases of Interviews

Phase 1: GM

Greater Manchester climate governance teams

Phase 2: International

City representatives from selected case studies

Workshop with Greater Manchester Combined Authority

WHAT'S THE GOAL?

The Goal is to ...

Design a **Revised Governance Approach** for cities to improve climate action by actively engaging the private sector

References: Mazzucato, M. and Dibb, G. (2019). *Missions: A Beginner's Guide. UCL Institute for Innovation and Public Purpose.*

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PhD Researcher @ University of Manchester

Supervisors: **Dr Christopher Jones, Prof Carly McLachlan, and Dr Claire Hoolohan**

External Collaborators: **GMCA Environment Directorate**

MANCHESTER 1824 The University of Manchester

Tyndall Centre for Climate Change Research

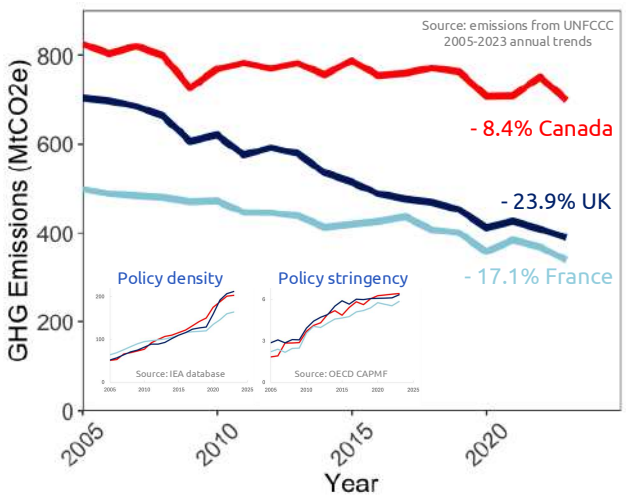
GMCA GREATER MANCHESTER COMBINED AUTHORITY

Drivers of emissions reductions in Canada, France, and the UK

Corinne Le Quéré[1], Adam Smith[1], Simon Schaub[2], Jale Tosun[2], Andy Jordan[1]

1. Tyndall Centre for Climate Change Research, School of Environmental Sciences, University of East Anglia (UEA)
2. Institute of Political Science, Ruprecht-Karls-University Heidelberg

Canada, France, and the UK have very different emissions decreases, despite having more similar policy density and stringency – why is this?

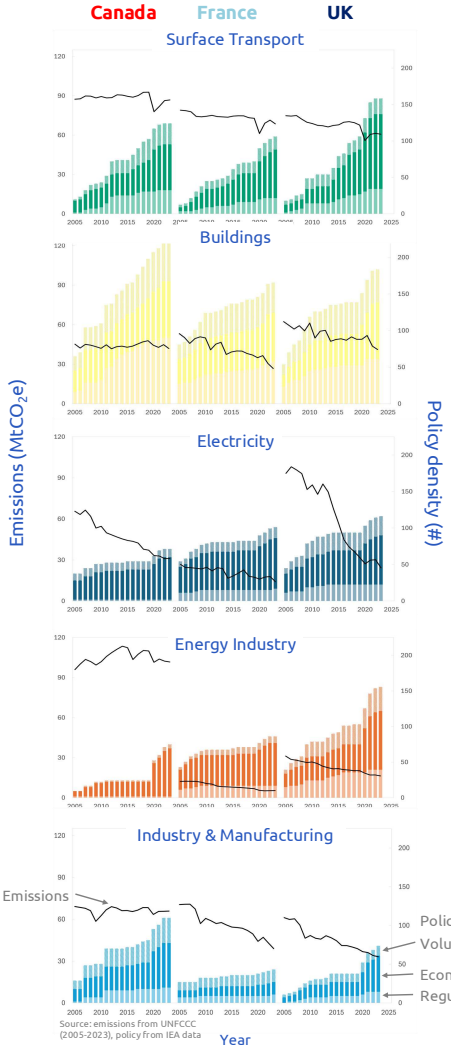


Preliminary take aways

- ❑ The differences in emissions trends among countries and among sectors:
  - ➔ cannot be explained primarily by policy density or stringency
  - ➔ but are correlated with experts' assessment of (1) ambition, extent, and effectiveness of single policies and (2) the coherence of policy packages
- ❑ France and the UK managed deeper reductions in total emissions than Canada
  - ➔ experts suggest coherence between federal and national level directives helped in the UK and EU, while in Canadian, federal policy have often been ***weakened*** by conflicting provincial policies (or vice versa)
- ❑ Higher ambition in some sectors, more coherent policies at different governing levels, and more coherence between climate and other policies, would all accelerate emission reductions

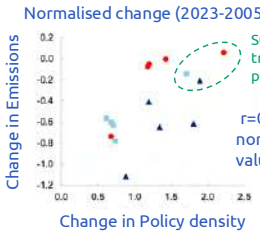
Preliminary analysis using the IEA sectoral policy database highlights issues in implementation and/or effectiveness

Some issues are shared across countries (e.g. transport), some specific to countries (e.g. industry)



Sectors with lower decreases in emissions tend to be those with higher increases in policies

(e.g. surface transport, some industry)



Possible explanations:

- Low-C alternatives not available
- Policies not at the right level
- Policies not effectively implemented

Canada emissions trends are notably below those of France and the UK in all but the electricity sector, despite putting most efforts in buildings and industry

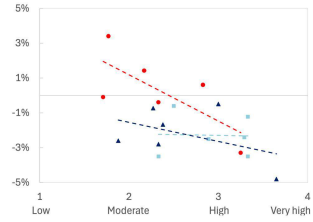
Data sources and links

- ❑ UNFCCC National Inventory submissions
- ❑ IEA Policies and Measures database
- ❑ OECD CAPMF database

A survey of 85 sectoral experts suggests that decreases in emissions at the sectoral level result from policy efforts (direct or indirect)

Higher ambition in some sectors, more coherent policies at different governing levels, and more coherence between climate and other policies, are all factors that would accelerate emission reductions

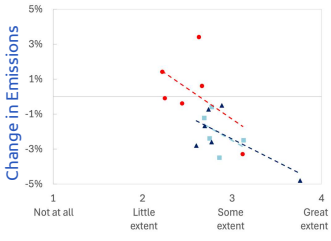
What is the level of policy ambition?



The level of policy ambition is correlated with emissions decreases (r = −0.55)

The lack of coherence between federal and provincial/national policies often mentioned as harming progress

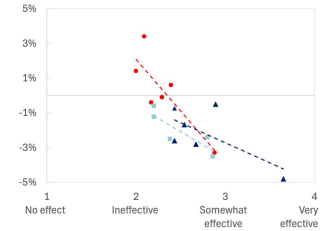
What is the effect on target behaviour?



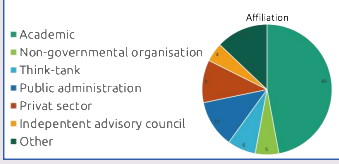
The extent to which policies have promoted and facilitated low-C alternatives is correlated with emissions decreases (r = −0.66*)

Conflicts with non-climate policy support (e.g. favourable taxation for gas over electricity, inconsistent regulations, discontinuities in subsidies) often mentioned as harming progress

What is the policy effect on emissions?



The effectiveness of policies according to experts indeed correlate with emissions reductions (r = −0.77)



Methods

- ❑ Survey responses received between December 2024 to March 2025.
- ❑ Canada n=70, France n=53, UK n=67
- ❑ **Thank you to all contributing experts**

* The fossil industry sector in France was excluded because of the low number of respondent and the low associated emissions

Acknowledgements: Emissions data were accessed from national inventory submissions to the UNFCCC. Policy data were accessed from the IEA Policies and Measures database and OECD Climate Actions and Policies Measurement Framework database. Henriette Gaus analysed expert survey results and we thank all contributing policy experts who responded to our survey. Ethics approval for our expert survey was granted by Ruprecht-Karls-University Heidelberg.

Funders: AS was funded by the Dr A.H. Heineken Prize for Environmental Sciences awarded to CLQ in 2020. CLQ was supported by a Royal Society Research Professorship (RP\R1\191063). AJ, SS, and JT were funded by the ERC Advanced Grant Deep Decarb (882601).

Grŵp Herio Cymru
Sero Net 2035
Wales Net Zero 2035
Challenge Group

Net Zero Wales by 2035
Education, Jobs and Work

Swansea University
Prifysgol Abertawe

Jennifer A. Rudd[1], *Sarah Clayton*[2], *Ben Rawlinson*[3]

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Key Pathways

- Introduce a National Green Skilling Wage for full time study, work experience and apprenticeships to incentivise widespread upskilling that is accessible to all, aligned with Wales' net zero ambitions.
- Build on the model of Carmarthenshire County Council to establish teacher/student Climate Action Groups in every local authority in Wales by 2030 to mainstream climate education across all subjects and levels.
- Mandate climate and nature literacy modules for all further and higher education students.
- Conduct a sustainability audit of all tertiary education courses to ensure curricula are relevant to the climate and nature crises.
- Create a carbon and nature literate workforce by establishing a continuing professional development pathway for all professionals by 2028.

Context:

Climate change is one of the greatest existential threats to human life. Securing a liveable and sustainable future for all requires 'rapid and far-reaching transitions across all sectors and systems'. Despite this, the public is largely unaware of the threat to their lives and the lives of future generations. The current education model does not clearly convey that the climate crisis is an emergency, requiring action from everyone, including students, who must act on it, as well as live with the consequences. While the Welsh Government's ongoing initiatives to tackle climate change are commendable and recent legislation provides a robust framework for further actions, sustained and enhanced efforts are necessary to ensure a just transition to net zero.

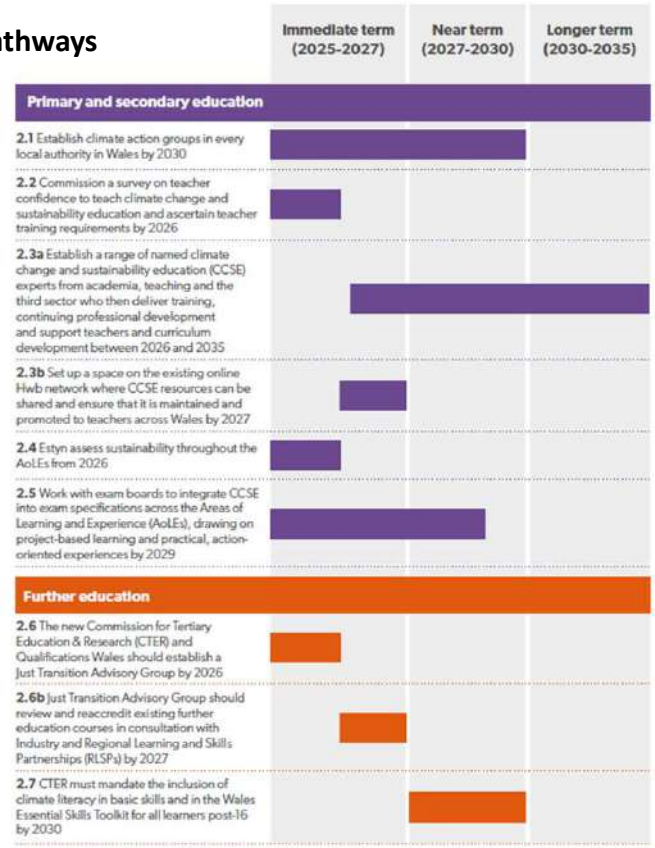
a) **The Welsh workforce is underprepared to capture the benefits of a net zero transition.** Wales faces significant hurdles due to a high proportion of low-skilled workers and decreasing participation in further education, indicating a lack of preparedness for a carbon neutral economy.

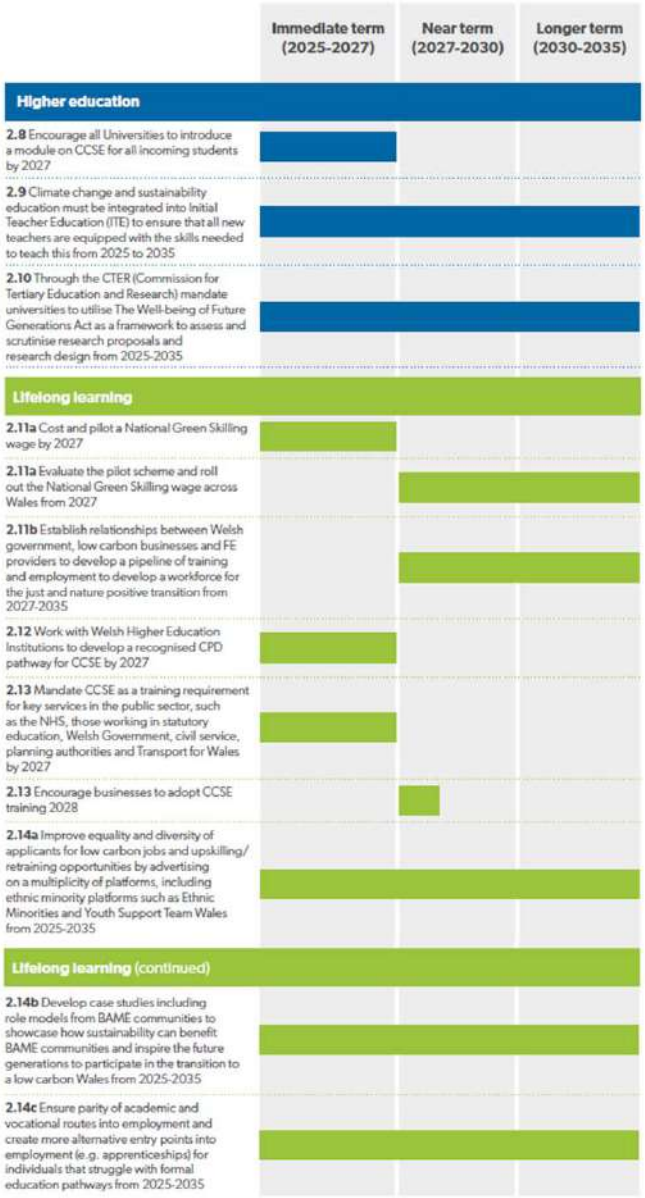
b) **Wales lags behind the UK in productivity.** The 2021 ONS survey found that Wales had one of the lowest productivity per hour worked, alongside Yorkshire and The Humber and the North East. This emphasises the critical role of skill development in driving economic growth. The WMCA, comparable in size to Wales, has shown how this is possible using devolution and government funding to up-skill and reskill the population, stimulating job growth in the region.

c) **Education on understanding and addressing climate change is lacking.** Although Welsh recycling rates are excellent, most UK citizens think recycling is the highest impact climate positive action they can take. Despite high concern about climate change, the public is poorly engaged in climate action, and there is low political will for change. Appropriate education from primary school through to retirement will galvanise support for higher impact actions at individual, community and political level.

d) **The sustainability aspect of the Curriculum for Wales could be lost**. The incorporation of sustainability into the new Welsh curriculum is an exciting opportunity to instil a sense of global responsibility and climate action from a young age. However, this aspect of the curriculum could be lost if teachers are not provided with appropriate support to deliver the learning to their students. Additionally, learners will not engage with this topic unless it is made relevant to them and their context, necessitating the need for place-based and project-based learning. Learners will also need opportunities to take positive, collaborative climate action to feel empowered to act on climate change rather than just learn about it. Working with teachers and learners in collaborative, local authority based groups will enable the exchange of ideas and allow learners to observe climate action beyond the school level.

Key Pathways





Case Study – Carmarthenshire Climate Action Group

The CAG, established in November 2021, includes pupil representatives from 15 primary and 11 secondary schools, along with senior Council members and officers. This structure provides clear communication pathways and increased opportunities for cross-departmental collaboration. When appropriate, the CAG contributes to decision making and provides pupil representation across all departments within the Local Authority.

Meetings, held every three months, are chaired by two pupil representatives on a rotating basis. The meetings provide an opportunity for the CAG to discuss issues relating to climate change, share best practice climate change education lessons, discuss new climate initiatives happening across the local authority and bring barriers to climate action to the attention of the Local Authority.

The CAG can engage with elected members, council officers and external organisations on climate change issues. Through this platform they are able to support their schools and local communities by raising awareness and initiating positive adaptations that address the climate and nature emergency. This fosters a culture of care and responsibility for our future generations at local, regional and national levels.

CLIMATE CHANGE AND SUSTAINABILITY EDUCATION IN ALN AND ALTERNATIVE PROVISION SETTINGS

Shannon O'Connor[1], Dr Jennifer Rudd[1], Dr Dai Thomas[2] and Bryony Bromley[3]

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INTRODUCTION

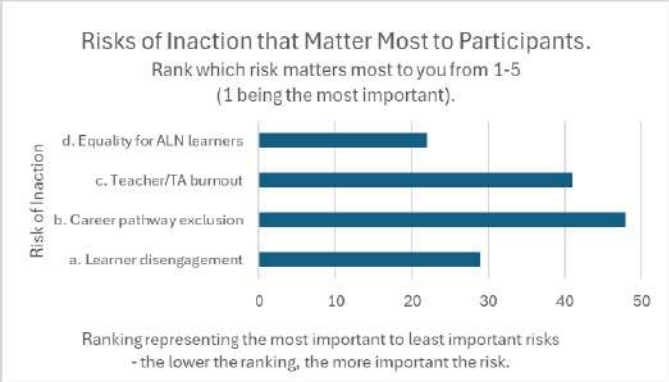
Climate Change and Sustainability Education (CCSE) is central to the Curriculum for Wales and global goals (SDGs 4, 10, 13), yet delivery is inconsistent, especially in additional learning needs (ALN) and alternative provision settings. Existing resources rarely meet diverse learner needs, leaving educators to adapt or create materials. This research, based on interviews with staff across ALN and alternative provisions in Wales, explores current CCSE practice, highlights key gaps, and offers recommendations for more inclusive approaches. Ensuring equitable access to CCSE is essential for climate justice and for achieving Wales's net zero targets by 2050.

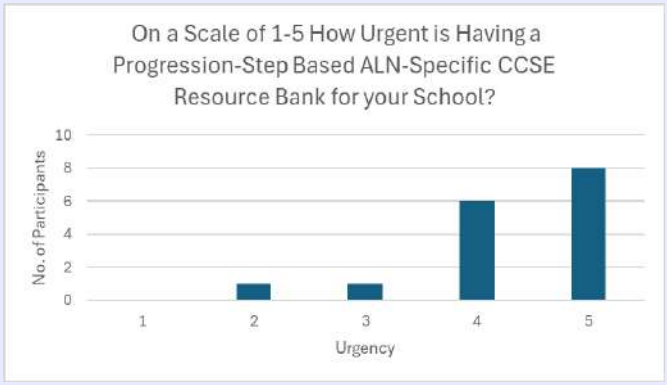
> " I was trying to figure out how I would do it [make an activity on coal mines] ... I just didn't do it; it just didn't exist."

DELPHI STUDY

The aims and outcomes of the micro Delphi study were:

- Validation and Solidification of Research Findings
- Identification of Priority Areas
- Generation of Actionable Insights
- Stakeholder Engagement and Buy-in
- Identification of Future Research Directions





> "For our learners, we have to bring it more to life. So, we have to make it a real living, breathing thing for them to actually buy into the idea".

RECOMMENDATIONS

- Develop and deliver ALN-specific CCSE resources and training, ensuring content is age-appropriate for older learners and accessible for pre-progression step levels.
- Embed sustainability as a cross-curricular thread across all Areas of Learning and Experience.
- Reduce teacher and TA workload by investing in high-quality, ready-made CCSE materials.
- Provide inclusive, practical training for both teachers and teaching assistants.
- Establish dedicated CCSE networks and communities of practice for ALN educators.

Acknowledgements: We acknowledge funding of a SMART Partnership through the Welsh Government and additional funding from MEDR. We acknowledge all the teachers and teaching assistants who contributed to this study.

Tyndal Annual Conference 2025

Barriers to Implementation of Displacement Policies and Strategies in Bangladesh

Md Redwanul Islam Chowdhury, Parvez Bhuiyan and Mahmudol Hasan Rocky [Refugee and Migratory Movements Research Unit (RMMRU)]

Background

- Every year, Monsoon floods causes a displacement of an average of one million people in Bangladesh . Cyclones trigger a further 110,000 internal displacements annually (IDMC 2025)
- The government of Bangladesh has three types of interventions in managing displacement- Post disaster support in place of origin, in respect to local integration and resettlement in planned relocation
- This poster concentrates on policies and actions related to planned relocation
- Based on the review of the planned relocation policies and actions this poster demonstrates that there is a major gap between existing policies and their implementation

Objective

•This poster aims to understand level of implementation of the policies in climate-vulnerable coastal areas.

•The assessment focuses on infrastructure, community participation and institutional coordination

IDMC Data on Displacement (2025)

Methodology

- **Mixed-Methods Interdisciplinary Approach**
- **Thematic Policy Analysis:** 10 policy papers on Planned relocation in Bangladesh
- **Qualitative Research:** 16 KIIs and 12 FGDs under JRPR
- **Participatory Methods:** 76 Photovoice under SUCCESS and JRPR

Multi-Stakeholder Engagement

- Government & Policy Actors: • Disaster management agencies, municipal leaders & planning boards
- Civil Society & Grassroots Networks: • NGOs and CSOs
- Academia and Global Organisations: • Research institutions & international bodies
- Community Leaders: • Village representatives, self-help groups & district officials

Studied Policies

- Bir Ashrayan Guideli Loan Guidpin Nijomite Grihio Training
- Disaster Management Act, 2012
- Climate Resilient House
- Policy on Char development project
- Rehabilitation for the landless and the homeless on the occasion of Mujib 100
- Resettlement Plan: Chenchuri Bill Sub-Project
- Resettlement Action Plan for Matarbari 2

Identified gaps

- In Ashrayan Guideline, there was little detail about community representation and how individuals could make appeals to the authority
- In Ashrayan Guideline, opportunity to retrieve necessary documents are mentioned but the action regarding this are not suggested
- There is lack of documents on long term and short-term risk assessment in Climate Resilient Houses. Also, there is nothing mentioned in the policy about the necessity of the initiative.
- In Housing on the occasion of the Mujib 100 years celebration, there is a formal stated process, but it lacks mechanism of accessing to justice for the displaced.
- In the Resettlement Plan for Chenchuri Beel Sub project, there are lackings in consultation process with the affected population, the design was specified and pre-determined
- In Matarbari Housing Project, there was some attempt to accommodate local needs but found limited efforts in documentation.
- According to the structure of the Inter-Agency Standing Committee (IASC), recovery of housing, land and property damaged by disaster should be entitled for the displaced in the relocation sites but none of the studied policies have any provision of that.

Lived Experience

- *I used to beg for my living after the Cyclone Amphan hit my village, devastated my house and source of livelihood. I begged for a place of living in different government offices in different time. I suffered a lot in rain and flood. One day I heard the local government authority was announcing for application for the houses of Ashrayan in Gavarchar, Satkhira. I applied for the house in 2020 and in January, 2021 finally I shifted in my house in the Ashrayan! The Upazila Nibahi Officer asked her officials to manage a livelihood opportunity for me by providing a small shop. They helped me in receiving BDT 25000 for setting up a shop in the resettlement site and now I earn my living through this shop.- Abbas Ali Mollick, Gavarchar Ashrayan 2, Satkhira*
- *Water scarcity is a challenge in our Mukimpur Ashrayan. 15-20 families are dependent on each tubewell, every time we have to wait in a long queue while fetching water.– Farzana, Ashrayan 1, Mukimpur, Noakhali.*
- *Gavarchar Ashrayan 2 where I am relocated, faces the problem of too much iron in water in the tubewell. The tubewell is situated far away from my home. – Reshman Khatun, Gavarchar Ashrayan 2, Satkhira*
- *In the planning meeting of the Gucchagram 1, we expressed desire to have a mosque and a graveyard in the relocation site. Authority did provide a land for graveyard but did not build the mosque. We the dwellers generated fund and built our own mosque. However, the place for graveyard is now being grabbed by locally influentials. We are powerless in fighting them. The government is not coming to our aid. - Shahidul, Gucchagram 1, Tala, Satkhira*

Implementation Success

- In all the 10 planned relocation sites, the landless and homeless people get permanent house to live with 2 specious rooms, an attached toilet, a kitchen and a balcony
- In all the 10 sites, displaced people get registration of the house on their name
- In 4 out of 10 planned relocation sites, there are space in front of the houses where the inhabitants grow vegetables, keep chickens and animals
- In 3 out of 10 resettlement sites, there are canals beside or ponds inside where they catch fishes for their daily living
- The resettled persons get social welfare service by the local office of the Department of Social Welfare in 5 out of 10 planned relocation sites

Implementation Gap

- Lack of meaningful effort to create alternative livelihood are found in 6 out of 10 planned relocation sites
- Absence of linkage with market/development of local market (e.g. tea stall, tailoring shop, small verity shop) is not viable in 6 out of 10 planned relocation sites
- Though basic community services such as playground, graveyard, mosque etc. are in the design, they are not actually built in 7 out of 10 planned relocation sites. These are built/installed by local/community initiative in some planned relocation sites (e.g. Ashrayan 1 and Gucchagram 1 in Satkhira),
- No effective mechanism has been found for developing social coherence with host community in 7 out of 10 planned relocation sites
- 4 out of 10 planned relocation sites(e.g. Amadi in Khulna and Gucchagram 1 in Tala, Satkhira) are not enough resilient to climatic events like river erosion, floods etc.
- Some IASC standard e.g. livelihood opportunities, safety and security, opportunity to retrieve necessary documents (e.g. the displaced people who are being resettled in the planned relocation find it difficult to get enlisted in the voter list of the new area) are absent in 5 out of 10 planned relocation sites
- Insufficient institutional coordination between the grass root level government offices of Department of Livestock Services, Department Social Services, Department of Fisheries are found in 5 out of 10 planned relocation sites
- In 4 out of 10 planned relocation sites, it is observed that one fourth of the houses got severely damaged within 5-7 years because of the absence of post construction monitoring system of the houses
- Some planned relocation sites are resilient to climatic events, some are not resilient enough

Bridge Research & Action

Refining estimates of carbon uptake by secondary tropical forests

Douglas Houston[1], Carlos Peres[1,2], Hugo C. M. Costa[2]

There is increasing awareness of how secondary tropical forests can contribute to climate change mitigation

Secondary tropical forests (STFs) are defined as regrowing after full deforestation, typically after agricultural abandonment, and comprise 25% of deforested land in Amazonia.

STFs grow incredibly fast, absorbing carbon at 11-20 times the rate of primary forest, providing a potent source of nature-based climate mitigation.

For example, Brazilian STFs could absorb 19 TgC.yr-1 until 2030, equating to 5.5% of Brazil's NDC under the Paris Agreement.

But STFs have highly variable regrowth rates, creating uncertainty in their climate mitigation potential.

Local factors that affect regrowth, such as initial plot conditions and seed availability, have not yet been empirically measured.

How past land-use and surrounding landscape affect STF growth

Plot conditions at the onset of regrowth are determined by past land-use, particularly the type, duration and intensity of agriculture practised before abandonment. Soil fertility and presence of remnant vegetation and seeds are reduced by more intensive past land-use.

Seed migration into regrowing forest is necessary to ensure the diversity and carbon stock of primary forest can be regained. The potential for seed migration is determined by the extent and proximity of surrounding primary forest.

Research Objective

To quantify the effect of past land-use and surrounding landscape on carbon uptake rates in STFs.

Study Area

Fieldwork was conducted in manioc cultivation zones that surround riverside communities in the Médio Juruá region of western Amazonas State, Brazil (see inset).

Cultivation of manioc requires recently harvested fields to regrow into secondary forest, which is then cut and burnt to re-fertilise the soil for further cultivation.

Manioc cultivation zones thus contain numerous STFs of various ages and land-use histories.

Local consent was requested to access communal cultivation zones, and past land-use variables were obtained by interview from farmers.

Inset: Community of Bom Jesus, Carauari municipality, Amazonas, Brazil. The locations of four secondary forest plots (red) and one primary forest plot (yellow) are shown. Image: Google Maps

Design

STF carbon uptake was measured as accumulation of above-ground biomass (AGB) in 0.1 hectare plots of varying age, past land-use and distance to primary forest.

Four STF plots and 1 primary forest (PF) plot were assessed per community, in 25 communities, totalling 100 STF and 25 PF plots.

AGB was measured using the diameter, wood density and height of all trees > 5cm diameter at breast height and calculated with allometric equations from Chave et al 2014.

The extent and proximity of surrounding forest will be calculated using ArcGIS Pro.

Soil samples were taken in each plot for physical and chemical analysis.

Fieldwork was completed in June 2025. Analysis is pending.

Potential Uses and Benefits

Refine estimates of carbon uptake by STFs for more accurate NDC calculations.

Improved validation of satellite-based biomass assessments.

Enhance the understanding of the value of secondary tropical forests for climate change.

Background image: Sentinel-2, 2025, accessed from SOAR.Earth

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Acknowledgements: Communities of the Médio Juruá, Instituto Juruá
Required authorisations given by Reserva de Desenvolvimento Sustentável de Uacari and Sistema de Autorização e Informação em Biodiversidade
This work was funded by Instituto Juruá and Leverhulme Trust Grant DS-2020-028

INSTITUTO JURUÁ POVOS, RIOS E FLORESTAS

LEVERHULME TRUST

Tyndall Centre for Climate Change Research

University of East Anglia

Who Suffers, How, and Why? A Review of UK Household Flood Impacts

Lily Sharp
University of Southampton
Supervisors: Prof Emma Tompkins, Dr Sally Brown,
Dr Victoria Dominguez Almela, Richard Taylor

"Loss of over 37 years of memories – thrown out with the flood water." [6]

1. Introduction

Currently, **6.3 million** properties in England are in areas at risk from one or more sources of flooding [1]

By 2050, 1 in 4 properties in England will be in areas at risk of flooding. This amounts to **8 million** homes and businesses [1]

Only **20%** of those previously flooded have taken steps to adapt their home [2]

2. Research Aims

PhD aim: to assess the spectrum and prevalence of adaptations across discrete populations, of varying social and economic contexts, to pluvial and fluvial floods of discernibly different characteristics

-> Identifying areas of impacts aids in identifying all potential areas of adaptation

Hence the aim of this research: to determine who is impacted by floods, how, over what timeframes, and what affects how these impacts are experienced

3. Methods

A narrative systematic review methodology was followed [3]:

- Three databases searched: Elsevier Scopus, Web of Knowledge, Google Scholar
- ≈ 268,700 papers found and screened
- Empirical impact-related data were extracted and analysed

4. Results

Study Metadata

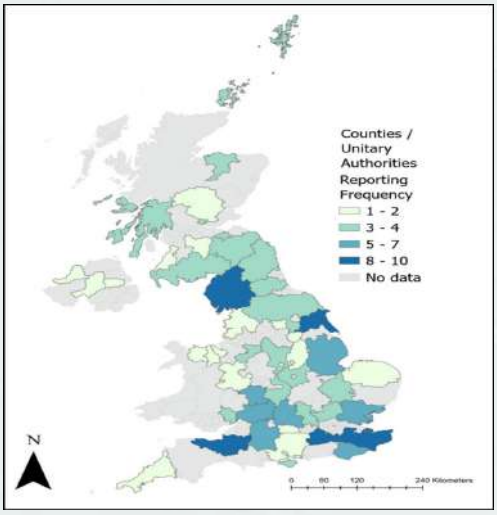

Fig 1. Map of study locations

- **51** papers found; total sample size of **42,500**
- Re-use of same data (e.g., **Public Health England 2013/14 Study**) explains frequency of certain counties (e.g., Cumbria, Surrey) (Fig. 1)
- Limited coverage of Wales, Scotland, and Northern Ireland
- Data often collected **6 months+** post flood – more information on **long-term impacts**.
- Little socioeconomic / demographic disaggregation

*Paper currently in review with Journal of Flood Risk Management.

Areas of Impact

Fig 2. Impact Areas and their reporting frequencies

- Focus on **health**-related impacts (psychological, physical, wellbeing) and **home**-related impacts

Drivers of Impact

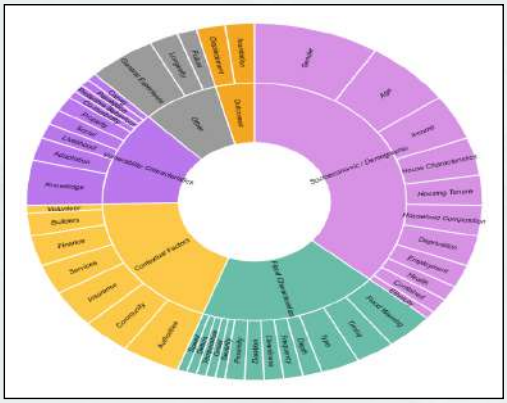

Fig 3. Identified drivers of flood impacts

Impact Profile

- **46** unique drivers identified
- These drive the **145** relationships which make up the Flood Impact Profile

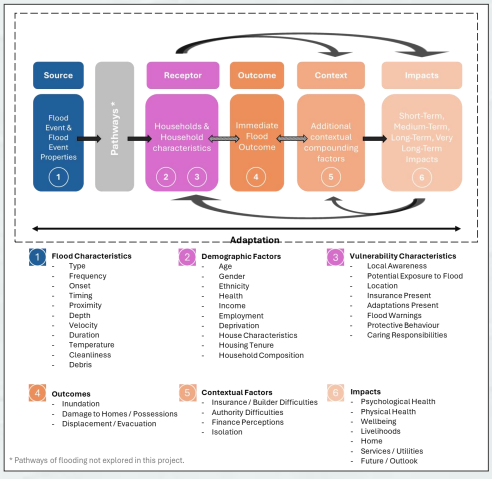

Fig 4. Flood Impact Profile

- **Fig. 4** offers an updated Source-Pathway-Receptor-Harm Model [4]
- It summarises the **pathways of impact** and the drivers (factors and characteristics) that affect impacts
- Demonstrates the **uniqueness** of the lived **flood experience**

Make a Flood Plan[5]

References

5. Conclusions

Flooding is unique - different members of the same household can experience vastly different impacts. To develop fair and effective flood policy, lived experiences must be placed at the centre of planning, with a greater focus on compounding impacts and events. There is a need to expand the evidence base to include underrepresented impacts, timeframes, and communities

"I found it very hard to put belongings out on the street for all to see. Local radio presenter commented it was awful to see streets full of rubbish. How insensitive; this rubbish was my home." [6]

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Research funded by NERC and EA

HOW DOES A HUMAN CORPSE LOSE ITS LEGAL AND MORAL STATUS AND BECOME WASTE?

WHAT ARE THE SPATIAL AND MATERIAL CHARACTERISTICS OF DISPOSING OF THE HUMAN CORPSE AS WASTE?

WHAT METHODS SHOULD BE USED TO DISCUSS AND PRESENT DISPOSING OF THE HUMAN CORPSE AS WASTE?

AN ETHNOGRAPHIC STUDY USING GRAPHIC ANTHROPOLOGY BRIDGING BETWEEN DEATH & WASTE STUDIES

MARK SHTANOV, UNIVERSITY OF MANCHESTER
FINAL YEAR PHD
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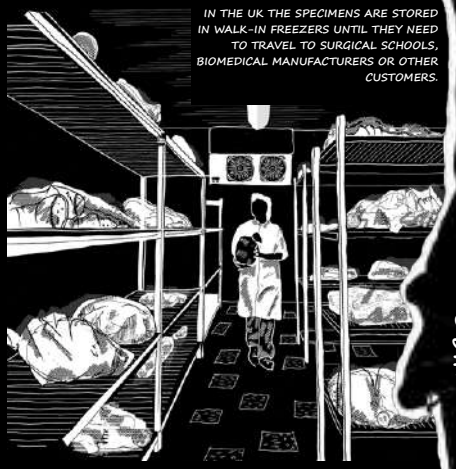
A BODY OF A DECEASED PERSON IS DONATED IN THE UNITED STATES. UNDER CERTAIN STATES' REGULATIONS, THIS CAN BE A SECOND PARTY DONATION, SUCH AS THE NEXT OF KIN OR A PRISON AUTHORITY.

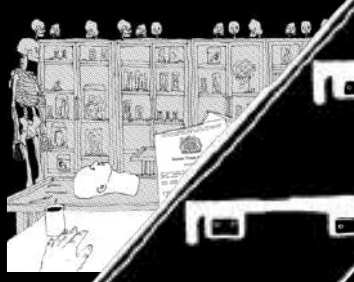
FOLLOWING PROSECTION (DIVISION INTO PARTS), INDIVIDUAL BODY PARTS AND TISSUES ARE ASSIGNED BAR CODES NOT TO BE IDENTIFIABLE OUTSIDE OF THE DONATION COMPANY'S REMIT. THEY ARE SUBSEQUENTLY TRANSPORTED IN A FRESH FROZEN STATE.

IN BEING PREPARED FOR TRANSPORTATION, THE SPECIMENS ARE FROZEN, WRAPPED IN LEMON-SCENTED TOWELS AND PACKAGED IN COOLERS LINED WITH POLYSTYRENE FORM FOR CUSHIONING.

IN THE UK THE SPECIMENS ARE STORED IN WALK-IN FREEZERS UNTIL THEY NEED TO TRAVEL TO SURGICAL SCHOOLS, BIOMEDICAL MANUFACTURERS OR OTHER CUSTOMERS.



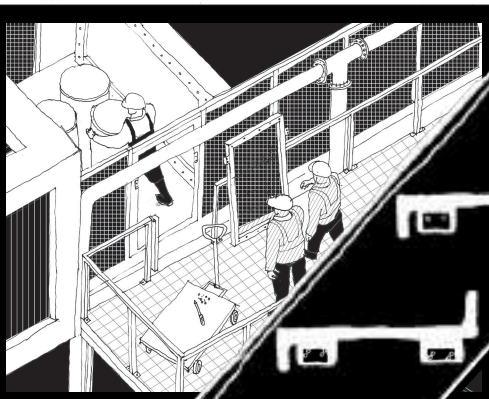
AFTER 2-3 USES, THE SPECIMENS NEED TO BE DISPOSED OF. THE IMPORTED HUMAN TISSUES CANNOT BE CREMATED IN THE UK. NEVERTHELESS, THEY CAN BE INCINERATED, IN ACCORDANCE WITH THE HUMAN TISSUE ACT 2004, THE HUMAN TISSUE AUTHORITY'S GUIDELINES AND MANY OF THE CONSENT FORMS' SMALL PRINT.

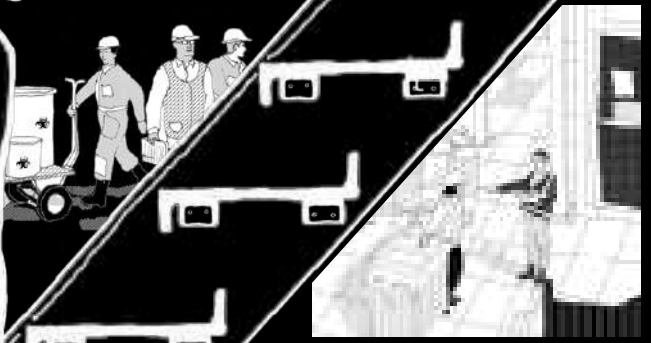


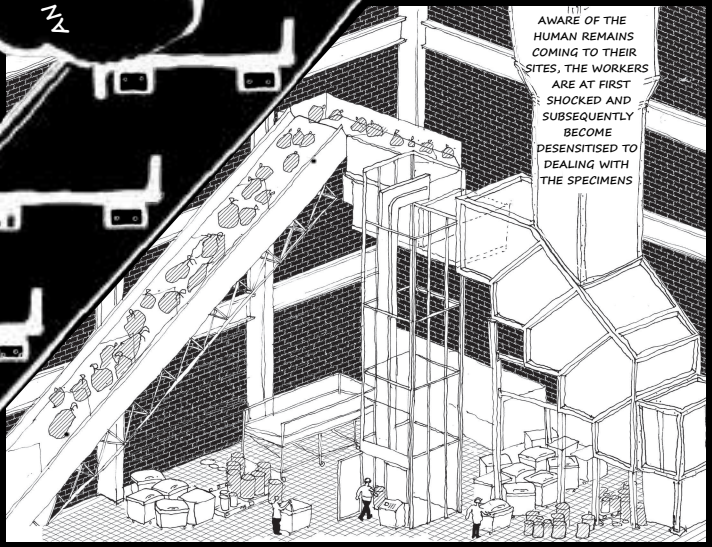
WHEN OPTING FOR INCINERATION (THE MOST COST-EFFECTIVE OPTION), THE BIOMEDICAL ORGANISATION PACKAGES THE SPECIMENS INTO WASTE CONTAINERS...

... SUCH AS PLASTIC DRUMS, RANGING IN VOLUME BETWEEN 50 AND 200 LITRES. IN ACCORDANCE WITH THE NATIONAL HEALTH SERVICE'S (NHS) REQUIREMENTS, THE DRUMS ARE YELLOW WITH RED LIDS.

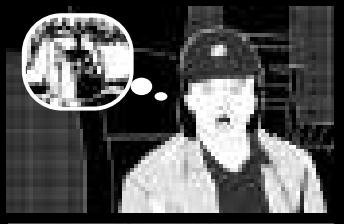
THE SPECIMENS ARE DELIVERED TO WASTE INCINERATORS WHERE THEY SOMETIMES NEED TO UNDERGO A SPECIAL 'RESPECTFUL' TREATMENT, BASED ON THE REQUIREMENT OF THE ORGANISATION SENDING THEM







AWARE OF THE HUMAN REMAINS COMING TO THEIR SITES, THE WORKERS ARE AT FIRST SHOCKED AND SUBSEQUENTLY BECOME DESENSITISED TO DEALING WITH THE SPECIMENS



Devastation Driving Adaptation?
Insights into and from IGAD Region's Climate Resilience Building

Background

The Region: 8-member bloc, East and Horn of Africa

- Climate hazards
- Formation of IGAD – IGAD
- Green Belt Movement
- Climate change impact interfaces with protracted crises

Paris Agreement: signatories

IGAD's specialized climate centres

Climate science + actions ≠ climate resilience

Central Question

What does IGAD's climate science-climate action dynamic tell us about climate resilience building?

Methodology

- Mixed methods, interdisciplinary
- Literature review
  (p=184 publications, n=7)
- Constructivism, framing (theory)
- Content analysis
- Thematic analysis

Roselyne Omondi r.omondi@outlook.com

Key Findings

Region is seized on climate change

*Climate inaction is not an option; more action, less risk exposure

Devastation – not Paris Agreement - is a key driver of region's climate action

Climate resilience to: climate crisis (global warming) + climate-related hazards

'Climate posture' shift: Mitigation to adaptation

*Adaptation is a regional and continental priority

Climate adaptation is a two-fold priority: climate action priority and development priority

*Focus shift: HDP nexus to HDPC

2 main climate narratives: Reactive-proactive and responsibility-blame

*Anticipatory action is the how of region's resilience building

*Increasing appreciation of climate science varies inversely with responsibility-blame narrative

Conclusion

Devastation - on the backdrop of the interfacing of impact of climate change with protracted, transboundary crises – misaligns the region's climate actions with Paris Agreement (commitments). These impede climate action and climate resilience building in the region.

Aligning Shipping Emissions with the Paris Climate Agreement

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1. Shipping and carbon budgets

The international shipping sector is responsible for around 2% of global greenhouse gas emissions. Tyndall Manchester research has set out Paris-compatible emissions pathways for the sector, which have been used to inform negotiations around the International Maritime Organisation (IMO)'s revised climate strategy in 2023, and subsequent IMO deliberations on policy design.

Our research has made three core points:

1. Staying with the remaining "carbon budget" for shipping requires much steeper decarbonisation trajectories than assumed in the IMO's original 2018 strategy (Figure 1).

2. Cutting emissions before 2030 is critical. Without this, the sector will consume so much of its carbon budget that it will require infeasibly steep emission reduction rates in the 2030s.

3. Because clean fuels can only be deployed at scale from the mid-2030s, the industry needs a greater focus on measures that can be deployed in the short term on existing ships. This includes route-optimisation, shore-power and wind-assist propulsion, the focus of current shipping research at Tyndall Manchester.

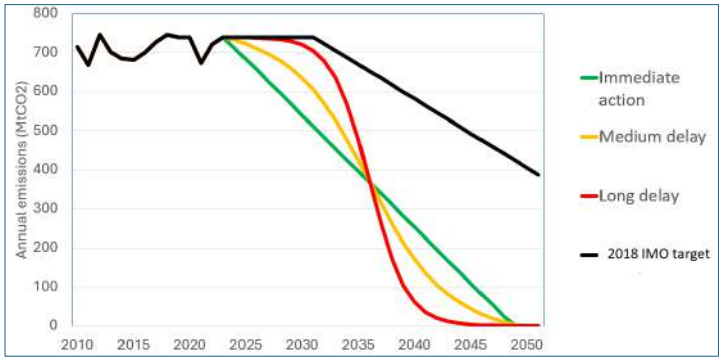

Figure 1: Paris-compatible pathways and the IMO's 2018 strategy.

2. Policymaker engagement

We published this analysis in journal articles [1,2], as a joint paper into the IMO's ISWG-GHG process, and as an input into the UK Government's BEIS CSN0W project (the UK Government submitted this latter analysis in full to the IMO in October 2022). We also engaged with the Science Based Targets Initiative (SBTi), a UK Parliament's POST note, NGOs supporting the Pacific island nations, the ICCT, and the World Economic Forum.

The IMO's 2023 strategy set new targets; its "strive" targets of 30% cuts by 2030 and 80% by 2040 are compatible with Paris' 1.5°C goal (Figure 2) [3].

The priority now is for the IMO to set policy capable of enabling the industry to meet these 2030 and 2040 targets. Tyndall research shows the pivotal role of reform to the IMO's "Carbon Intensity Indicator" (CII) to deliver the 30% 2030 target [4]. In April 2025, the IMO did not reform this policy in line with its new targets, although the UK strengthened its position on CII to align with this higher level of ambition.

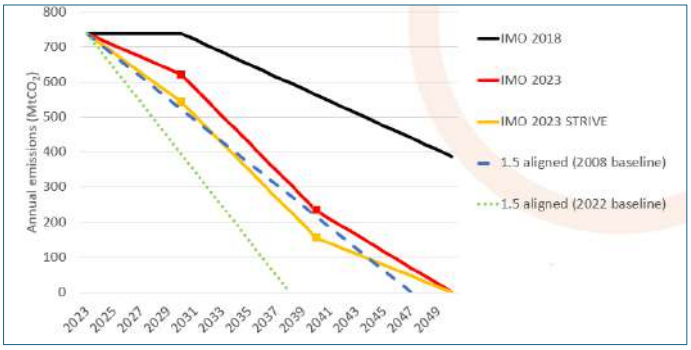

Figure 2: Paris-compatible pathways and IMO's 2023 strategy.

3. Conclusions

Insights from this research and policy engagement include:

- It is possible to set targets for a global sector in line with the Paris Agreement. Aviation take note!
- Progress on IMO shipping policy development is ongoing, but so far both new and old policy instruments are not aligned with the new targets, with many nations successfully lobbying for delay, weak policy stringency and poor enforcement mechanisms.
- To improve this situation, broader coalitions will be needed – particularly to integrate climate ambitions with requirements for "just transition" for developing countries.
- Energy efficiency measures have the potential to be more politically attractive, as they are cheaper than investment in cleaner fuels, and can be deployed more quickly.
- IMO policy reform is possible, but not in time to deliver the 2030 target. Therefore, IMO policy should be considered a "low-bar", with higher ambition driven by front-runner nations and industrial players.

References:

[1] Bullock et al. (2020): Shipping and the Paris climate agreement: a focus on committed emissions

[2] Bullock et al. (2022): The urgent case for stronger climate targets for international shipping

[3] Bullock et al. (2024): Are the IMO's new targets for international shipping compatible with the Paris Climate Agreement?

[4] Bullock et al (2025): Beyond fuel: the case for a wider perspective on shipping and climate change

Funding: Funding support from EPSRC (EP/L016141/1) through the Power Networks Centre for Doctoral Training (SB) and the University of Manchester EPSRC Doctoral Training Partnership (JM).

Tyndall Manchester Climate Change Research

MANCHESTER 1824 The University of Manchester

Wind-Assisted Ship Propulsion (WASP):
Research at The University of Manchester

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1. Wind-assisted shipping

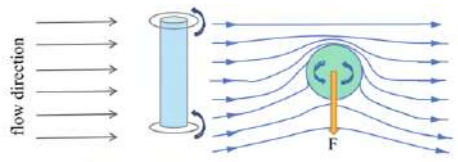

Figure 1: Propulsion from a Flettner Rotor [1].

The maritime shipping sector accounts for 2–3% of global greenhouse gas (GHG) emissions, releasing around 1 billion tonnes of CO_2 each year [2]. To meet the Paris Agreement's 1.5°C global warming limit, the sector must cut emissions by 34% by 2030 compared to 2008 levels [3]. Since zero-emission fuels are unlikely to be available at scale for at least another decade, the industry must rely on solutions available today to reduce emissions.

Over 50 wind-assisted ships are sailing the world's oceans today. These vessels use modern sails, such as Flettner rotors and wing sails, which can reach over 35 metres high and harness wind power for propulsion (Figure 1). These sails have proven to cut emissions in real-time, lowering fuel costs and helping shipowners comply with increasingly strict environmental regulations.

2. Fuel savings from the wind

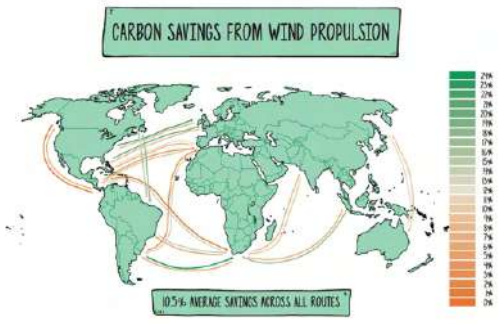

Figure 2: Fuel savings from four Flettner rotors on a Panamax bulk carrier.

Fuel savings from wind-assisted ships vary significantly across different regions around the world. By modelling a Panamax bulk carrier with four Flettner rotors on fourteen routes using historical wind data, we showed that these sails can cut fuel consumption by over 24% on ideal routes (Figure 2).

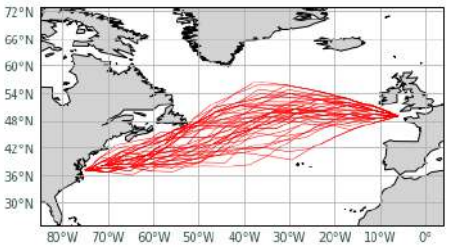

Figure 3: Optimised weather routes for a bulk carrier with Flettner rotors in the North Atlantic.

Additionally, wind-assisted ships can maximise fuel savings by using weather routing, which guides ships towards areas of ocean with favourable winds (Figure 3). By developing a computational optimisation algorithm, we showed that weather routing can amplify fuel savings by 1.6 times in the North Atlantic.

3. Wind-assisted shipping and the BlueVisby Solution

Alternatively, fuel consumption can be reduced by optimising port arrivals. The BlueVisby Solution offers a systematic approach that adjusts vessel speeds based on port availability, tackling the traditional 'Sail-Fast-Then-Wait' practice. This method alone has demonstrated fuel savings of up to 9% under ideal conditions [4]. It is therefore important to explore how the benefits of wind-assisted ships and the BlueVisby Solution can be combined to mutually enhance fuel efficiency and reduce emissions.

Figure 4: ETA optimised route in the North Sea, accounting for weather conditions during navigation.

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By using historical ship tracking data and estimated times of arrival (ETA) provided by the BlueVisby Solution, the most fuel-efficient route can be calculated for each vessel arriving at the same port. The interaction between each ship and the environmental conditions it encounters is modelled using "digital twins", which are digital copies of each of the sailing vessels. This ensures the impact of wind-assist is considered when calculating a new fuel-optimised route.

4. Green corridors

The Clydebank Declaration introduced the concept of green corridors at COP26 in 2021. Green corridors are maritime routes between two or more ports that bring together stakeholders to enable zero-emission vessels. Running until 2028, ongoing research at The University of Manchester is exploring how wind-assisted shipping fits into the green corridors framework. It aims to:

1. Investigate whether wind-assist can help bridge the fuel cost gap for zero-emission fuels.
2. Identify how green corridors can overcome barriers to adoption.

References

[1] Li et al. 2024. *Analysis of aerodynamic performance and application of Flettner rotor.* Journal of The Institution of Engineers (India). **[2]** Smith, T.W.P. et al., 2015. *Third IMO GHG Study 2014.* International Maritime Organisation. **[3]** Bullock, et al., 2021. *The urgent case for stronger climate targets for international shipping.* Clim. Pol. 22, 301–309. **[4]** Sung et al., 2022. *Multi-lateral ocean voyage optimization for cargo vessels as a decarbonization method.* Transp. Res. Part D 106: 103254. **[5]** Petkovic et al., 2021. *Wind Assisted Ship Propulsion Technologies.* Naše More: Int. J.Mar. Sci. Technology 68(2), 102–109.

Scan me for links to The University of Manchester's papers on wind-assisted ships:

Paper 1: Propulsive power on selected shipping routes

Paper 2: Global fuel savings from optimised wind-assist

Paper 3: Wind-assist and stochastic uncertainty

Tyndall Manchester Climate Change Research

MANCHESTER 1824 The University of Manchester

Designing a new module:
Engineering Design in a Constrained World

Dr Alicia Gonzalez – Buelga; Prof Chris McMahon

1

Working with the UNESCO key competencies we identified the following competency gaps

- Negotiate sustainable development principles
- Able to create personal vision for the future
- Apply the precautionary principle
- Develop inclusive, viable, equitable solutions
- Question norms, practices and opinions
- Understand and respect others
- Take a position
- Reflect on one's own values

2

Short term actions were defined to enhance competencies

- Form working group to manage the actions
- Develop a new level 7 module
- Develop a set of case studies
- Develop tutorials
- Introduce SDG mapping and reflection into research projects
- Enable more collaboration staff/students

3

Development of a new level 7 module

ENGINEERING DESIGN IN A CONSTRAINED WORLD Intended Learning Outcomes (ILOs)

Two central ILOs

- Energy and materials
- Technology
- Geopolitics
- Economics

able to create their own visions for the future

understand and respect the needs, perspectives and actions of others

- Deep ecology
- Communalism
- Accommodation
- Cornucopian

4

Schedule

Week 1	Week 2	Week 3	Week 4	Week 5
The past	The present	The future	Engineering from an Earth system approach	

Persons of the week:
Helen Thompson, Philippe Bihouix; Donatella Meadows, Kate Raworth, Riane Leisler ....

Learning materials

- Podcasts
- Public debates
- Books and book reviews
- Blogs and websites
- Governmental publications
- Newspapers & Magazines

Glossary of topics discussed

Prisoner dilemma
Convivial Technology
Low-tech
Green growth
Carrying capacity
Peak everything
Overshoot
Carbon budgets
Energy justice
Ecological Footprint
Extractivism
Gigacorns
Transition Engineering
Geoengineering
IPCC & COPs
Doughnut Economics
Multipolar traps
Degrowth

School of Electrical, Electronic and Mechanical Engineering

University of BRISTOL

Hot Himalayas, Shifting Species and Changing Communities

Rethinking Conservation in a Warming World

Bibek Raj Shrestha, Dr. Johanna Forster, Dr. Aldina Franco
University of East Anglia (UEA)

Context:

- Nepal has 23.39% of its area protected, and it is 7% short of its 30X30 target to bring 30% of terrestrial land under protection by 2030.
- Conservation area demarcation has been ad hoc, rather than systematic, leaving key ecosystems unprotected.
- Historically, protected areas establishment hasn't been participatory, displacing communities from their lands.
- Climate change may alter species' habitats, movements, and survival.

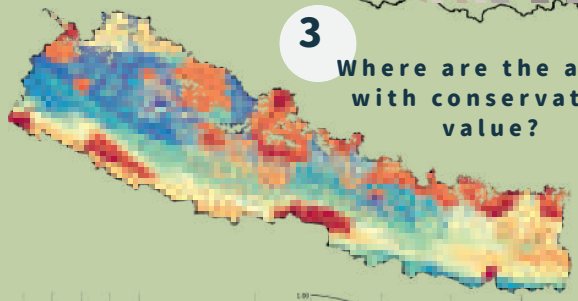
The problem:

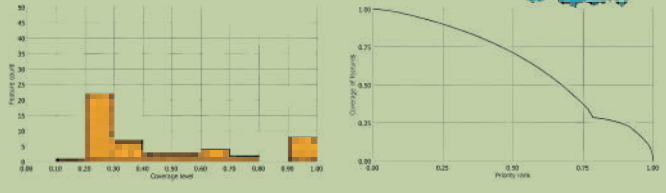
Nepal's 20 protected areas were designated over 50 years ago without systematic science or community input. As Nepal moves toward its 30x30 target, continuing with the current approach can risk species and create conflict. A new framework that integrates ecological data, community voices, and climate change is needed.

Objective:

This research, in its early stage, aims to integrate ecological data, community perceptions, and climate change considerations into conservation planning in Nepal.

Illustrative example of using species distribution modeling to assess how climate change may alter species' habitats.





Zonation outputs for 50 endangered mammal species of Nepal. (Left) Histogram showing the relationship between the proportion of landscape retained and the proportion of species' distributions retained, highlighting the top 30% of the landscape. (Right) Performance curve illustrating the proportion of species' distributions retained across different conservation priority levels.

Methods

- **Systematic Conservation Planning:** Zonation will be used to prioritize conservation areas under current and future climate scenarios.
- **Social Science Methods:** A qualitative case study combining semi-structured walking interviews, focus groups, indigenous methodologies and governance analysis to capture community perspectives on conservation.

SENSS
South and East Network for Social Sciences

UEA
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Dirty Business: Comparing Natural and Restored Saltmarsh Carbon

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SALTMARSH CODE

"...a voluntary standard enabling the verification and sale of carbon sequestration through saltmarsh restoration. Saltmarsh carbon can be sold to buyers seeking to voluntarily compensate for their emissions…"

However, hydrology and plant communities are different in restored marshes.[1,2]

So, can we restore saltmarsh blue carbon?

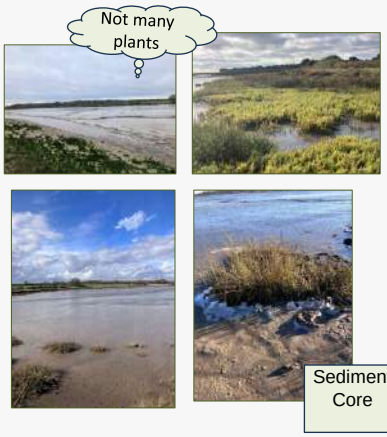
Foraminifera – **Marine** unicellular organisms

Calcareous – prefer mudflat conditions

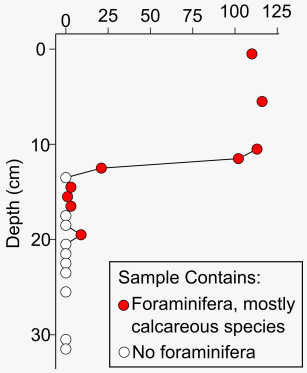
Agglutinated – prefer less tidal flooding

The Restored Marsh: Fingringhoe Wick, Essex
10 years old

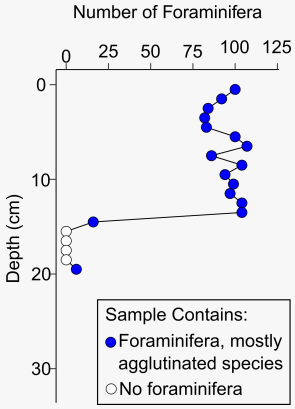
Restoration – breaching the tidal wall around a field to allow regular tidal flooding

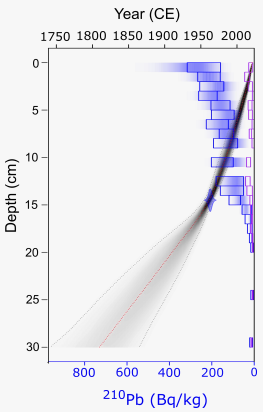


Sediment Core



The Natural Marsh: Lindisfarne, Northumbria
~60 years old

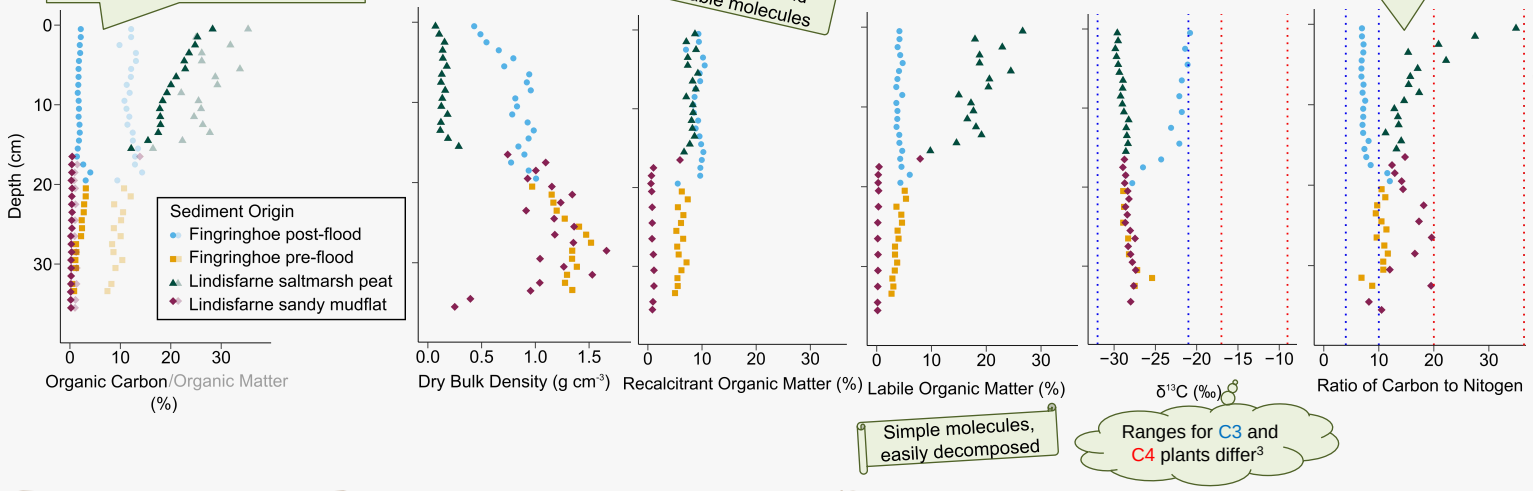




~46 % of organic matter is expected to be organic carbon – but it's much lower in the restored marsh…

Complex, stable and preservable molecules

Marine organic matter has a lower C/N value than terrestrial OM



Simple molecules, easily decomposed

Ranges for C3 and C4 plants differ[3]

References
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3. Khan, N.S. *et al.* (2015) 'The application of δ13C, TOC and C/N geochemistry to reconstruct Holocene relative sea levels and paleoenvironments in the Thames Estuary, UK', *Journal of Quaternary Science*, 30(5), pp. 417–433.

Conclusion: Carbon in restored saltmarshes originates from external sources so should not be counted toward carbon credits.

Bioenergy for Net Zero Transition: Assessing Biomass Resources in Indonesia

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1. Problem Identification

- Fossil fuel dependence accelerates climate change [1].
- Global target: renewable capacity must *triple* by 2030 [2].
- Biomass provides >50% of global renewable energy supply [3].
- Indonesia has rich biomass resources: rice husk, palm oil residues, forestry waste, sugarcane, cassava [4].
- Diversification still limited, and agricultural residues and waste underutilised.
- Wider use could reduce emissions & strengthen clean energy transition.

2. Research Context

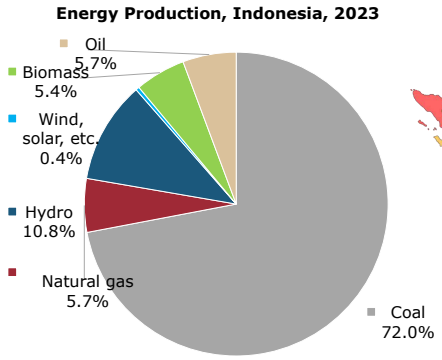


Fig 1. Indonesia's primary energy mix[3]

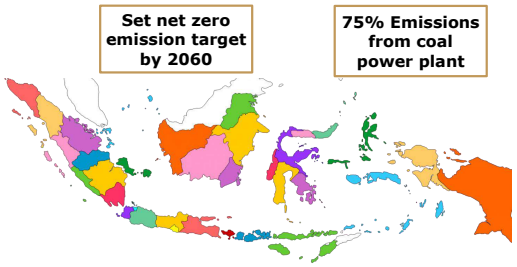


Fig 2. Overview of Indonesia's energy situation [6]

3. Research Aims

Fig. 3 Palm oil

Fig 4. Palm Oil Kernel Shell

Fig 5. Food Crop Residues

- Explore how Indonesia can leverage its bioeconomy by identifying biomass sources and assessing bioenergy potential.
- Assess the role of biomass diversification in Indonesia's net zero pathway.
- Provide insights for policymakers & stakeholders.

4. Methodology

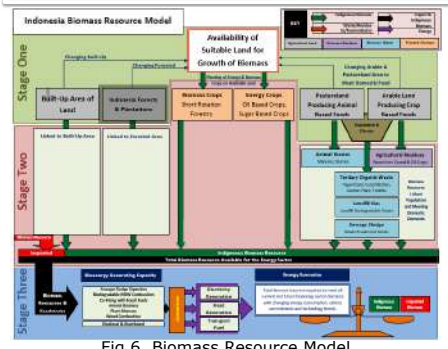


Fig 6. Biomass Resource Model

- Stage One: Assess land use and availability across key sectors.
- Stage Two: Quantify and forecast the availability of biomass resources from various sources.
- Stage Three: Calculate the bioenergy potential of each biomass type by applying appropriate energy conversion pathways.

5. Results

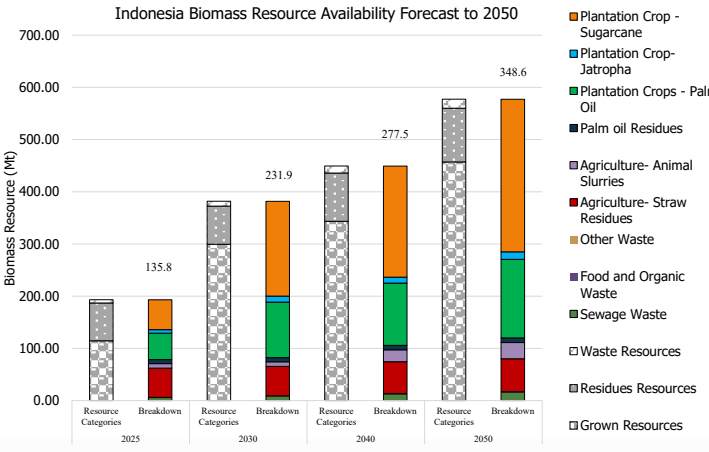
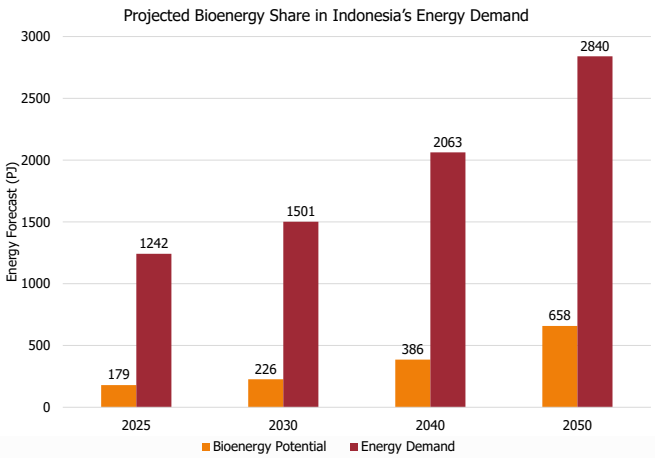


Fig 7. Available biomass projection in Indonesia



6. Discussions

- Indonesia's biomass potential reaches **348 Mt**, making it a key driver for the net zero 2060 target.
- **Diversification beyond energy crops** is crucial, especially through agricultural residues and waste.
- Stronger **policy frameworks and incentives** are needed to support sustainable biomass utilisation.
- Key challenges: **availability, sustainability, and technological development**.

7. References

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Acknowledgements

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Beyond the 'Big 5': Diversifying Seafood Preferences in South West England

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INTRODUCTION

Sustainable dietary transitions are vital to tackling climate change and health challenges in the UK. Seafood generally has a lower environmental impact than other animal proteins, and presents substantial health benefits (Hicks et al., 2019; UN Nutrition, 2021). Small pelagic fisheries (e.g. herring, mackerel) offer particularly **low environmental footprints**, requiring less fuel to catch (Hilborn et al., 2018).

Despite government advice to **'eat 2 portions of fish per week, including 1 oily fish'**, UK consumption remains low and focuses on mostly imported 'Big 5' species (salmon, cod, haddock, tuna, and prawns). However, increasing consumption risks overfishing and harm to marine ecosystems (FAO, 2022). Greater consumer flexibility is needed to align consumption with changing sustainable supply over time. Shifting diets towards diverse, local and sustainably caught seafood can **reduce environmental impacts**, **support local economies**, and **improve resilience to climate change**.

	Salmon	Sole	Cod	Mackerel	
Format	Fresh fillets	Breaded fillets	Easy-to-cook fillets in oven tray with sauce	Breaded fillets	**None of these**
Origin	Imported (Outside of Europe)	Imported (Europe)	Local (South West Europe)	Domestic (British)	
Sustainability	Sustainably caught from healthy stocks	Sustainably caught from healthy stocks	Sourced from a well-managed fishery		
Price	£6.50	£4.50	£4.50	£1.50	

Figure 1: Example choice task shown to survey respondents

The NHS website *states that "**A healthy, balanced diet should include at least 2 portions of fish a week, including 1 of oily fish**", because fish and shellfish are good sources of many vitamins and minerals, and oily fish are particularly high in long-chain omega-3 fatty acids, which can help maintain a healthy heart. In general, most of us should eat more fish in our diet, including more oily fish.*

Oily fish include:

- Herring (bloater, kipper, and hilsa are all types of herring)
- Pilchards
- Salmon
- Sardines
- Sprat
- Trout
- Mackerel

Some white fish species *can also be a source of omega-3 fatty acids, but at lower levels than oily fish.*

For example:

- Sea bass
- Sea bream
- Turbot
- Halibut

Box 1: UK guidance presented to NHS treatment group before choice tasks

OBJECTIVES

1. Understand **seafood choices and their drivers** by systematically exploring preferences across wide ranging species beyond the 'Big 5'.
2. Examine whether existing **nutrition guidance** can facilitate diversification of preferences by promoting oily fish consumption.
3. Identify **barriers and opportunities** to encourage local, sustainable and diverse seafood consumption in the UK.

METHODS

Through an online survey of 1000 seafood consumers in South West England, a discrete choice experiment was used to assess preferences for fish **species**, **origin**, **format**, **sustainability messaging** and **price**.

By choosing their preferred fish product across 6 different choice tasks (**Figure 1**), respondents made trade-offs revealing their relative preferences for each product attribute. Their choices were statistically analysed using multinomial, mixed logit and latent class regression models.

To appreciate the role of UK government guidance on healthy diets, the questionnaire adopted a split-sample design, presenting health guidance 'nudges' from the NHS and the respondent's supermarket to two respective treatment groups (**Box 1**).

RESULTS

- **Species:** Findings confirm strong and persistent preferences for salmon and cod ('Big 5' species), which were not influenced by the provision of health guidance. Herring, mackerel, hake, and sole are found to be least preferred species, likely due to lower familiarity.
- **Format:** Preferences depended significantly on species, particularly for breaded products which were favoured over fresh fillets for white flaky species used in fish and chips, as well as herring and mackerel, suggesting that breaded formats could make oily fish more palatable to consumers.
- **Origin:** Local and domestic products were preferred, with respondents willing to pay a premium for them, compared to products from further away.
- **Sustainability messaging:** Respondents preferred sustainability messaging to none, but its impact on choice was marginal. Findings suggest that in practice respondents struggle to distinguish between sustainability messages and their meanings.

CONCLUSION

This study goes beyond the 'Big 5' to better understand seafood preferences, examining barriers and opportunities to diversifying UK fish consumption. Current **health guidance is not effective** in encouraging oily fish consumption, confirming the challenges in promoting healthy diets and suggesting that simplified guidance in **succinct, digestible claims** may be more successful. **More prominent labelling** of locally caught fish, **sustainability messaging**, and **providing low-risk opportunities to try unfamiliar species** (e.g., in breaded or mixed-fishcake formats) could help shift consumption towards more sustainable, local, and nutritious species.

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CREATE AQI
Chemical Engineering
THE UNIVERSITY OF UTAH

RAPID. LOCAL. CO-CREATED. IMPACTFUL.
CIVIC INNOVATION CHALLENGE
NSF RISE 2322009

THE UNIVERSITY OF UTAH
CENTER FOR HIGH PERFORMANCE COMPUTING

TRACE AQ
AIR QUALITY INTELLIGENCE

CREATE AQI

Community Resilience through Engaging, Actionable, Timely, high-rEsolution Air Quality Information

Air Quality Forecasting Team


Taylor Wilmot


Derek Mallia


Heather Holmes*

Project PI


Kerry Kelly

Objectives

Protect Utah Children From Outdoor Air Quality Hazards

- Low-cost sensor (LCS) network
- Automated air quality (AQ) forecast
- Combine both to inform decision makers

Co-Develop Actionable, Uniform AQ Guidelines

- Youth outdoor activities
- Consistent throughout the state


Photo From: Dr. K. Weenig (UHSAA)

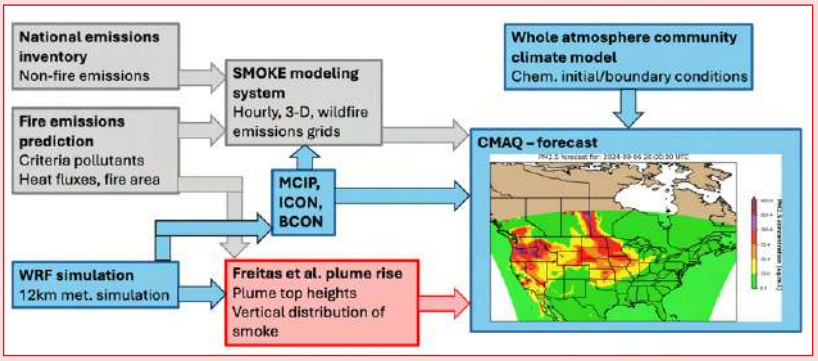
CREATE AQI Partner Organizations

- Utah DHHS APPLETREE
- Utah DHHS Asthma Program
- Utah Division of Air Quality
- Utah High School Activities Association
- Utah Athletic Trainers Association
- Utah State Board of Education
- Utah Parent Teachers Association

Forecasting Approach

Air Quality Forecasting Framework

- 3-day forecast: Hourly, 12km horizontal grid
- Global Boundary Conditions (WACCM)
- Numerical Weather Prediction (WRF)
- Air Pollution Emissions (U.S. EPA)
- Fire Emissions and Plume Rise (Utah)
- Chemical Transport Model (CMAQ)



Fire Emissions Modeling Framework

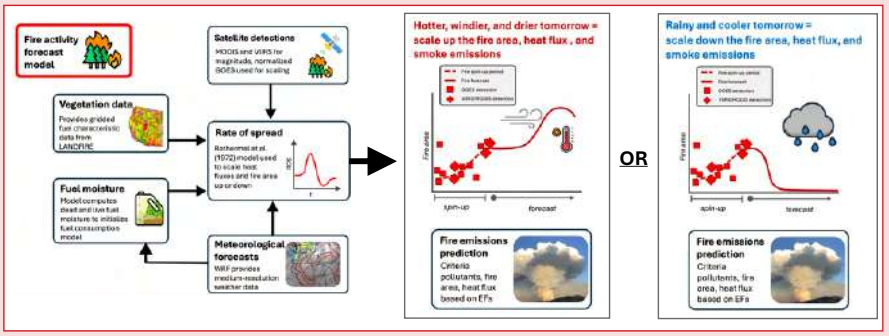
Larkin et al., (2014); Seiler & Crutzen (1980); Ichoku & Kaufman (2005)

$$Amount\ of\ Species_i\ Emitted = A \cdot B \cdot C \cdot EF_i$$

A = Fire Size
B = Available Biomass
C = Combustion Completeness (fuel moisture, wind, season)
EF_i = Emissions Factor (for species i)

$$Amount\ of\ Species_i\ Emitted = R_{FRP} \cdot FRPEF_i$$

R_{FRP} = Fire Radiative Power (FRP)
$FRPEF_i$ = FRP Based Emissions Factor (for species i)



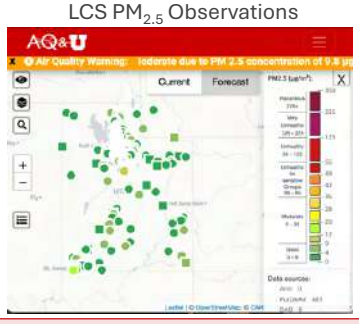
Results

(*right*) CREATE AQI $PM_{2.5}$ images taken at 1:22pm MDT on 21 Aug 2025 for: State AQ alert, LCS, and forecast.

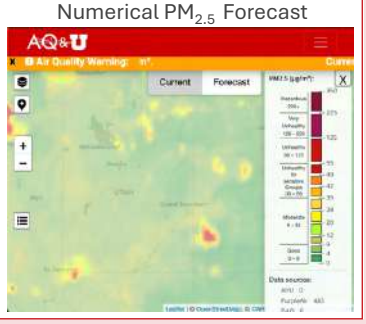
(*bottom*) Trace AQ AERO AQI forecast for 26 July 2025 7pm MDT (27 July 01:00UTC) in Moab, Utah compared to NASA satellite products: AERO AQI forecast, visible image, NO_2, and AOD.

UDAQ $PM_{2.5}$ AQ Alert at Login

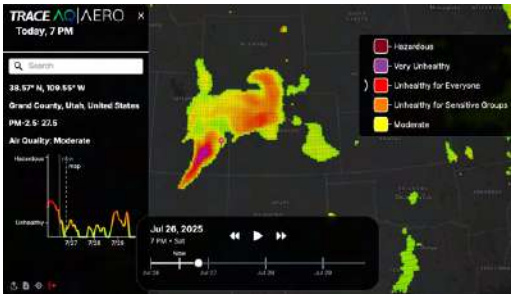
LCS $PM_{2.5}$ Observations



Numerical $PM_{2.5}$ Forecast



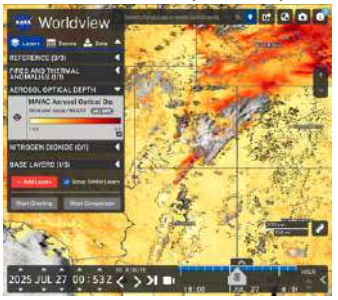
Trace AQ AERO Air Quality Index (AQI) Forecast



MODIS Terra Visible Image

TEMPO Tropospheric NO_2

MAIAC Aerosol Optical Depth



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Disclosure Statement: Holmes, Mallia, and Wilmot have a financial interest in Trace AQ, a company that is developing and selling air quality forecasting products.

Transitioning health systems for climate change

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Infectious diseases and health

Infectious disease have a substantial global burden.

~704 million disability-adjusted life-years (DALYs) were associated with 85 infectious diseases (2019).

This represents ~28% of total DALYs from all causes

Naghavi et al. 2024

58% of infectious diseases aggravated by climatic hazards

<u>Hence may be affect by climate change</u>

However, ~1,000 unique pathways where climatic hazards lead to infectious diseases

Mora et al., 2022

How might climate change affect infectious diseases

Direct effects - Increasing temperatures elevating bacterial replication leading to food poisoning (e.g. Salmonella)

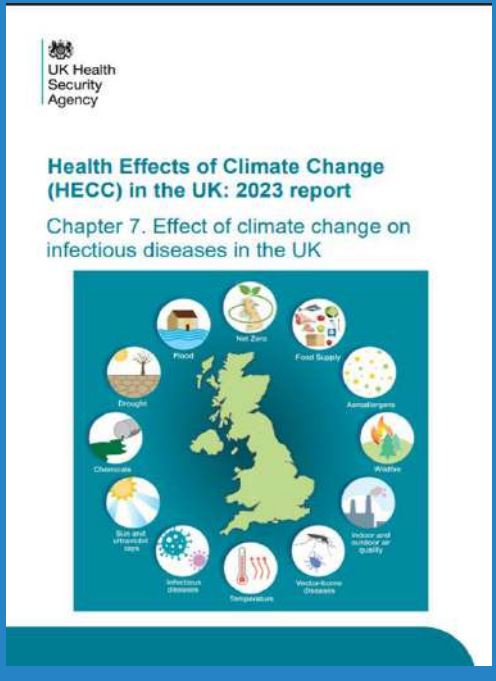
Indirect effects – Flooding on agricultural land contaminating fresh produce (e.g. E. Coli)

Indirect effects - Changing climate induced food insecurity leading to encroachment into natural environments increasing disease spillover risks (e.g. disease X)

Relationships between climate and infectious disease are complex and hence impacts of climate change uncertain. This makes it difficult to know what specific effects will be and on what timescales. A focus on making health systems more resilient and adaptable to infectious diseases is essential.

A climate resilient health system

- Integration of plant, animal and human surveillance to maximise potential for identifying threats
- Increased commitment to cross-border data sharing
- Assuring sustainable organisational structures and financing
- Focusing surveillance in areas under-going rapid change
- Novel surveillance methods to speed up disease detection
- Adapting standards and regulations to cope with emerging risks



UEA ENV

NIHR | Health Protection Research Unit in Emergency Preparedness and Response at King's College London

Tyndall Centre for Climate Change Research

Reimagining the "School Run"

Using insights from theories of social practice to reduce car dependency for specific journeys

Introduction

Car miles travelled on Britain's roads by cars, vans and taxis has increased twelvefold in just over 70 years, from an estimated 58 billion in 1952 to 680 billion in 2023[1]. The level of car dependency in this country is illustrated by the fact that 82% of people use a car at least once a week[2].

One impact of this is that, with road transport contributing the largest share[3], transport is now the largest CO2 emitting sector in the UK. And it is remaining stubbornly high[4].

However, not all journeys are equal!

Car use for some journeys is decreasing, such as commuting, shopping, and "personal business". This means overall miles travelled per person is actually going down[5]!

This research project is drawing on theories of social practice to explore why, unlike other journeys, car use is increasing for the "school run" and, more importantly, what can be done about it.

Why the "school run"?

As well as bucking the national trend (especially at younger ages)[6] the "school run" is an important journey to focus on because the high car use associated with it has been shown to turn schools into pollution 'hotspots'[7], affecting those most vulnerable to its impacts. This means children are more likely to suffer from respiratory disorders, neurodevelopmental impairment, and exacerbated chronic conditions such as asthma[8], whilst also impacting upon classroom attention, behaviour and attainment levels[9].

In contrast, children who travel actively to and from school not only help reduce air pollution they are also more likely to be more active, and healthy, in general[10].

Finally, it is shorter than most other trips, and therefore theoretically easier to travel by 'active' means.

Applying a social practice lens to better understand why as well as how people travel for specific journeys provides opportunities for alternative insights that might be used to facilitate change[11].

If this approach is successful in this research project, then it could be replicated for other journeys and reduce car dependency overall.

Why do people drive to and from school?

With car use linked to so many detrimental impacts for the environment as well as children's health and wellbeing, it would be easy to wonder why we do it.

Four commonly cited reasons in the literature relate to the need to travel long(er) distances[12]; the quality of local walking and cycling routes[13]; other journeys parents and caregivers have to make[14]; and, perhaps most pertinently today, perceptions of child safety[15].

It is likely that, as road traffic continues to increase, and children's outdoor play continues to decline[16], parents are increasingly concerned about their chances of walking and cycling to school safely.

What can be done?

Lots! The benefits of infrastructural changes are well documented (and rightly so), but a social practice perspective encourages us to look at other factors which can facilitate change. Here a few non-material examples sourced from the literature or successfully implemented elsewhere.

National level:

- Reintroduce "neighbourhood schools"[17] (and reduce number of independent and grammar schools) to reduce time-pressures on parents and caregivers
- Support schools to provide breakfast and after-school supervision as a way of encouraging flexible travel[18].

Local/city level:

- Support schools with the organisation and implementation of Walking Buses and Bicycle Trains[19]. These provide a safe way of travelling while also increasing children's capabilities and confidence to travel independently.

School level:

- Embed healthy and active lifestyles into the curriculum ao nurture positive meanings around human and planetary wellbeing
- Lead by example such as walk to school trips, active breakfast clubs, and cycle training and maintenance sessions.

However, it is important to note there are no 'silver bullet' solutions. For best results, interventions should be mixed-and-matched together![20]

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Searching for Meaning and Direction in Women's Resilience to Extreme Heat

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University of Southampton

LEVERHULME TRUST

1. BACKGROUND

In 2022, the UK experienced 40ºC+ for the first time since records began[1]. Heatwaves in the UK are becoming longer, hotter and more frequent due to climate change[2].

Extreme heat does not impact all members of society equally. Gender, age, ethnicity and health can all affect an individual's ability to cope with higher temperatures, along with social factors such as income, housing and care responsibilities[3].

2. FOCUS ON WOMEN

Women face unique and often overlooked challenges during heatwaves:

3. RESEARCH GAP

While there is a growing body of research on the impact of heatwaves in the UK, there remains significant gaps concerning women's experiences.

Resilience building efforts are hindered by disagreement over the objective of resilience and a lack of empirical evidence of resilience in practice.

This project contributes to these research gaps by analysing the lived experience of women's resilience during extreme heat in the UK, drawing from diverse forms of literature to uncover the memories, narratives and stories that exist in relation to past, present and future resilience.

4. RESEARCH AIM

To explore women's resilience to extreme heat in the UK


4


5

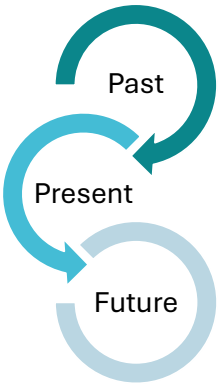
5. OBJECTIVES

To understand women's *lived experience* of extreme heat resilience in the UK.

To investigate past heatwaves in the UK as moments of cultural production and assess how women's experiences and resilience have been depicted in various forms of literature.

To evaluate how experiences of extreme heat and cultural production of extreme heat resilience affect women's imagining of and capacity for future resilience

6. VISION FOR THE PROJECT



Understand how the memories, stories and cultural moments of resilience during past heatwaves...

Have shaped women's lived experience of resilience to extreme heat in the present...

And contributed to their imagining of resilience in the future.

Discussion:

★ How would you approach this project?

★ What methods would you use to capture the lived experience of women?

→ Interviews? Oral histories? Ethnography?

★ What is your own lived experience of extreme heat?

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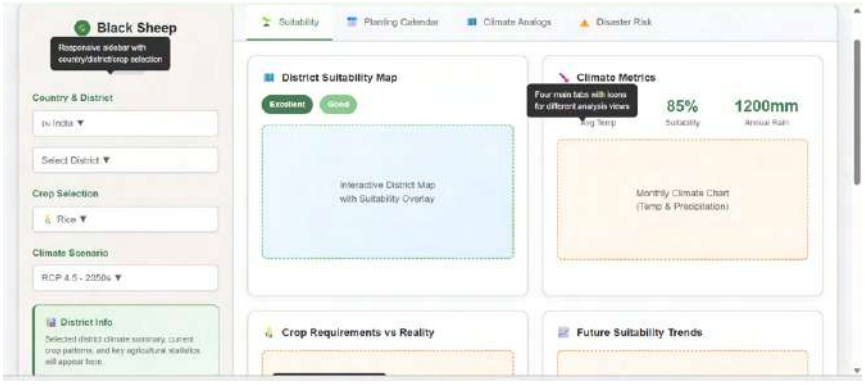
Climate-Adaptive Agricultural Systems for South Asia: Integrating ECOCROP with Climate Analogs for Smallholder Resilience

Manasa Sharma[1,2], Jeff Price[1,2], Rachel Warren[1,2,*]

1 University of East Anglia; 2 Tyndall Centre for Climate Change Research



INTRODUCTION

Despite abundant climate data, a usability gap remains in applying it to farm decisions. **This research develops a framework and tool that translates climate information into actionable, location-specific guidance, enabling farmers and policymakers to craft effective climate-resilient strategies.**

METHODOLOGY

Data Sources

-Climate data (CMIP6)

-FAO Ecocrop database

-EM-DAT disaster records

Ecocrop Suitability Analysis

-Define crop thresholds

-Apply projections for 2050

Climate Analog Identification

-Spatial analogs (current vs. future)

-Temporal analogs (historical events)

Integration in Decision Tool

-Overlay suitability & analogs

-Provide location-specific options

FUTURE CLIMATE WILL SHIFT CROP SUITABILITY ZONES

By 2050, staple crops will decline in high-production zones, while new areas emerge as viable for climate-resilient varieties.

ANALOG-BASED INSIGHTS IMPROVE ADAPTATION PLANNING

Spatial analogs are current regions with climates matching future target areas, allowing knowledge transfer of successful crops and practices via Ecocrop.

COMBINING CLIMATE AND DISASTER HISTORIES

Integrating temporal analogs with EM-DAT reveals future-suitable areas that faced severe droughts or floods, informing risk-aware adaptation strategies.

URGENCY AND TIMELINESS - OUR CRITICAL DECADE

- Provides immediate, actionable insights on planting times, crop choices, and risks;
- Tailored to local districts; simplifies climate projections into visual, non-technical guidance;
- Answers key farmer questions like "Will rice grow here in 20 years?" or "Should I try different crops?

Tyndall Centre for Climate Change Research

Norwich Institute for Sustainable Development

University of East Anglia

INTERESTED IN TESTING THE APP? DROP ME AN EMAIL --->

Developing an assessment tool to measure the outcomes of social prescribing of healthy food

Mark Wilson

Contact: mw2640@bath.ac.uk WellFed Cornwall website: https://www.healthandclimateresilience.net/about-1-2

Research Aim

To develop an assessment tool which will support Cornwall Council, health care professionals, food growers, and voluntary sector organisations to measure the outcomes of their healthy food social prescribing pilot. The pilot is coordinated by the WellFed Cornwall Network.

There are three ways in which this research could help the UK meet its net zero targets through agri-food: 1) evidence one route to healthier, net zero-compatible diets; 2) improved food capabilities can reduce household food waste; 3) reduce the carbon footprint associated with providing medication and health care for dietary-related diseases.

The intervention is a free veg box for 3 months + cooking classes. Our Theory of Change proposes this will lead to:

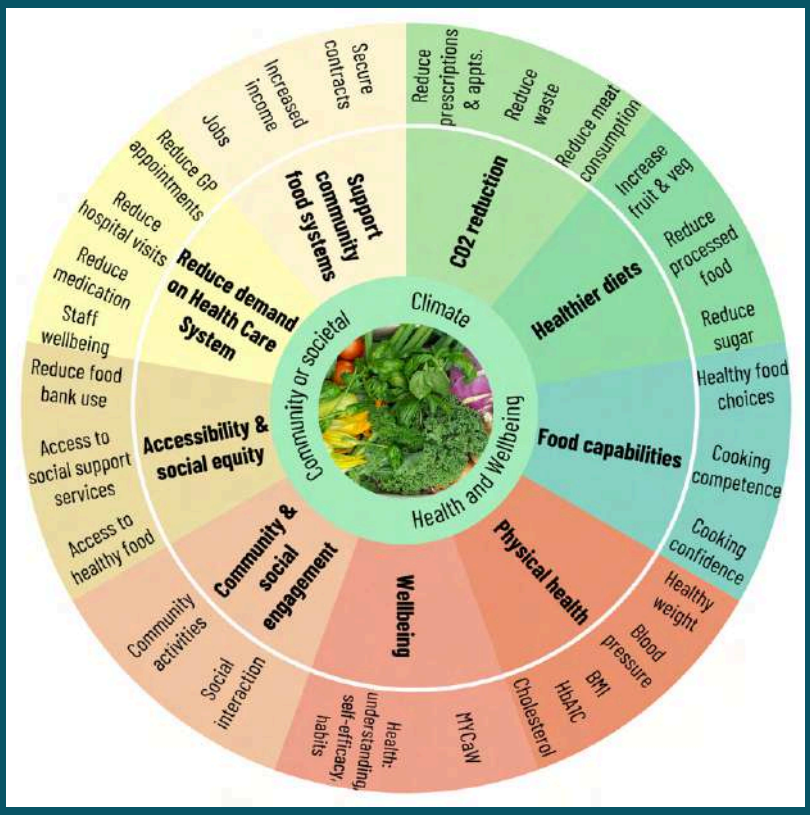
- An increase in healthy food consumption
- Improved physical health, wellbeing and social interaction for the pilot participants
- Societal co-benefits - for growers, the health care system, the climate

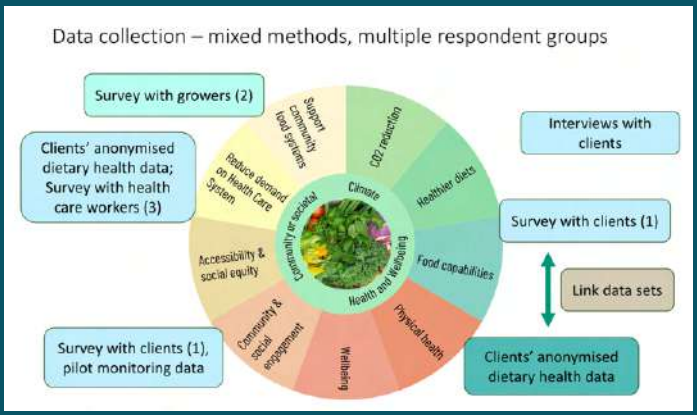
The 9 outcomes and the associated metrics are shown in the radial figure.

Community-based provision model:

- Growers provide the veg boxes, cooking classes, volunteering opportunities and community support
- Social prescribers and health coaches provide dietary advice, highlight community support and wider social services, engage with participants, collect data

The pilot participants are people who have, or are at risk of developing, dietary-related diseases such as type 2 diabetes.





Methodology: pre- and post-intervention design

- A repeated survey will measure potential benefits for pilot participants (n = 120) relating to dietary shift, food capabilities, wellbeing, and community engagement
- These participant outcomes will be compared with a control group (n = 300)
- Semi-structured interviews with pilot participants (n = 25) will provide deeper insights into dietary shift and improved food capabilities which can be attributed to the intervention
- Physical health outcomes will be determined using observed, anonymised medical data
- Reduced dependence on food banks and increased participation in community activities will be assessed using monitoring data from community food organisations
- Two additional surveys will identify benefits for 1) growers and 2) health care workers
- Potential CO2 reduction will calculated using a Life Cycle Assessment synthesis

This project is funded by the UKRI Agri-food for Net Zero Network+ www.agrifood4netzero.net

LCA of Solar PV to Reduce the Carbon Footprint of Militaries: A Case Study at RAF Leeming

Washington D.C., and Tyndall 2025

Authors are:
Miriam H. Fsadni, Elizabeth A. Gibson and Oliver Heidrich.

Solar Energy for Militaries

Replacing fossil energy sources with renewables is critical to reaching net-zero targets. Solar energy is the most abundant source of energy on earth. China controls the vast majority of the photovoltaic (PV) supply chain (>70%), from mineral extraction to module manufacturing (IEA, 2023). Processing silica to silicon (Si) is highly energy intensive accounting for 30-50% of all supply chain GHG emissions. Silica mining leads to environmental degradation and displacement of human populations.

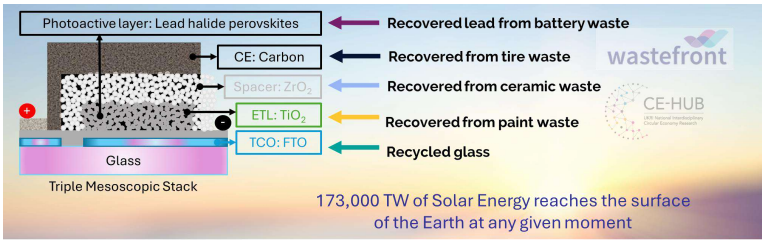


Figure 1. Triple-mesoscopic perovskite solar cell from recovered materials.

Greater focus on circular design, recycling and the security of supply chains is needed (Figure 1). Advancing PV technologies produces versatile devices that are less material and energy intensive than conventional silicon PVs.

ViTAL Living Lab

As part of the ViTAL Living Lab project (ViTAL, 2021), we explored the application of PV technologies for reducing the carbon footprint of militaries (Figure 2). We used the Royal Air Force (RAF) base at Leeming as a case study (Rajaeifar & Heidrich, 2023). Integrating MFA and LCA in planning and designing strategies for militaries and their suppliers is needed for a successful transition to net zero (Baars et al. 2022).

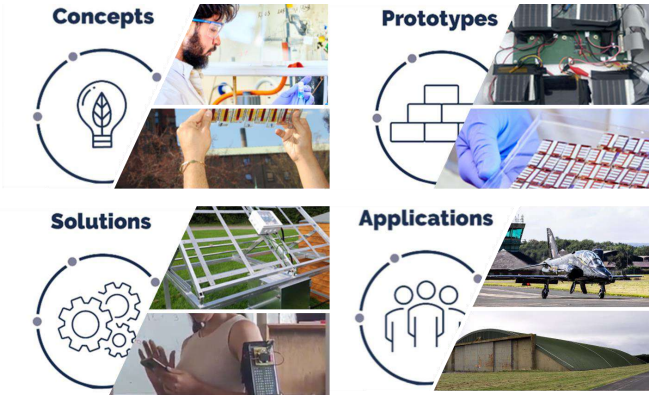


Figure 2. ViTAL framework for the Living Lab Solar Technologies experiments.

Emerging Solar Technologies

The ViTAL solar technologies experiments developed PV devices. An iterative process was used, testing designs under lab and outdoor conditions at RAF Leeming (Figures 2 and 3).

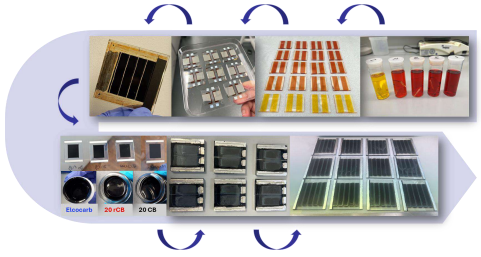


Figure 3. PV material development to small scale (4 cm^2) PV cells and to mini-modules (25 cm^2).

These devices are lightweight making them suitable for integrating with existing infrastructures. Other advantages over conventional silicon panels include: less energy intensive production, easier recycling, and enhanced performance under low, diffuse or indirect irradiation. Our designs use abundant materials (e.g. lead, recovered carbon black) that have more secure supply chains for UK markets to deliver decarbonisation targets.

LCA of PVs

We conducted a comparative assessment of the environmental impacts of different PV types. A cradle-to-grave life cycle assessment (LCA) was performed, based on ISO14040 (ISO, 2006). SimaPro was used to calculate the difference in carbon emissions due to substituting fossil with PV generated electricity.

The functional unit is 1kWh electricity produced and consumed on the base, over the lifetime of different PV panels. The impact assessment method used was IPCC 2021 GWP100. The developed LCA model considers scenarios for different PV technologies, supply chains and installation methods (Table 1).

Table 1. LCA for PV scenario details.

Categories	Types
PV Type (3 kWp):	Monocrystalline silicon (m-Si) Polycrystalline silicon (p-Si) Amorphous silicon (a-Si) Ribbon Si Cadmium Telluride (CdTe) Copper Indium Gallium Selenide (CIGS)
Installation type:	Façade Slanted roof Flat roof
Recycled components:	Aluminium Steel
Country of manufacture:	China (Jiangsu/ Zhejiang/ Shandong/ Fujian) Germany (Freiburg/ Munich/ Frankfurt/ Cologne) UK USA (AZ/ San Jose CA/ San Diego CA/ Portland OR)
Ports:	China (Shanghai/ Ningbo-Zhoushan/ Qingdao/ Xiamen) Germany (Hamburg/ Bremen/ Bremerhaven/ Wilhelmshaven) UK (Hull/ Tees/ Tyne /Leeds) USA(Long Beach/ Oakland/ Tacoma)
Transportation mode:	Truck Train Container ship

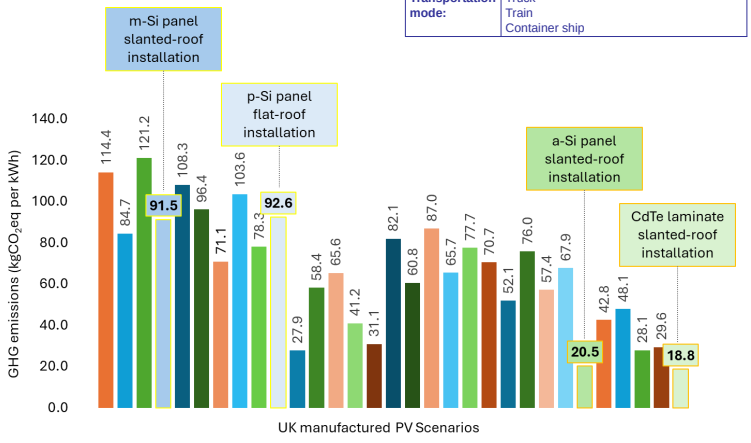


Figure 4. GHG emissions of UK Manufactured PV, by different scenarios.

As an example, in the UK, conventional m-Si and p-Si leads to significant GHG reductions in electricity generation, while CdTe and a-Si panels were found to have the lowest life cycle GHG emissions overall (Figure 4).

Sourcing devices from the UK instead of China could lower the GHG emissions attributed to manufacturing and transportation. We calculated that estate emissions at RAF Leeming could be halved by 2030 (↓0.3 $ktCO_2eq$) if electricity is obtained from UK-sourced CdTe panels, while sourcing them from China would lead to only a 10% reduction.

Conclusions

Our methodology and findings have implications across all NATO military bases that want to decarbonise their estates. It helps decision-makers monitor their progress towards Net Zero. Moreover, sourcing materials domestically or from NATO allies reduces national security, supply chain vulnerability, and operational risks (Neimark et al, 2025). We are investigating these issues further as part of the newly awarded ESRC Grant- Critically Green.

The diffusion of resource control over critical minerals, from in-ground deposits in regions to in-use stocks in consuming countries, can ease geopolitical polarisations (Wang et al, 2024) – but we need a shift to circular economy strategies, such as reuse, recycling and circular design principles.

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OUR NEW ESRC FUNDED PROJECT

CRITICALLY GREEN
Tracing the geographical, social and environmental footprint of military decarbonisation

Growing Resilience:
Legumes in UK Food System Transformation

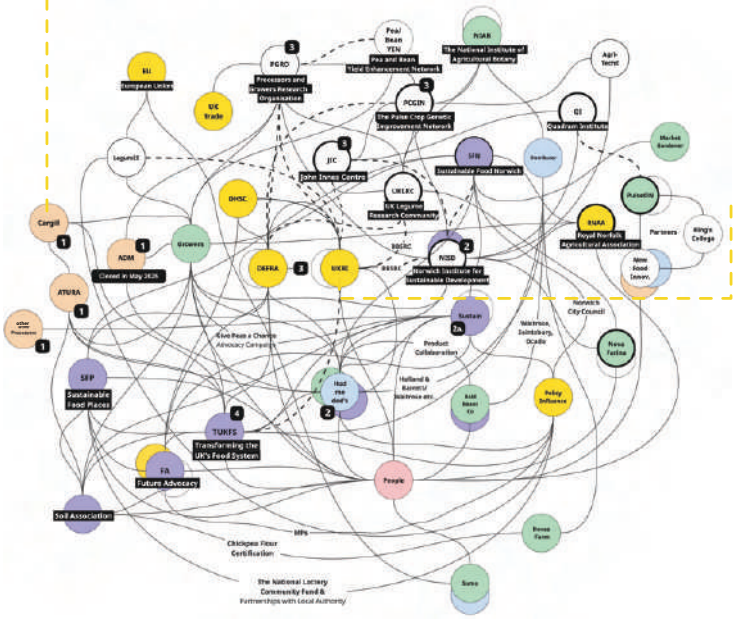
Mind Lin and Georgia Oliver
School of Global Development, University of East Anglia
Advisor: Natasha Grist (Norwich Institute for Sustainable Development)

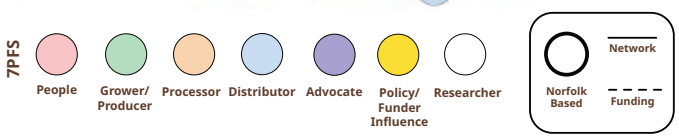
Introduction

- The UK's food systems (food imports, processing and waste) produce a significant **26% of UK greenhouse gas emissions**[1].
- COVID-19, Brexit-related supply and food security issues highlight the **urgent need for better food system resilience.**
- **UK-grown legumes offer potential system-wide benefits** towards healthier diets, restoring ecosystems, and reducing the use of nitrogen fertilisers.

Our research aims to understand whether current activities can lead to a genuine food system transformation, leading to greater food system resilience. Focusing on Peas *(Pisum sativum L.)* and Faba beans *(Vicia faba)*, we analyse the system-wide implications of associated human health and environmental benefits.

Figure 1. **The UK's Legume Stakeholder Map**

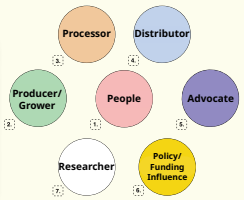




Approaches

To assess **food system resilience (FSR)**, we developed the **7 Pillars of the Food System (7PFS)**, tracing UK activities around the UK legume system. Key informant interviews with legume system actors gave insights supplementing background research.

Food System Resilience:
"capacity over time of a food system and its units at multiple levels, to provide sufficient, appropriate and accessible food to all, in the face of various and even unforeseen disturbances." [2]



Findings

1. **Challenges include lack of processing facilities, low market prices and stability, and lack of resources.** Farmers expressed the lack of financial incentives and knowledge dissemination around local pulses. Fig 1. shows limited number of actors, with variable connections.

2. **Current UK pulse consumption is limited to its fraction forms (e.g. pea protein) due to changing dietary preferences.**[3] Current purchases are driven by convenience, with processed pulses sales outweighing minimally processed forms (e.g. dried pulses). The average 15g/ day consumption falls far short of the recommended 80g/ day.[4]

3. Current UKRI and DEFRA research funding focuses on crop science and system research; **overlooking real-time implementation challenges, effective response to immediate needs (e.g. of producers) and connectivity gaps.**

Implications for Environmental Schemes

Methods: Literature and policy review, triangulated with stakeholder meetings, identified key barriers to *Sustainable Farming Incentive (SFI)* adoption in Norfolk.

Lessons for Effective Environmental Schemes

- **Clear, stable rules:** predictable guidance builds farmer confidence
- **Fair payments:** cover opportunity costs, particularly for smaller or tenant farms
- **Trusted advice:** invest in local advisors and provide practical, region-specific guidance
- **Flexible, inclusive design:** accommodate farm size, tenure, and farmer identity

ROYAL NORFOLK AGRICULTURAL ASSOCIATION

Research & Policy Recommendations

1. **Building legume system resilience must address the interconnected challenges by using systems thinking** to align environmental and health priorities.
2. **Create an independent food commission** supporting UK food system transformation and improving collaboration, keeping government and food actors accountable.
3. Promote attitudinal change and dietary shifts. **Include British grown pulses in public sector catering procurement.**
4. **Set up pathways to resolve issues for current and potential growers.** Provide stable policy and support.
5. **Use applied interdisplinary research to support effective food system transformation.**

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Air-Source Heat Pump Flexibility: Cost–Comfort Trade-offs and Policy-Relevant Insights

Owen Smith, Tyndall Centre for Climate Change Research, The University of Manchester

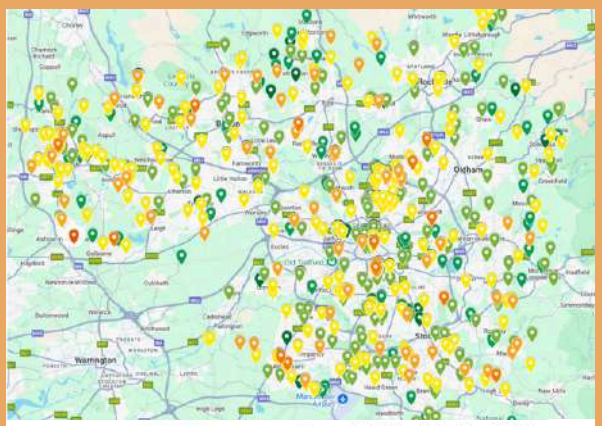
INTRODUCTION

Air-source heat pumps (ASHPs) can decarbonise domestic heat, but operation is shaped by weather, time-varying prices, and comfort expectations (HM Government, 2021; Octopus Energy, 2025).

We analyse Greater Manchester's domestic building with ASHP's portfolio with 2024 half-hourly weather/prices via cost-minimising optimisation under strict/banded/elastic comfort, reporting results on an electrical-input basis and using SCOP to link bills to delivered heat (CEN, 2022; ISO, 2017). Flexibility arises from thermostatically controlled pre-heating and brief set-backs consistent with GB demand-side services; because pre-heat occurs at higher outdoor temperatures, average COP(pre-heat) > COP(peak), so shifted heat is delivered more efficiently in expectation (IEA EBC Annex 67, 2023; NESO, 2024; CEN, 2022).

The research aims to answer the following questions:

1. What are the bill and comfort impacts of alternative operating strategies under half-hourly prices? (Octopus Energy, 2025)
2. What is the cost–comfort frontier across heterogeneous homes, and how much firm turn-down/energy shifting is achievable within explicit comfort guarantees? (IEA EBC Annex 67, 2023; NESO, 2024)
3. Which comfort formulations (e.g., ±2 °C bands, elastic penalties) are most credible for local households given standard methods and observed building characteristics? (ISO, 2017; CEN, 2022)



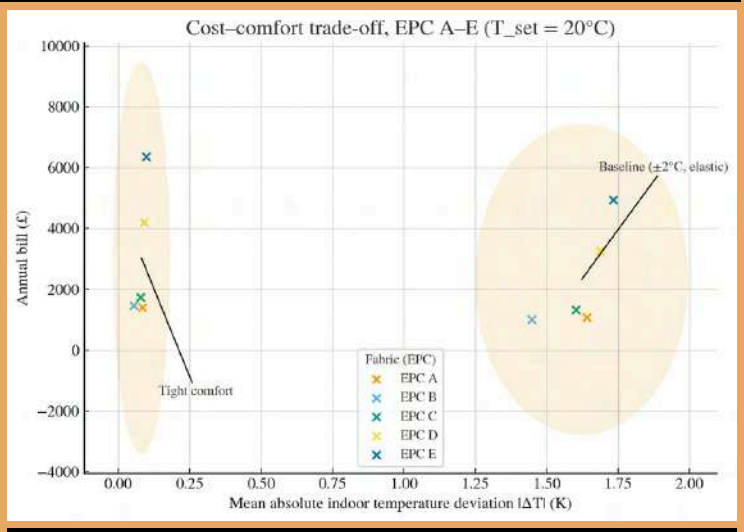
METHODOLOGY

We model each Greater Manchester EPC archetype as a single thermal zone evolving at half-hourly resolution over 2024, with indoor temperature driven by outdoor weather and ASHP input. Physics are captured by a 1R1C formulation (heat loss and thermal inertia). ASHP behaviour uses a weather-compensation mapping to flow temperature and an exogenous COP surface, preserving linearity. A linear, cost-minimising optimisation selects electrical input subject to physics, capacity, and a comfort envelope around the setpoint. Results are reported on an electrical-input basis; flexibility is read off by comparing optimal schedules to a comfort-preserving baseline. The GM EPC distribution underpinning archetypes is shown in the top right; the scenario family used to trace the cost–comfort frontier is shown below.

Scenario	Comfort guarantee	What the optimiser does	Expected behaviour
Cheapest (bill-only)	None; deviations unrestricted	Minimises $\Sigma\ \pi_t \cdot P_t \cdot \Delta t$	Aggressive set-backs; large |ΔT|; frequent breaches. Lower bound, not a control policy
Strict	Tracks set-point exactly (capacity permitting)	Holds T_set wherever feasible	Highest cost/energy; no violations; thermostat "hold"
Band ±2 °C (elastic)	≥95% of time within ±2 °C; exits penalised	Accepts small in-band drift; strongly discourages exits	Modest pre-heat/turn-down; pragmatic baseline
Comfort-elastic	Soft guarantee: small average deviation targeted	Trades cost vs deviation magnitude	Tighter tracking; more pre-heat; higher energy
Weighted-β grid	Tunable comfort weight	Systematically sweeps comfort value	Traces the cost–comfort frontier

Key components

- Structure & horizon: Single-zone 1R1C per EPC archetype; 30-min steps; full year 2024.
- Parameters & drivers: *H*, C, and design-day *Qmax*; half-hourly outdoor temperature and retail price series.
- ASHP performance: Weather-compensation → capped *Tflow*; COP = COP(*Tflow, Tout*) exogenous.
- Comfort model: Setpoint with envelope (strict bounds or elastic penalties) for explicit cost–comfort trade-offs.
- Optimisation: Linear programme chooses *Pt* to minimise bill subject to thermal dynamics, *Qhp = COPxPt*, capacity, and comfort.
- Scenarios: Cheapest, Strict, Band ±2 °C (baseline), Comfort-elastic, and a β-sweep to fill the frontier.
- Outputs & interpretation: £/property, *kWhel*/property, mean/max $|\Delta T|$, ±2 °C breaches, optional SCOP; pre-heat/turn-down inferred versus baseline (no extra constraints).



RESULTS

- **Band ±2 °C, elastic**. Comfort similar across bands—mean |ΔT| ≈ 1.5–1.7 K—while bills and energy rise with poorer fabric: **Band C**: £2,346 / 15.77 MWh / 1.615 K; **Band D**: £5,789 / 37.66 MWh / 1.694 K; **Band E**: £8,794 / 57.18 MWh / 1.738 K. Breaches of ±2 °C are modest (≈ 5% of half-hours).
- **Tight comfort (Comfort-elastic)**. Reducing mean |ΔT| to 0.10–0.15 K increases cost by +31–35% and energy by ≈18–19% vs baseline: C: £3,156 (+£0.81k); D: £7,583 (+£1.79k); E: £11,514 (+£2.72k).
- **Lower bound (Cheapest).** Near-zero bills only with very large deviations (mean |ΔT| ≈ 8.3–8.5 K) and frequent breaches; this is a theoretical bound, not a viable control policy.
- **Cost–comfort frontier.** Within each EPC band, cost decreases as mean deviation increases (Pearson ρ: ≈ −0.98 to −1.00). Poorer EPCs sit higher for any given comfort (larger "comfort premium").
- **Price intensity & basis**. Results are on an electrical-input basis (kWh_{el}); implied price intensity ≈15 p/kWh. Because pre-heating occurs at higher outdoor temperatures, $COP_{pre\text{-}heat} > COP_{peak}$ on average, so part of shifted heat is delivered more efficiently.

DISCUSSION

- Within each EPC band, a clear cost–comfort frontier emerges: tighter comfort (lower mean |ΔT|) increases energy use and bills; relaxing comfort does the opposite (strong monotonic relationship, ρ ≈ −0.98 to −1.00).
- Fabric and control are complementary. Under the Band ±2 °C (elastic) [Baseline], costs rise steeply as EPC worsens while average comfort remains similar (~1.5–1.7 K). Tight Comfort-elastic control reduces deviations to ~0.10–0.15 K but raises costs by ~31–35% and energy by ~18–19%.
- Equity signal: the comfort premium (extra £ to maintain very tight comfort) is largest in poorer-fabric homes (e.g., Bands D–E), motivating targeted support (fabric-first upgrades, differentiated incentives) to avoid regressive outcomes.
- Credible flexibility exists within comfort. Intermediate weighting shows pre-heat in milder periods and turn-down in the evening peak; because pre-heat occurs at higher outdoor temperatures, COP(pre-heat) > COP(peak) on average, so shifting can be marginally efficiency-enhancing.

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URGENT TRANSITIONS FOR JUST ADAPTATION:

Rethinking Mobility, and Inequality in South Asia's Climate Futures

Rethinking Adaptation Through Four Urgent Transitions

As climate impacts intensify across South Asia, mobility has become a defining way communities respond to environmental change. Yet public and policy narratives often frame migration as a failure of adaptation rather than a legitimate, and sometimes aspirational, strategy for resilience and opportunity.

Unlike the IPCC, which defines transitions as large-scale systemic shifts in energy, land, infrastructure, and society, we focus on the lived transitions that households and individuals experience through migration, immobility, and adaptation. These include shifts in livelihoods, care arrangements, gender roles, and social identities that shape how systemic change is taken up, resisted, or reworked in practice. Drawing on the SUCCESS and CLAPS projects, we present four urgent transitions to make adaptation more just, inclusive, and effective for both mobile and immobile populations.

Interdisciplinary & Mixed Methods Approach

Our research integrates policy analysis with diverse field-based and analytical methods. These include household surveys to capture migration drivers and adaptation strategies; qualitative research such as key informant interviews, focus group discussions, and life histories; participatory approaches including photovoice and foresight; geospatial analysis to map hazards, vulnerabilities, and migration corridors; and scenario analysis of alternative adaptation pathways. Case examples illustrate the four urgent transitions in practice across varied geographies and social contexts.

Why Urgent Transitions Matter

By redefining transitions to include both systemic and lived dimensions, we highlight that adaptation cannot be understood solely through sectoral or infrastructural change. In South Asia, where climate risks intersect with entrenched inequalities, incremental change is insufficient. Urgent transitions demand rethinking narratives and governance—recognising migration as a legitimate adaptation strategy, centring agency and wellbeing, integrating rural–urban resilience, and adopting gender-transformative approaches. Without such shifts, adaptation risks reinforcing rather than reducing vulnerabilities.

01 Transition from neglect to inclusion

Mohan, Nepal

Migration can be a tool for adaptation to climate risks and other vulnerabilities such as when Mohan (NEP) successfully relied on remittance from abroad to cope with floods in his village. However, it also needs to center the voices and aspirations of the people impacted to be successful. If not, just like Rajesh (IN), who made a difficult decision to stay in a cyclone prone area to continue earning as a fisherman, trading physical safety for livelihood security, migration attempts can fail as an adaptation strategy.

02 Shifting from vulnerability to agency

Kinley, Bhutan

The opportunity to upgrade their financial and social mobility against the precarious life in destination places like Pasakha is a big tradeoff many migrants are willing to make to support their and their families long term wellbeing and adaptive capacity. Kinley (BHT) returned to Pasakha after being displaced by the floods to continue earning. Today Kinley has successfully invested in his daughter's education in Australia by working in the disaster-prone area, opening doors of opportunities and socio-economic mobility for the family.

SCAN ME!

Want to hear directly from the frontlines of change across South Asia? Scan to dive into powerful stories of just adaptation

03 Transition from fragmentation to integration

Maheswar, India

Migrants often belong to both places: In destinations - as invisible workforce, and in origin - bringing in social and economic remittance. It opens corridors of connection such as Kulna's (BD) transformative migratory trajectory, which has provided an opportunity in the destination while keeping a strong relationship with origin. Such corridors also encourage entrepreneurship like in the case of Maheswar (IN), enabling growth and learning in both the rural and urban places.

04 Moving from gender-blind to gender-transformative approaches

Sakii, Bangladesh

Gender profoundly shapes migration experiences, creating both opportunities and risks for women. Relocation can open space to renegotiate roles and expectations, as seen in Pasakha (BHT), where childcare has shifted from being solely women's responsibility to greater involvement from fathers. In BD, women displaced by coastal erosion in Cox's Bazar and now living in Bastuhara colony, have entered garment scrap-sorting work. The wages help them escape the hunger they faced in their villages. Yet alongside such opportunities, women migrants remain highly vulnerable to gender-based violence and harassment in new settlements.

Say Hello!
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CLARE CLIMATE ADAPTATION ASSESSMENT

UK International Development

The 2023-24 spike in global temperature

Key findings

Global mean temperature increased rapidly in 2023-24.

What are the implications?

Is global warming happening faster than predicted?

No. 2023 and 2024 global temperatures sit well within the predicted range of global warming.

What about the short-term variability? The rate of warming from 2021-22 to 2023-24 looks unusual.

The year-on-year warming (peaking at 0.36°C/year) **was more rapid** than all but one previous warming spikes.

But does this mean that our understanding of interannual climate variability is deficient?

The El Niño Southern Oscillation (ENSO) is known to be a primary contributor to interannual climate variability. Annual changes in global temperature are highly correlated with annual changes in ENSO.

ENSO caused about half of the 2023-24 temperature spike.

The 2023-24 El Niño was not itself extreme, but it was preceded by a strong La Niña in 2021-22. Thus, it was **the change in ENSO** (and its influence on global temperature) from 2021-22 to 2023-24 that **was extreme**.

After accounting for ENSO, the remaining year-on-year warming peaked at 0.20 °C/year. A similar rate of warming has been observed multiple times before.

So, the 2023-24 global warming spike could be explained entirely as long-term human-caused warming plus an extreme change in ENSO plus non-ENSO natural climate variability.

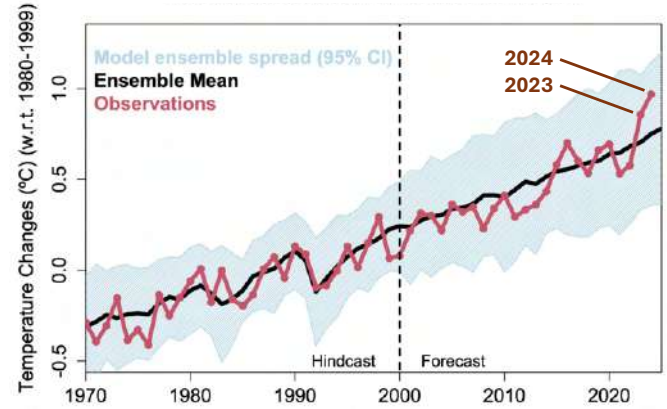
This does not rule out other contributors to the exceptional warming spike (especially because the non-ENSO natural variability component would have had to be at the upper end of the historical range).

Other possible contributors to the warming spike?

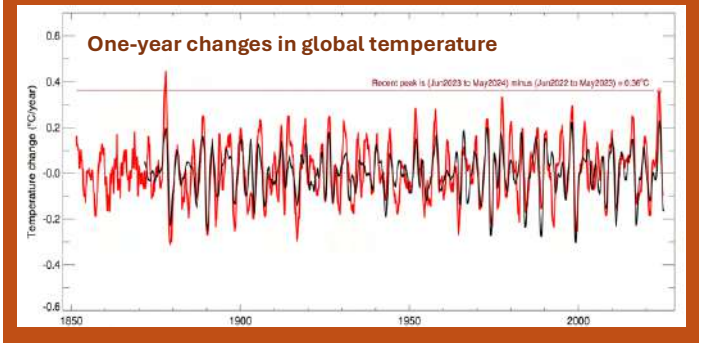
The 2022 **Hunga Tonga-Hunga Ha'apai eruption** put exceptional amounts of water vapour (which would cause warming) but also moderate amounts of sulfate aerosol (which would cause cooling) into the stratosphere. Schoeberl et al. (2024) find that the net was likely a weak cooling (not warming) effect.

There have been rapid decreases in **sulfate aerosols from East Asia** over the last decade (Samset et al. 2025) and in **sulfur emissions from maritime shipping** post-2020 (Watson-Parris et al. 2025). Rapid removal of these previously-present cooling factors has likely contributed to an increase in the rate of warming (rather than just a temporary 2-year spike).

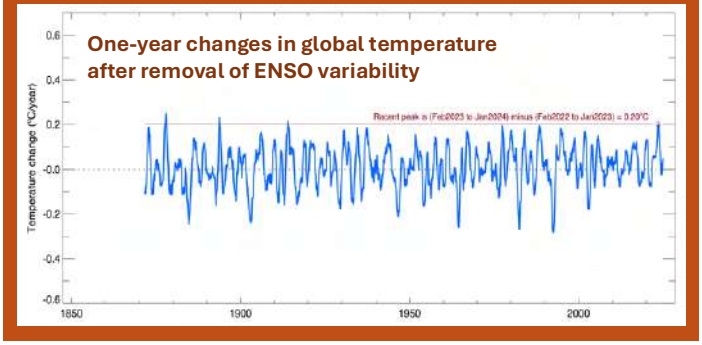
Long-term global warming remains within predicted range



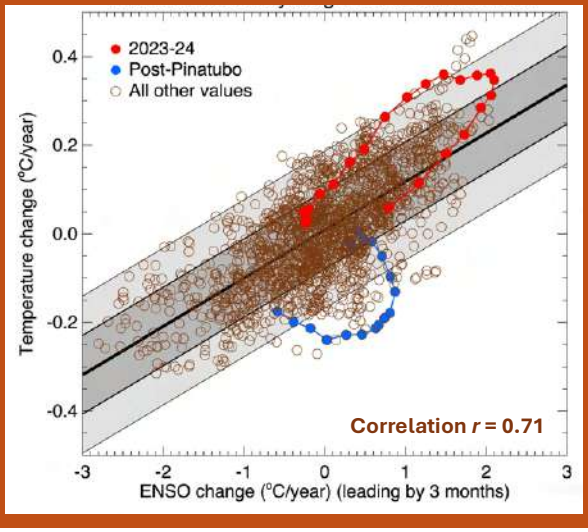
Short-term warming was exceptionally rapid from 2022 to 2023



Short-term warming was unusual but not exceptional once ENSO is accounted for



Short-term warming due to short-term changes in ENSO and non-ENSO natural variability including volcanoes



Details

Figure 1 is from RealClimate. It compares observed global temperature changes with those projected by CMIP3 climate models run around 2004. Similar agreement is found with more recent projections using CMIP5 and CMIP6 climate models.

Figure 2 shows year-on-year changes in global temperature (red) and the changes predicted by the year-on-year changes in ENSO (black). For global temperature, we use the HadCRUT5 (Morice et al. 2021) dataset, with a 12-month running mean. For ENSO, we use the Nino3.4 SST index with a 12-month running mean, leading by 3 months because the full effect of ENSO takes a few months to be seen in the global temperature.

The horizontal red line compares the most recent peak with all previously observed year-on-year changes. The only larger change was during the 1877-78 El Niño, though the global temperature data is much more uncertain before 1900 so the 1877-78 peak may not really have been above 0.40°C/year.

Figure 3 shows year-on-year changes in global temperature after removing the effect of ENSO changes (blue).

The horizontal red line compares the most recent peak with all previously observed year-on-year changes (also with ENSO effects removed). Multiple cases have similar year-on-year rates of warming as the recent peak.

Figure 4 is a scatter plot showing the relationship between 1-year changes in global temperature and 1-year changes in ENSO (leading by 3 months). Each brown circle is an individual time point (the use of 12-month running means allows a time step of 1 month, whereas calendar-year annual averages would have required time steps of 1 year and would have missed the peak warming which did not occur between calendar years).

The red dots show the year-on-year changes that ended in months from Jan 2023 to Dec 2024 (moving clockwise). The blue dots show the year-on-year changes that ended in months from Jan 1992 to Jun 1993 (moving anti-clockwise) when the Pinatubo volcanic eruption caused cooling.

The regression line is marked together with shading to show where ±1 (dark grey) and ±2 (pale grey) standard deviations of the regression residuals lie. Symbols lying close to the uppermost line are from cases where the short-term warming, after removing the ENSO effect (captured by the regression line), is around +2 SD of observed non-ENSO variability.

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STRUCTURAL ACCOMMODATION
a coastal adaptation response to sea-level rise in Europe

Ulysse Pasquier[1], Robert J. Nicholls[1,2], Gonéri Le Cozannet[3], Paul Sayers[4], Vanessa Völz[5], Jochen Hinkel[5], Alexandra Toimil[6], Claudia Wolff[7]

Introduction

- **Accommodation**: "all natural system effects are allowed to occur, but human impacts are minimized by adjusting the use of the coastal zone"
- **Structural** examples: raised floor levels, refuge areas, floating/amphibious houses
- Common practice in the U.S., Southeast Asia and small islands
- There is a poor understanding of the role of **structural accommodation** in Europe compared to other coastal adaptation strategies (protect, retreat)

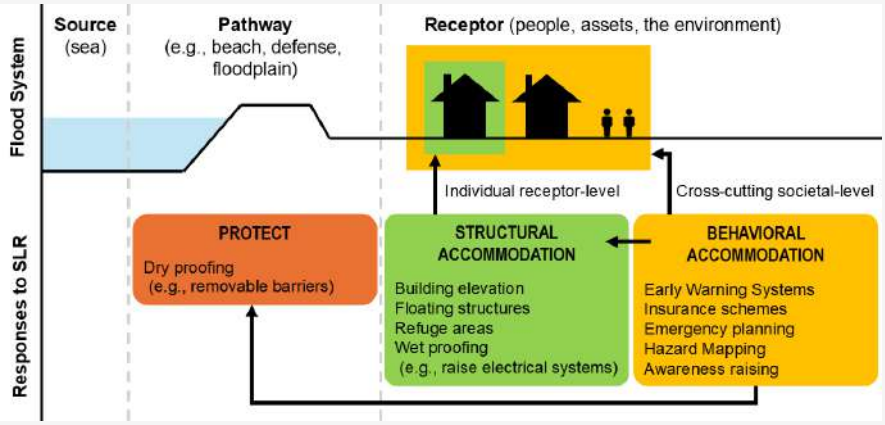
Objectives

1. Provide a conceptual framework for accommodation
2. Assess the current state of structural accommodation in Europe
3. Identify challenges and opportunities

→ Improve the definition of the coastal adaptation **solution space**

Methods

1. Qualitative analysis of academic and grey literature, existing policy, case studies and input from expert knowledge
2. Systematic review of municipal-level policy and technical documents in France, UK and Ireland



Results & Findings

- Measures in local (municipal) spatial planning documents
- Geographically fragmented implementation
- Poorly integrated in national adaptation plans and with other coastal adaptation strategies
- Not a first line of defence: in sheltered or protected coasts

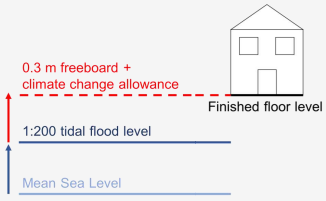
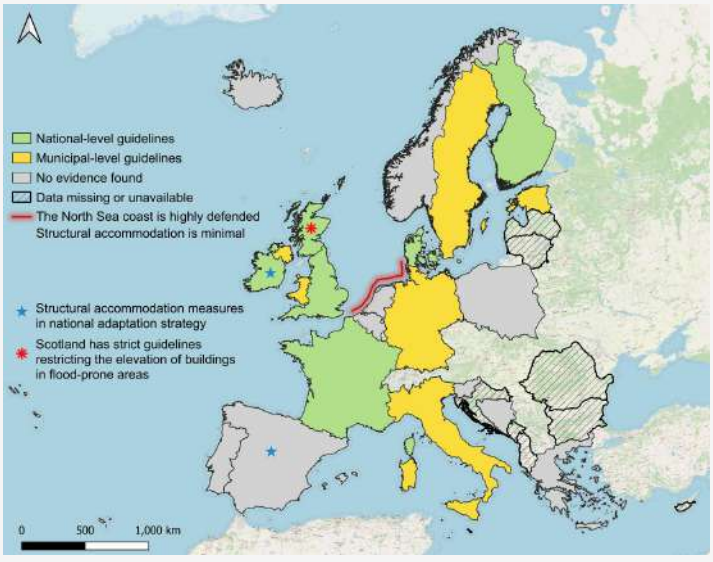


Table – Share of local planning documents in high coastal flood risk zones with structural accommodation measures

	Raised floor levels	Sacrificial ground floor	Refuge area	Raised vulnerable systems
France	83%	0	81%	80%
England	73%	42%	36%	51%
Wales	40%	40%	33%	47%
Scotland	46%	0	0	4%
Northern Ireland	43%	0	0	14%
Ireland	89%	61%	0	50%

Financial responsibility falls on individuals and there are few sources of funding for structural accommodation in Europe. In the U.S., the **National Flood Insurance Program** has in the past incentivised property-level resilience.

The implementation of structural accommodation in Europe does not always consider its physical limitations. More technical guidance could be provided to avoid maladaptation (i.e. consider the impacts of high velocities, waves, wind and seismic activity on adapted structures).



Conclusions

Structural accommodation holds an untapped potential as part of a diversified and adaptive response to sea-level rise.

An integrated approach, both in terms of policy and funding, that also accounts for the limitations of structural accommodation, can enhance its feasibility and effectiveness. This can buy time for coastal regions, delaying the need for retreat, and helping prepare for more transformative change in the face of rising sea levels.

SCAN ME

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University of East Anglia

CoCliCo
coastal climate core services

Evaluating Open-Source and LiDAR Generated Digital Elevation Models (DEM) and Building Footprints in Addressing Data Limitations for Urban Flood Modelling

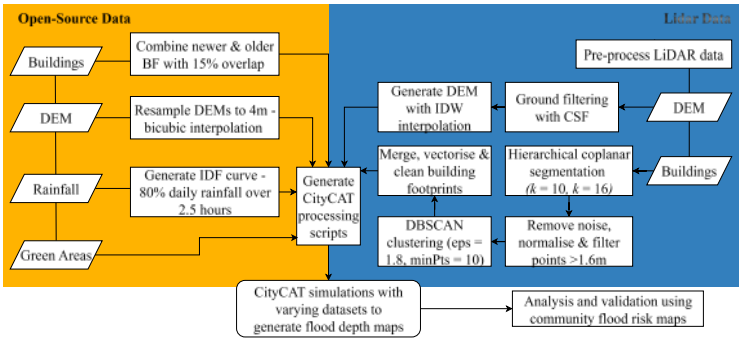
Authors: Ambreen Masud[a], Maria-Valasia Peppa[a], Yady Tatiana Solano-Correa[b], Jon Mills[a] & Cat Button[a] - [a]Newcastle University, [b]Universidad Tecnológica de Bolívar

RESEARCH MOTIVATION

High resolution urban flood models are valuable tools for assessing flood risk and enhancing resilience planning, however their reliability can be constrained by data quality and availability, especially in flood-prone data-scarce cities. Understanding how flood model outputs vary according to available datasets, particularly in contexts with limited data in hazardous situations, is critical in comprehending flood vulnerability and risk.

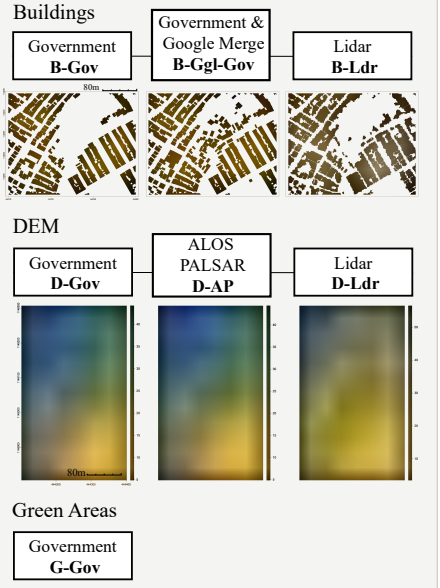
This research assesses the effectiveness of open-source DEMs and building footprints using urban flood model CityCAT, and compares model outputs with proprietary LiDAR data. Flood model simulations are then compared with local community and government flood maps to understand flood risk in Cartagena, Colombia.

METHODOLOGY



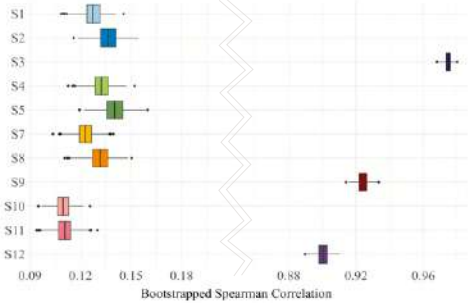
FINDINGS

Model data inputs with code to match flood scenario labels on the right.



Scenarios that did not use the LiDAR DEM showed weaker correlations with ρ values ranging between 0.11 and 0.14.

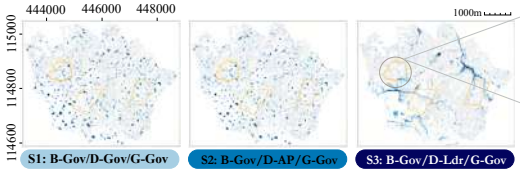
Comparison of scenario 6 against other scenarios.

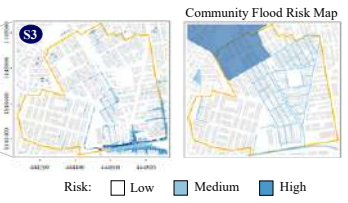


Flood risk maps at neighbourhood level

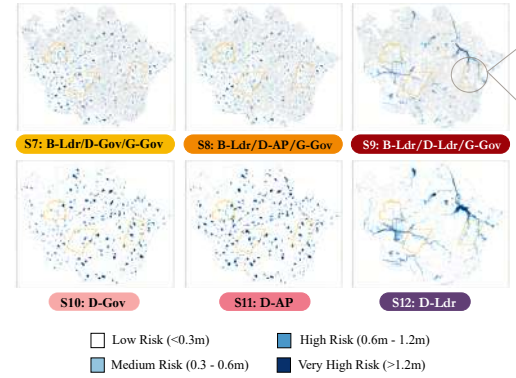
Medium to high risk flood pixels (>0.6m) form between 11 to 13% of the overall spatial extent, but maximum flood depths range between 3.89 to 4.81 across scenarios.

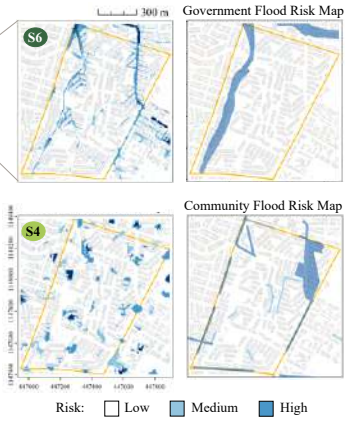
Flood model scenario maps with coded data input labels.





There is greater crossover of spatial patterns of flood risk between community flood risk maps and scenarios which use LiDAR data, particularly with scenario 6.





Merged outdated government building with up-to-date google builldings show more alignment with community flood risk map.

Model outputs when comparing different building footprints.

DISCUSSION

- Open source global DEMs do not provide realistic flood spatial extents with high resolution urban flood models. LiDAR is a key alternative in providing necessary data required for flood information at a local level in data-scarce contexts. However, LiDAR accessibility and cost is a limitation.
- Model results correspond with community flood risk maps, but can over- and under-represent in some areas, requiring cautious interpretation. Future work will include citizen contributed data for local flood information in near real time.

Research Sponsors & Stakeholders

From climate science to tangible action

Art as a catalyst

Anke Schlünsen-Rico M.A.

GERICS Climate Service Center Germany

An institution of Helmholtz-Zentrum **Hereon**

KEY MESSAGES

- *To encourage society to adopt climate-friendly actions, it is essential to align with culture.*
- *Art emerges as a particularly empowering format that can potentially contribute to a cultural paradigm shift.*

INTRODUCTION

With **Climate Service and Art**, GERICS acts as an interface between climate science and art, as a lab for exchange between climate, social scientists and artists, as an information desk for the art-science community, and as a partner in European art-science projects.

As a service at the interface of climate science and art, it maintains a special network that connects scientists with matching artists. Conversely, considering their climate-related artistic research, it connects artists with suitable in-house climate and social scientists.

Foto: pixabay, Michelangelo 'The Creation of Adam'.

BEST PRACTICE EXAMPLES

- We brought artists into the interdisciplinary research fellowship '**Art meets Science**' of the Helmholtz Information & Data Science Academy (HIDA) in 2022/23, and enabled the fellows to exchange their artistic research 'DiscoEarth' with in-house climate and social scientists for three months. The sequel 'DiscoPlanet: Letheia' has been invited to the Ars Electronica Festival 2023. (Fig.1)

Fig. 1: Do Mayr, 'DiscoPlanet: Letheia' at Ars Electronica 2023

- As a partner of '**City Climate meets Creative Coding**' (CCmCC), a project of the City Science Lab (CSL) at HafenCity University Hamburg (HCU), one climate scientist and one social scientist from GERICS advised the artists in their creative process. (Fig.2)

Fig. 2: Elisa Berdica, 'Citizen AI' at 'CCmCC', 2022

- We are working closely with a media artist who has fed his digital climate installation, 'The World in a Painting', with climate data from GERICS, visualised them and combined them with sound data from the Alfred Wegener Institute. (Fig.3)

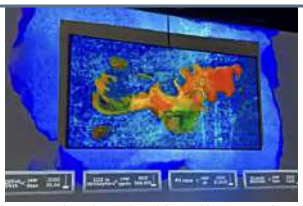


Fig. 3: Alexander Borchers, 'The World in a Painting'

- GERICS' Climate Service and Art is also involved in EU projects. In '**The Human-Tech Nexus. Building a Safe Haven to Cope with Climate Extremes**' (The HuT), we bridge science and technology with art. The artistic intervention 'Welcome to 2050 - Adapt or Succumb', based on the co-creation of scientists, artists and students, is a model of outreach: four publications have reported on the project, a documentary film on the exhibition was shown at the Royal Academy of Bhutan. (Fig.4)

Fig. 4: Chele Esteve, 'Welcome to 2050

- GERICS represents The HuT's artistic interventions at EU conferences. At **ECCA 2023**, together with Playback Theatre Dublin, we performed 'Weather extremes are going to hit you! Early Warning Systems are going to "HuT" you!'. At **EGU 2024** we held the session 'Art-science cross-fertilisation. The HuT: good practice of project-based collaboration'. We were invited at **UNDRR 2024,** Ignite Stage, with 'The HuT: Art as a Driving Link'. (Fig. 5)

Fig. 5: Michele Calvello, The HuT & Playback Theatre Dublin at ECCA 2023

OUTLOOK

- The blend of art and science is becoming increasingly recognised as a powerful tool in shaping the future of climate action.
- The launch of the *Group of Friends of Culture-Based Climate Action* at COP28, an international coalition of UN Member States aimed at building political momentum for the recognition of culture as a uniquely powerful force in climate change policy, is an important milestone in this direction.
- As GERICS and other organisations demonstrate, this collaboration can lead to transformative experiences that both inform and inspire.

PARTNERS

hereon · city climate meets creative coding · The HuT · Funded by The European Union · ARS ELECTRONICA Art, Technology & Society

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SEED: A mixed-methods Study investigating the Effects of climate change on food insecurity through Empowering women in Karaga District, Northern Region, Ghana

Jessica L Boxall[1*], Alex Brown[1*], Mohammed Malle Abdulai[2], Amelia G Bird[3], Michael G Head[4], Abdul Kasiru Shani[5], Patience Kanyiri Gaa[6]**
1 Primary Care, Population Sciences & Medical Education, Faculty of Medicine, University of Southampton, UK | **2** Karaga Health Directorate, Ghana Health Service, Ghana | **3** Human Development & Health, Faculty of Medicine, University of Southampton, UK | **4** Faculty of Medicine, University of Southampton, UK | **5** Songtaba, Ghana6 School of Allied Health Sciences, University for Development Studies, Ghana *Joint primary author. **First and last author, all authors in between organised in alphabetical order.

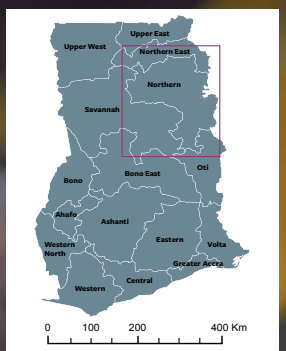
BACKGROUND

Climate change is a significant driver of health inequalities, especially in rural populations across sub-Saharan Africa.

Northern Ghana's reliance on subsistence farming heightens the risk of malnutrition and subsequent food insecurity, due to inabilities to withstand consequences of climate change.

Current interventions lack sufficient community engagement and integration of local knowledge, particularly from the perspective of women, even though they are the primary household decision-makers regarding food.

Women face disproportionate vulnerabilities to climate change and food insecurity. The Food and Agriculture Organisation (FAO) estimate that closing the gender gap in agriculture could reduce the number of hungry people by 100-150 million globally, with sub-Saharan Africa holding the largest potential impact.

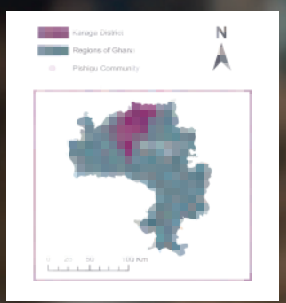


Ghana Statistical Services (GSS) (2025) Ghana - Subnational Administrative Boundaries. Available at: https://data.humdata.org/dataset/cod-ab-gha (Accessed: 20/09/2025)

Figure 1: Map of Ghana, divided into regions (above). Map showing location of SEED study site, Pishigu, within the Karaga District, Northern Region (bottom). Created by Gracie Horton, University of Southampton.

AIM

- **To describe** the prevalence and determinants of food insecurity in Karaga, Northern Ghana.
- **To gain female opinion** on reasons for food insecurity, including climatic impacts.
- **To assess** local dietary patterns and health outcomes to understand the extent and impact of nutritional deficiencies and priorities for intervention.
- **To identify** previous interventions in Ghana by NGOs/ government agencies to address food insecurity.



METHODS

- **Household surveys** took place in Pishigu, Karaga, a district in the Northern Region of Ghana (Figure 1).
- **Data were collected by trained local healthcare workers and teachers**, who carried out the survey within their own communities. This approach increases acceptability within the community and increases local research capacity.
- **The survey and subsequent modelling** measured the prevalence of food insecurity. Additionally, women were asked about perceived causes of food insecurity including climate factors, dietary patterns and self-reported health status.
- **Households were randomly selected**, and used the random-walk method, previously used in a similar study in Mion District.
- **Two focus groups** have also been conducted, each with a mix of 12 purposively selected and volunteer local women, predominantly working as farmers and traders. Discussion topics included local perceptions of climate-related food insecurity, existing support, and community-identified priorities for improvement.
- **A narrative review** also captured food aid interventions that had taken place in Karaga district in the last 20 years.

RESULTS

- **There were 384 survey respondents** to the household survey and focus groups have now taken place.
- **Early quantitative analysis indicate** high levels of food insecurity. 52.6% of participants had experienced severe food insecurity over the last 12 months; 93.4% had experienced moderate/severe food insecurity. For comparison, globally 1 in 3 have moderate/high insecurity according to the Food and Agriculture Organisation (see Table 1).
- **The prevalence of food insecurity** was far worse than that reported in Mion in May 2023, and national averages from 2020-2022.
- **Less than 2% of participants** had eaten any fresh fruit or vegetables in the previous 24 hours – the average diet was predominantly compromised of starchy carbohydrates and little protein.
- **Only 12% of participants** had received help from an intervention: 97.8% of these were from NGOs, 93.5% were food aid - both of which are short-term and unsustainable solutions.
- **Interventions identified in the narrative review** did not have publicly-available evaluation data, and reach of location to communities such as Pishigu could not be verified. The survey results suggest that rural, under-served communities are not within geographical scope of past interventions, though they are the most vulnerable to severe food insecurity.
- **Results from the focus group** will identify potential areas for food systems and health policy development, utilising knowledge from local women.
- **This project forms part of ongoing research** and further results will be shared in due course.

Results are being disseminated across Ghana Health Service at district, regional and national level, as well as Ghana Ministry of Health and WHO country office.

Region/ Standard	Prevalence of moderate or severe food insecurity (%)	Prevalence of severe food insecurity (%)
Pishigu, Karaga, Northern Region (March 2025)	93.4	52.6
Sang, Mion, Northern Region (March 2025)	61.5	26.4
Ghana (2020-22)	39.4	6.2
West Africa (2020-22)	64.1	21.2
Global standard (2020-22)	29.5	11.3

Table 1, showing preliminary results of levels of moderate and severe food insecurity in Pishigu, Karaga. There are also results from a previous study on a mixed-gendered demographic in Mion, another district in Northern Ghana; Ghana as an entire country; West Africa; and Global standard, available from the FAO.

Thank you to the Sustainability & Resilience Institute, University of Southampton, for funding SEED.

Tyndall Centre for Climate Change Research

University of East Anglia

tyndall.ac.uk/datavisuals

Seeing science clearly

Co-designing climate visuals for intergovernmental assessments

Dr Jordan Harold, Prof Irene Lorenzoni, Prof Kenny Coventry

jordan.harold@uea.ac.uk, i.lorenzoni@uea.ac.uk, k.coventry@uea.ac.uk

Challenge: Data visuals are important communication devices to convey and reinforce key messages from environmental scientific assessments with broad audiences. However, data visuals produced by researchers are often challenging for other-disciplinary researchers, decision-makers and publics to understand. Designing data visuals that are scientifically robust and easy to understand is essential for making complex information more accessible.[1,2]

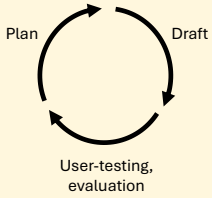
Approach and innovation: Adopting an interactive design process and evidence-based approach in the co-design of data visuals enables informed decisions to be made on communication choices.

We adopt the **MADE principle**, which considers:[3]

- the intended **message** of the figure
- the intended **audience,** their needs and prior knowledge
- evidence-based **design** principles from the psychological sciences
- **evaluation** and testing to check if the figure is understood as intended

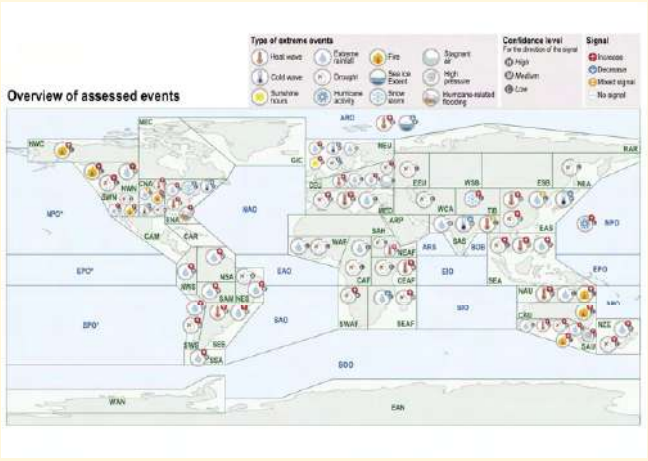
These elements are applied through a co-design process involving a multidisciplinary team of researchers and content experts, information designers, cognitive and social scientists, report management teams and users of reports.[4]

Iterative design process



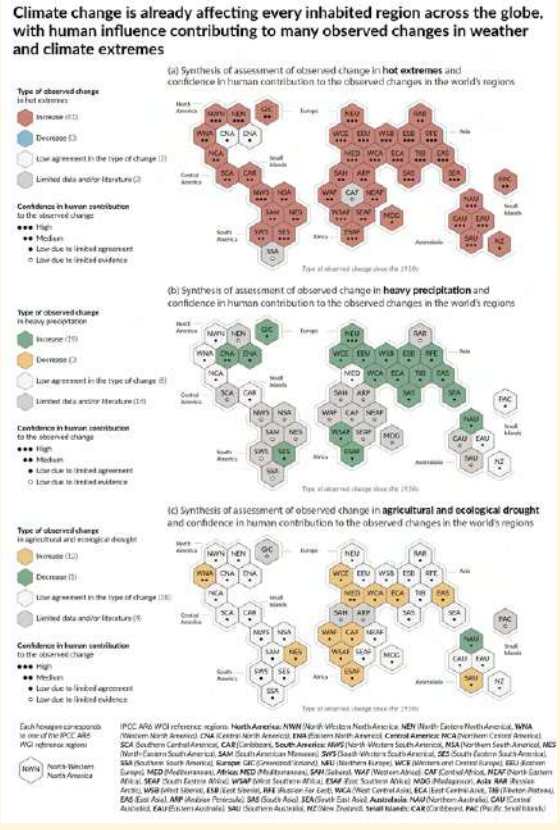
Reflections: Following our contributions to the IPCC Sixth Assessment Report and the forthcoming UNEP Global Environment Outlook (GEO-7), key considerations for successful co-design of more easily comprehensible data visuals include:

- Establishing **trust and understanding** across diverse co-design teams
- Enabling time and space for **open discussion** and reflections on the visuals and co-design processes
- Incorporating **users' views** during confidential drafting processes
- Exploring use of **digital formats**, e.g. interactive atlases, chatbots, and digital signposting



Before

First order draft of IPCC AR6 WG1 Figure SPM3, prior to co-design.



After co-design

Final government approved IPCC AR6 WG1 Figure SPM3, created through co-design, incorporating a clear message and more accessible content.

1. Harold, J., et al. (2016). Cognitive and psychological science insights to improve climate change data visualization. *Nature Climate Change*, *6*, 1080-1089. **2.** Harold, J., et al. (2020). Communication of IPCC visuals: IPCC authors' views and assessments of visual complexity. *Climatic Change*, *158*, 255-270. **3.** Harold, J., et al. (2017). Enhancing the accessibility of climate change data visuals: Recommendations to the IPCC and guidance for researchers. Tyndall Centre for Climate Change Research, UK. **4.** Morelli, A., et al. (2021). Co-designing engaging and accessible data visualisations: a case study of the IPCC reports. *Climatic Change*, *168*, 26.

Bridging the adaptation knowledge-to-action gap:
the role of online knowledge platforms

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Learn more about the study and SEI's online knowledge platforms/tools!

Context

With the world on track to pass 1.5°C of warming above pre-industrial levels in the next 5 years[1], our ability to effectively adapt to the impacts of climate change becomes increasingly urgent. Online knowledge platforms - when designed and governed effectively - can play a key role in helping policymakers, researchers, and practitioners build upon, learn from, and implement existing, good practice adaptation approaches. This, in turn, advances more informed and coordinated climate action.

However, the production of information – and misinformation and disinformation – is accelerating. On top of this, donor and project requirements are contributing to a 'proliferation of platforms'[2], resulting in a collection of dispersed short-lived websites that are often abandoned once project-funding cycles conclude.

How can online platforms stay relevant in this fragmented and siloed knowledge landscape and drive climate action at the scale required?

Research study

The weADAPT platform - launched by SEI in 2007 - is one of the world's leading and longest-running user-led platforms and networks for climate change adaptation. We assessed weADAPT's usability and impact in our study **'Measuring what matters: Building impact pathways to actionable information for the weADAPT platform'**[3] to better understand how we as knowledge brokers can effectively bridge the knowledge-to-action gap.

Over 300 users - spanning 83 countries across Africa, Asia, Europe, Oceania, and North and South America - were consulted through a survey (379) and series of interviews (21). The analysis identified:

- Examples of weADAPT's impact e.g. promoting adaptation awareness, supporting capacity development, influencing policy and planning, and facilitating knowledge exchange and collaboration.
- Six core knowledge management activities that support the realisation of these outcomes in practice.

These insights helped refine weADAPT's theory of change; establish a monitoring, evaluation, and learning framework, and guide a technical upgrade of the platform finalised in January 2024.

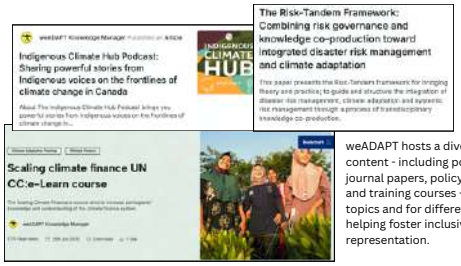
Knowledge management activities that bridge the knowledge-to-action gap

Explore the six core knowledge management activities, and understand ways to monitor and track their progress in practice, through a series of examples from across SEI-Oxford's online knowledge tools and platforms that seek to bridge the adaptation knowledge-to-action gap:

1 Increasing usability though translation, tailoring, syntheses and capacity development

Use of simple language, case studies, and succinct syntheses can support training and capacity development initiatives, contribute to policy inputs, and help transfer practical applications of solutions from one location to another. They can also break down communication barriers between users who experience, understand, and discuss climate change using different concepts, metrics, values, and beliefs.

Example indicators: most viewed formats; number of new courses added; number of trainings provided on using the platform.



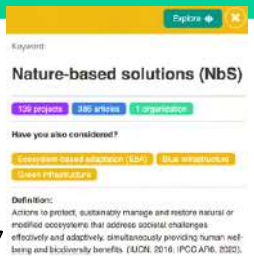
weADAPT hosts a diverse range of content - including podcasts, blogs, journal papers, policy briefs, reports, and training courses - on a range of topics and for different audiences, helping foster inclusivity and representation.

2 Enhancing inclusivity through just and equitable sharing of multiple knowledges

Sharing knowledge from multiple sources and giving them equal presence across the platform supports cross-community learning across diverse regions of the world and fosters the exchange and learning of Indigenous and local knowledge practices.

Example indicators: number and types of registered organisations (e.g. community, youth-based etc.); availability of content in various languages; cultural, geographical and disciplinary diversity of contributors.

To break down communication barriers, our Climate Connectivity Taxonomy provides definitions, related terms, synonyms, and scope notes (contextual information about a concept) for more than 1,000 concepts, building on definitions from authoritative sources like the IPCC glossary and the Hazard Information Profiles developed by the UNDRR and the International Science Council. The Taxonomy can be integrated into online platforms through an API to enhance content interoperability and discoverability.



3 Building trust through collaborative knowledge management processes

Iterative collaboration between users, knowledge managers, and expert editors helps platforms retain impartiality, credibility, and a neutral tone, as well as create a trusted voice for a diversity of stakeholders.

Example indicators: citation analytics; number and diversity of editors who peer-review content for quality; number of 'unique opens', downloads, and forwards for newsletters.

Providing prompts and templates for user-led contributions can help standardise how material is shared and disseminated; in turn supporting learning, comparability, and transferability.

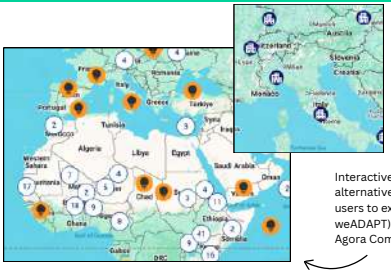
weADAPT and its microsites allow users and organisations to contribute their own content, building trust and maintaining impartiality.

weADAPT organises content into themes to support targeted learning. Content can also exist across themes or be connected to related themes, reducing siloes and supporting the cross-fertilisation of knowledge.

4 Creating transferability through sharing multi-scale, multi-sectoral, place-based knowledge

Sharing practical and geo-referenced case studies can support inspirational learning and transferability across different contexts. Comparability and transferability of lessons learned can also be fostered through systematic and semi-standardised syntheses.

Example indicators: number of case studies users contribute, view, engage with, and bookmark; the number and diversity of geographic locations of cases shared; the diversity of scales, sectors, and risks covered by case studies.

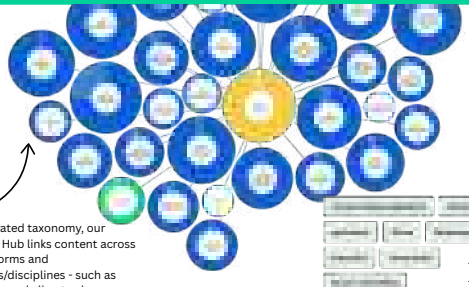


Interactive maps provide an alternative and accessible way for users to explore case studies (e.g. weADAPT) and organisations (e.g. Agora Community Hub).

5 Improving connectivity through cross-fertilisation of knowledge, users, and networks

Creating modular knowledge spaces such as themes and networks, newsletters, social media channels, and microsites - customised websites for projects and initiatives that are built on weADAPT architecture - can foster connectivity and cross-fertilisation of content, organisations and user contacts, and help ensure knowledge legacy beyond project lifetimes. It can also facilitate new partnerships between users and organisations.

Example indicators: the frequency with which the same content appears in different themes and networks; the number of new networks, themes, or microsites; frequency of 'tags' attached to, and connecting, content.



Using an expertly-curated taxonomy, our Climate Connectivity Hub links content across different online platforms and complementary fields/disciplines - such as disaster risk reduction and climate change adaptation - in dynamic visual knowledge maps.

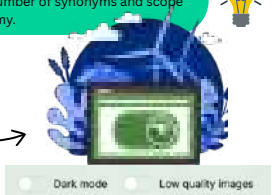
Tags describe content, and if harmonised, they can be used to connect content both within and across platforms.

6 Promoting FAIR and decolonised search and discovery

Implementing low-energy and low-bandwidth options, a downloadable/printable newsletter, bookmarking/read later options, interactive tools (e.g. maps), and translation features can help address common barriers to users in low-income countries and promote accessible, inclusive, and decolonised knowledge exchange.

Example indicators: measuring content access through low-bandwidth features; the top languages in which the platform is accessed; the number of synonyms and scope notes added to the taxonomy.

weADAPT and its microsites allow users to explore content in dark mode or with low-quality images to reduce their energy consumption.



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In collaboration with maia, adaptation Agora, Directed Project

Foresight as an emerging tool for coalition building in climate action: Insights from Mustang, Nepal

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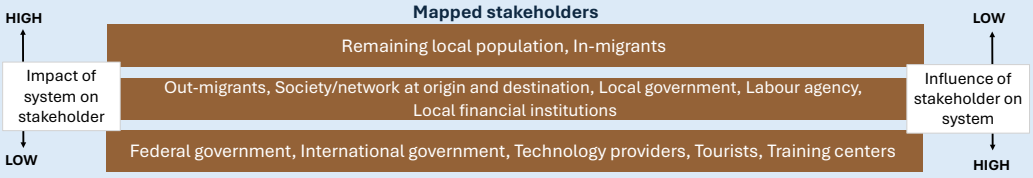
BACKGROUND: Climate change poses increasing risks in Mustang, Nepal, as shifting weather patterns disrupt traditional livelihoods and cultural heritage. Mustang is known for its arid and desert-like mountain landscape characterized by high altitudes above 2600m, historically having developed adaptive strategies for harsh winters. Over the years, this region has experienced climatic shifts combined with shifting demographics due to migration and tourism growth. This has altered the local system dynamics introducing new complex vulnerabilities. Anticipatory foresight approach is required to effectively address these emerging challenges by integrating knowledge of diverse stakeholders and engaging them to co-create anticipatory adaptation strategies that strengthen resilience to climate change.

OBJECTIVES: (i) Understand the livelihood system of Varagung in the context of climate change (ii) Identify key drivers and stakeholders that will shape Varagung's development trajectory (iii) Co-create appropriate solutions and develop forward-looking adaptation strategies to address climate change



Drivers influencing future trajectories:

- Climate change impacts
- Environmental hazards
- Demographic shifts
- Standard of living and access to services and facility
- Economic opportunities
- Education and skill level
- Aspiration (political, occupational)
- Local governance
- Social capital (cohesion, network)
- Culture and tradition (place attachment)
- National/ international migration policies

Key desired outcomes for Varagung's future 2050

A water-secured community resilient to drought and climate variability

Livelihoods that are prosperous and adaptive to climatic shocks through
- Agricultural innovation
- Economic diversification
- Development in tourism
- Culture and tradition conservation

Vibrant and resilient community (Ensure sustenance of community and community cohesion)

Establishment of climate-resilient infrastructure and services to reduce vulnerability and improve quality of life

Pathways/actionable areas to achieve the key desired outcomes

Advancing key outcomes for climate-resilient Varagaung requires coordinated cross-sectoral collaboration among diverse stakeholders, each playing roles aligned with their influence. Priorities include drought-resistant water storage solutions like underground tanks, improved irrigation access, and promoting climate-smart agriculture by investing in organic farming and high-value crops (kiwi, walnut, orange) that are suitable for the changing climate. Economic diversification through Yarsagumba *(Cordyceps)* harvesting, salt mining, and tourism, alongside job creation, will boost local incomes and aid in combating depopulation for a vibrant and resilient community. Preserving language, culture, cuisine, and festivals, restoring heritage, and fostering inclusion of immigrants and returnees will strengthen social cohesion. Investments in climate-resilient housing, disaster response infrastructure, and access to health, IT, and financial services are vital. These combined actions will build a thriving, inclusive, and climate-resilient Varagaung.

METHODOLOGY: The Participatory Foresight Process

SCOPING involves understanding context, identifying stakeholders, trends and drivers, and key issues to establish a clear focus for decision-making or planning.

Tools used: Field visits, expert interviews, literature review

SENSITIZING, UNDERSTANDING, AND MAPPING THE SYSTEM involves creating awareness, defining system boundaries and collaboratively developing a shared understanding through participatory mapping of actors, processes, relationships, linkages, and feedback loops.

Tools used: Rich pictures and Casual loop diagram (CLD), Stakeholder analysis, STEEPLE

PARTICIPATORY SCENARIO DEVELOPMENT identifying key drivers of change and uncertainties, co-creating scenarios through stakeholder engagement, and collaboratively defining a shared vision, potential impacts, challenges, and pathways toward desired outcomes.

MOBILIZING FOR SYSTEM CHANGE involves developing an action plan, identifying entry points and engaging stakeholders, operationalizing key strategies, and establishing markers to track progress along the pathway of change.

Tools used: Visioning and Back-casting, CLD, Stakeholder Analysis

Recognize and Identify stakeholders, their unique needs, interests, and challenges

Inclusive -engagement of vulnerable and marginalized groups

Evaluate diverse **implications** for each stakeholder group

Acknowledgement
We would like to duly acknowledge our partners National Institute of Development Studies (NIDS), Kathmandu University (KU) and Varagung Rural Municipality office and community for their support. This work is a part of the Successful Pathways for Migration as Adaptation (SUCCESS) project, which is funded by the UK government's Foreign, Commonwealth & Development Office (FCDO) and the International Development Research Centre (IDRC) from Canada, as part of the Climate Adaptation and Resilience (CLARE) research programme.

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Sunsets & Sunrises:

Climate change and transition through the lens of lost futures (and emerging hopes)

Dan Lockton and **Femke Coops**
Norwich University of the Arts
Eindhoven University of Technology

"There is nothing new under the sun, but there are new suns."
Octavia Butler

What is going away, through both the effects of climate change, and societal transitions to more sustainable futures? Sunsets and Sunrises is a participatory visualisation method that gives people space to engage with emotions around imagined futures that are disappearing (and appearing), as part of the phase-out and breakdown of systems, structures and practices.

Both a collaborative art piece and a research probe into imaginaries of climate futures, Sunsets and Sunrises uses creative materials to prompt participants to share ideas and emotions of imagined futures that they have perhaps had to let go ('sunsets'), or which they realise are disappearing, both personally and at a larger scale—whether as part of transitions to a more sustainable society or exactly because of the current state of the world. But we also explore ('sunrises'): what futures might be on their way, already effective (and affective) in our presents, bringing hope for better worlds and ways to live.

Through workshops with 100+ participants in the Netherlands, Norway, and Italy—a very small sample of whose creations you see exhibited here—we suggest that this form of collaborative imagination practice could be an important component of societal engagement with climate crisis. Collectively sharing our sunsets creates a collaborative memorial, but also (via our sunrises) a shared witnessing of the emergence of hope for new possibilities.

Background

When we think about imaginaries of futures, we often focus on new possibilities, practices, and configurations of everyday life. Designers may adopt roles as 'future-makers' (Mazé, 2025) but rarely consider how, as Tonkinwise (2014) puts it, "innovation is itself a deliberate act of destroying some aspect of current existence". Even in work on designing societal transitions towards more (ecologically) just, resilient and sustainable worlds in an age of climate crisis, less attention is given to how existing practices go away, and the societal effects of these changes. And yet we know the powerful cultural and political effects of memory, nostalgia, and histories. Our (imagined) pasts are ever-present, even as we imagine futures.

But how do people deal with previously imagined or hoped-for futures being threatened? Future-oriented design approaches rarely consider the intimately personal dimensions of change and how people living in these transitions feel about letting go of well-established practices, structures and cultures. Transitions are entangled with our affective lives (Bogner et al, 2024; Coops et al, 2024; Jönsson et al, 2023); we need to find ways to let go, but also, with more critical emotional awareness, to mourn lost futures, personal and societal (Machado de Oliveira, 2021; Chang, 2021). Lost futures, and nostalgia for them (Fisher, 2014), and concepts such as solastalgia (Albrecht et al, 2007) have started to be explored in design , but less so in transition studies or public engagement with climate change.

IMAGINE: Contested Futures of Sustainability (Welch et al, 2024) was an interdisciplinary research project across humanities, social sciences, design, and arts, bringing together researchers from Norway, the Netherlands and the UK, funded by the Research Council of Norway. The project addressed the societal power of cultural imaginaries of sustainability—specifically in relation to imagined futures—via a programme of research including working with design students in Norway and the Netherlands. Design methods can surface people's imaginaries of systems, enable shared exploration, and inspire creation of more radical, collective ideas. Actively co-designing can spark a sense of possibility and shared emotion missing when materiality is not present. Design methods can also enable prefiguration: experiential futures (Candy & Kornet, 2019), participatory prototyping and living (parts of) possible futures now, converging prefigurative politics (Monticelli, 2021) with imagination.

A participatory futuring method such as Sunsets & Sunrises can allow people to reflect on and share emotions and ideas around change, extending the individual into collective—and not only memorialising what is lost, but exploring new hopes for better futures. Inspired by the metaphor inherent in the Silicon Valley jargon of 'sunsetting' a product to refer to phasing it out, we developed a method that is is intentionally tangible, material, non-digital in form: participants look at each other in person, rather than through a screen. Through a guided process, participants draw or paint, on translucent discs, ideas and emotions of imagined futures they are letting go of ('sunsets'), and futures that might be on their way ('sunrises'), already effective (and affective) in our presents, bringing hope for better worlds and ways to live, reflect, and discuss together through a small exhibition, which stimulates the cycle of conversation further.

From a research perspective, we learn about the types of futures that are meaningful for participants, and the scopes (personal, societal, global) that relate to loss and hope. We note patterns emerging, in particular hopeful futures around community and connection with nature and place, sometimes where technologies have become background facilitators (e.g. allowing people physically separated to be in community together) but largely absent in an explicit sense. Our next workshop will be run in Norwich in November 2025.

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IMAGINE
contested futures of sustainability

INSTITUTE FOR SUSTAINABLE WORLDS

The Institute for Sustainable Worlds is a brand-new research group at Norwich University of the Arts, applying creative research methods to acts of collective imagination. In an age of crises in climate, health, and social inequalities, we aim to help people create and explore possible futures, and imagine, design, materialise, and experience new ways to live. Please get in touch to learn more: d.lockton@norwichuni.ac.uk

NORWICH UNIVERSITY OF THE ARTS

A Spatio-Temporal Analysis of Global Fires and Electrical Networks

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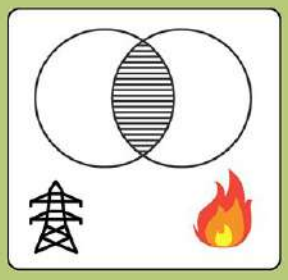
Background & Methodology

As climate change intensifies fire weather globally, understanding the exposure to electrical energy networks becomes more important

Where and how often do fires intersect with global transmission & distribution networks?



Transmission & distribution lines

Individual fire burnt areas

Intersecting burnt areas & power lines

Key Insights

3.7 Million transmission and distribution lines [2]

Over **19 Million** individual fires from **2003-2023** [1]

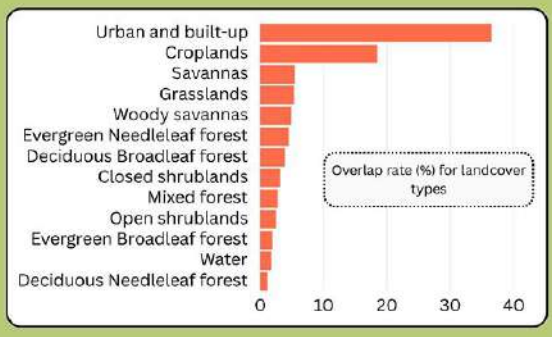
11% of lines intersected at least one fire [3]

On average distribution lines intersected **more fires** than transmission lines

Fires that intersected lines, were found to **last longer** on average than those that didn't

Vast majority of the **most exposed** lines are located in Southern Hemisphere Africa

Future work is needed to understand the implication that a changing global fire behaviour have on energy networks



Clustering of the most exposed transmission & distribution lines

[1]Global Fire Atlas (Andela & Jones, 2024)
[2]Gridfinder (Arderne et al., 2021)
[3]Quantifying Global Exposure of Transmission and Distribution Networks to Fire (Bunting et al., 2026, under review)
Maps created with data from
[1], [2] and OpenStreetMap contributors (ODbL).

Rain Gauge Data:
Uncertainties at a Catchment Scale & Underestimation at a Gauge Scale

Ruth Dunn [1], Hayley Fowler [1], Amy Green [1], Elizabeth Lewis [2]
[1] Newcastle University, School of Engineering [2] The University of Manchester, School of Engineering

Newcastle University

Introduction...

Aim
To investigate the degree of underestimation in rainfall by rain gauge networks, and develop a robust correction methodology, thereby enhancing the accuracy and reliability of rainfall records and the hydrological studies derived from them.

Importance
Despite technological advancements, rain gauges remain essential for calibration, validation, and providing reliable ground truth data for both in situ and remote sensors. They are critical for their long-term datasets and widespread use due to affordability and ease of use.

Issues
Accuracy challenges include random errors (e.g., human mistakes, equipment failure) and systematic errors (e.g., mechanical limitations, undercatch from wind, wetting, and evaporation)[1]. Gauges typically underestimate precipitation by 3–25%[2].

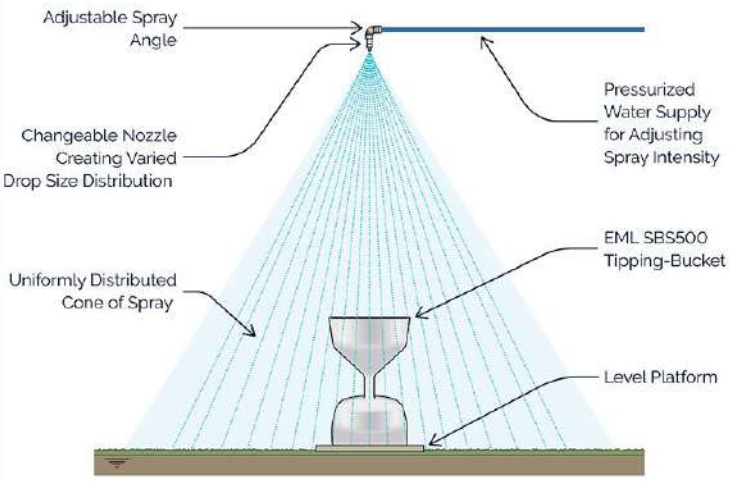
Implications
Reliable rainfall data is crucial for research, hazard monitoring, urban planning, infrastructure design, and resource management. Improving gauge accuracy will enhance understanding of precipitation trends and climate change, leading to better decision-making.

Current Work...

Catchment Analysis
The initial phase of this study analyses rain gauge data from the Brue[3] catchment, focusing on the following aspects:

- Temporal and spatial sensitivities, examining different resolutions, moving windows, and network density.
- Undercatch correction, applying existing methods for isolated comparison.
- Kriging interpolation, generating catchment-wide rainfall meshes to assess volume, intensity, and uncertainty.
- Validation, extending analysis to other gauged catchments and comparing with radar-derived rainfall fields.
- Open-source development, with all work published in a GitHub repository using open data.

The Rainfall Simulator



Additional Rain Gauges for Investigation:


Copper Manual Rain Gauge


Casella Tipping-Bucket


EML ARG100 Tipping-Bucket

Gauge Analysis
Rainfall Simulator (shown in the adjacent figure) is currently under construction. Designed to replicate natural rainfall in a highly controlled manner, thus enabling investigation of undercatch under various conditions with precisely known rainfall conditions and wind speed measurements.

Generates a uniform cone of spray with:

- Adjustable intensity
- Variable spray angle
- Controlled droplet size distribution

Performance validation using:

- Disdrometer (measuring droplet size distribution and fall velocity)
- Gridded containers (assessing spray uniformity)

Used to evaluate the accuracy of rain gauges, particularly those historically and currently used in the UK.

Future Work...

Field Work

Use the rainfall simulator to evaluate rain gauge accuracy under various wind conditions in the natural environment.

Laboratory Work

Use the rainfall simulator to evaluate rain gauge accuracy in controlled conditions, with a wind tunnel.

Data Correction

Develop and test an undercatch correction methodology for a UK rainfall dataset.

Impact

Compare hydrological application outputs using corrected data vs. original data.

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NO SHOW WITHOUT CLIMATE ACTION

Roadmaps, Pilots and Place-Based Partnerships for a Low-Carbon Cultural Future

Read the reports here

2021 *Massive Attack x Tyndall Centre*

SCIENCE-BASED ROADMAP / 1.5°C CARBON BUDGET / DECARBONISATION PATHWAYS / THREE FOCUS AREAS /

In 2021 trip-hop act Massive Attack commissioned the Tyndall Centre for Climate Change Research to develop the first science-based roadmap for decarbonising the live music sector. The project set 1.5°C-aligned targets for live music activities, and identified emissions hotspots including moving people and equipment, energy use at venues, and audience travel.

2024 *ACT 1.5 Bristol Downs Pilot Gig*

BATTERY POWERED STAGES / LATE-NIGHT CHARTERED TRAINS / PLANT-BASED MENUS / CROSS-SECTOR COLLABORATION /

In 2024 Massive Attack and ACT 1.5 used the roadmap to deliver the lowest-carbon concert of its scale. The pilot gig brought together collaborators across industry, and achieved emissions reductions of between 70 to 98% in key areas. Tyndall Manchester conducted the post-event analysis, turning the event into a proof-of-concept for multiple solutions that can enable low-carbon live music.

2025 *Liverpool and the UN Accelerator City*

CITY LEVEL ACTION / PILOTS ACROSS MUSIC, FILM & TV / SUPPORTED BY THE UNITED NATIONS /

The roadmap is now scaling live music decarbonisation to the city level, and expanding into film and TV production. Liverpool is the first UN Accelerator City for Climate Action, trialling nine pilots to cut emissions in the sector. The ambition was shaped by the roadmap and Tyndall Manchester are onboard as the academic partner, analysing impacts and learnings to help future cities and industry deliver truly low-carbon culture.

Dr Lois Pennington, Professor Carly McLachlan, Dr Chris Jones & Dr Sarah Mander @ University of Manchester

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