NH10.1 - Multi-(hazard) risk assessments: Innovative approaches for disaster risk reduction, management, and climate change adaptation

EGU25-18584

An innovative multi-hazard climate change risk assessment framework: Evidence from a place-based assessment of challenges and solutions in the UK Fens

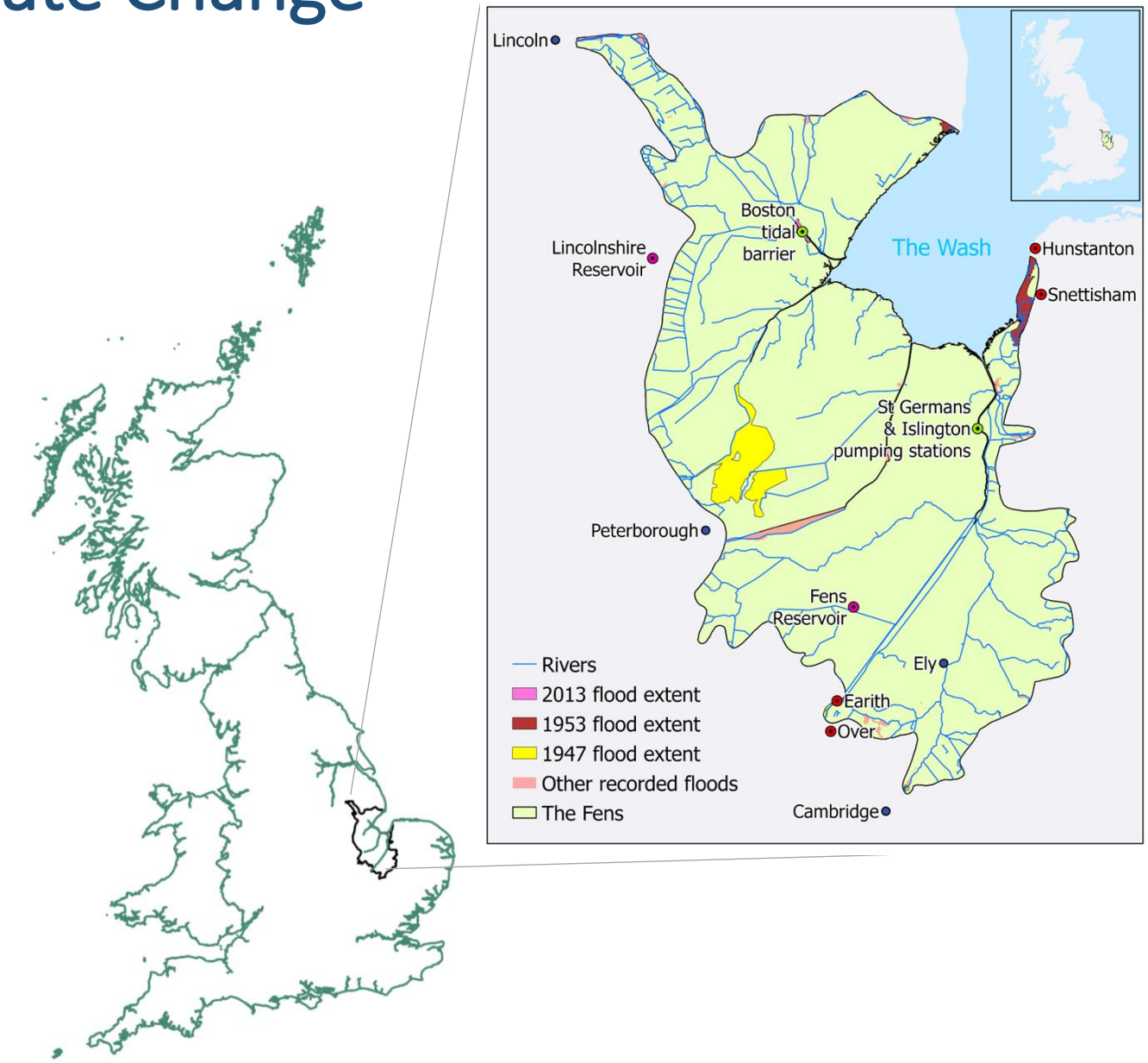
Katie Jenkins, Robert Nicholls, Noah Tozer, Jeff Price, Nicole Forstenhäusler, Helen He, Asher Minns, Paul Sayers, Sam Carr, John Redhead, Richard Pywell

Katie.Jenkins@uea.ac.uk

UEA University of East Anglia
Tyndall Centre for Climate Change Research
UK Centre for Ecology & Hydrology
SAYERS AND PARTNERS

The need for a UK Fens Climate Change Risk Assessment

- UK's largest coastal lowland.
- Home to fertile land, critical food infrastructure, ~700,000 residents.
- Exists due to intricate drainage systems, pumping, and fluvial and coastal defences and tidal barriers.
- Paradoxically, it is one of the driest regions in England
- Much of the land is below sea level.



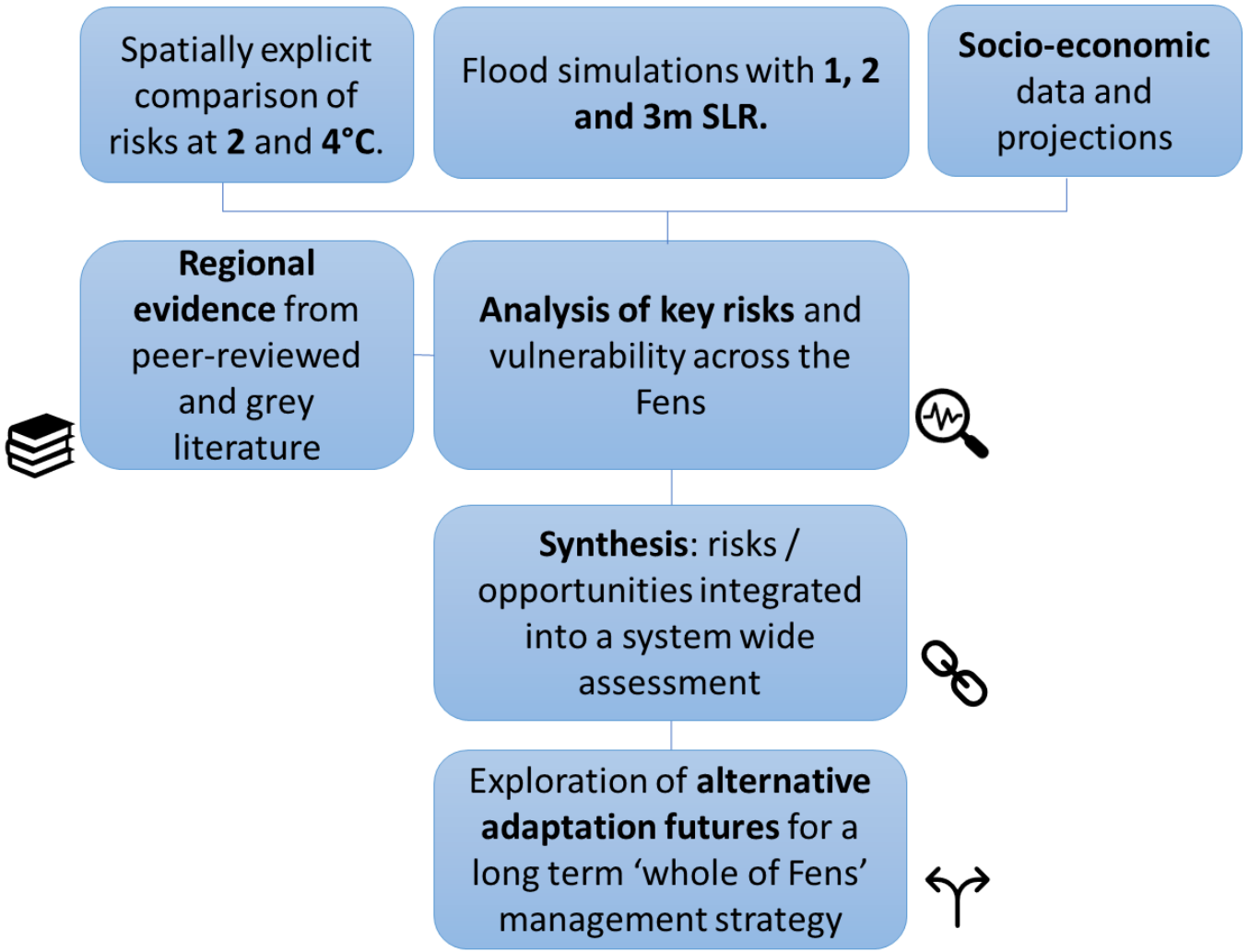
The Challenge of Climate Change

- Climate change is having an evident impact across the Fens.
- Increased flooding, drought and water scarcity, biodiversity loss and crop disruption
- Sea level rise of 1m likely by 2100. Poses a long-term existential risk.
- Urgent need for *system-wide, spatially explicit, and place-based* data.

River Great Ouse and Great Ouse Relief Channel

Boston floods, 2013, UK Fens

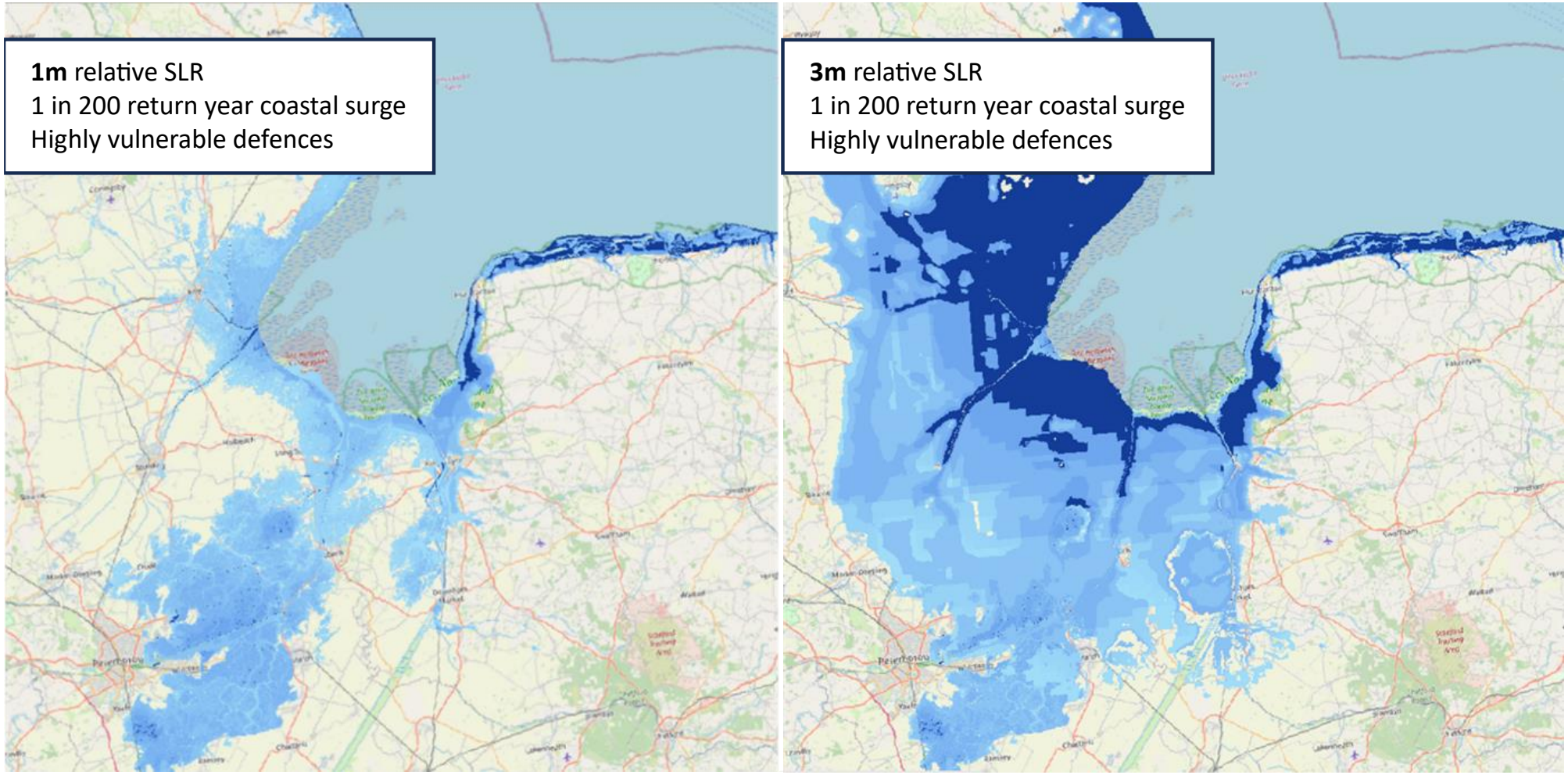
An Integrated Approach



Risk indicators:

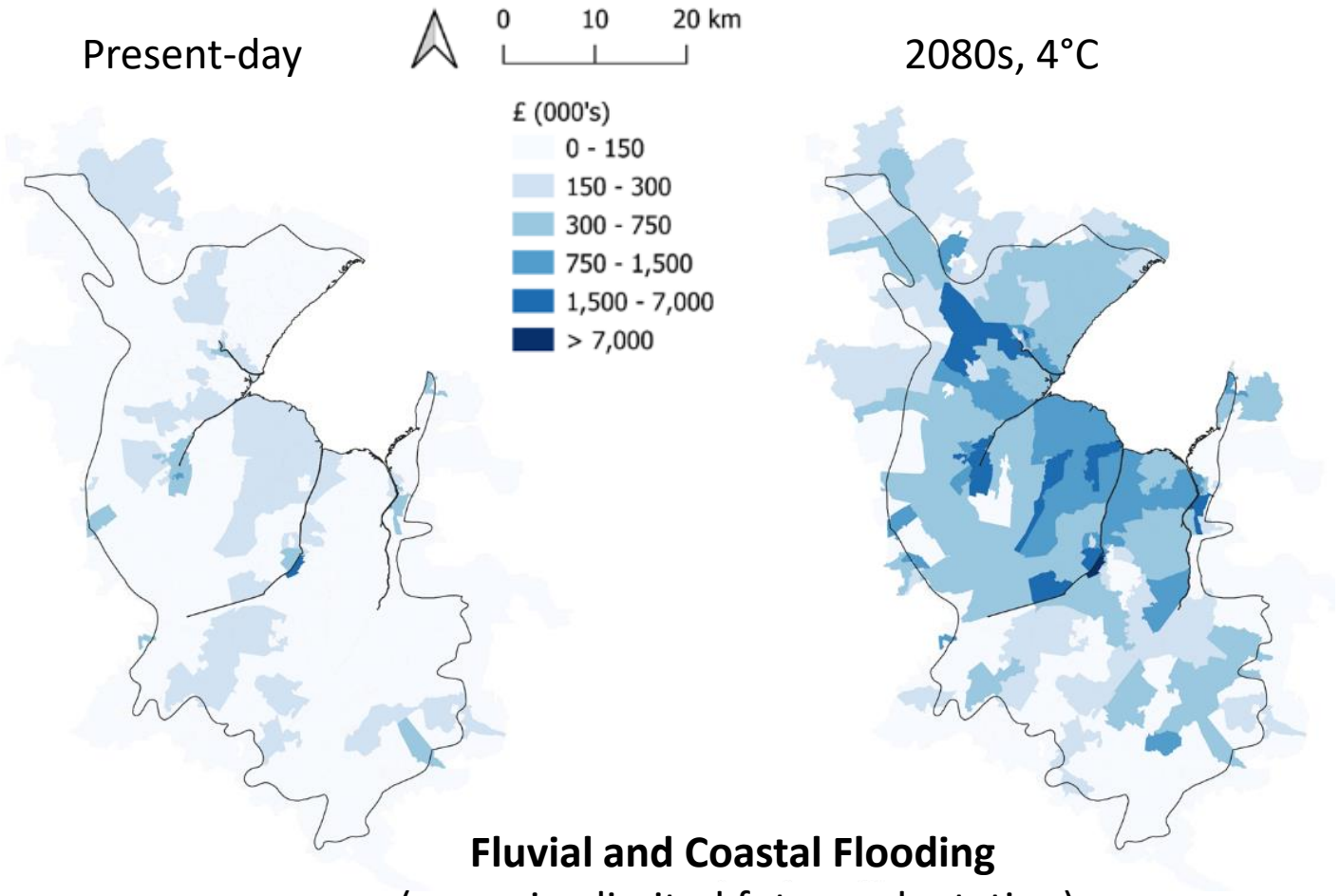
- **Heat stress and heat-related risks**
  - Mortality, exceedance of key temperature thresholds, livestock heat stress
- **Agriculture**
  - Changes in potential crop yield (wheat, OSR, grass), change in climatic suitability for >180 potential future crops
- **Biodiversity**
  - Species richness, local extinction rate, climatic refugia, pollinator species loss
- **Hydrological risks and water resources**
  - Low and high flows, probability of level of service water use restrictions.
- **Flooding (Coastal, fluvial and surface-water flooding)**
  - Expected Annual Damages, Neighbourhood flood vulnerability index

Sea level rise significantly affects the standard of coastal defences and the inundated area if some of these defences breach



A 1-in-200 return year coastal surge event reimagined in a future of 1m and 3m of sea level rise

Flood related risks and challenges



Fluvial and Coastal Flooding
(assuming limited future adaptation)

Without significant investment in adaptation, flood risk is set to increase

- Present damage: £16M/year.
- At 4°C & no investment: £250M/year.
- Even with investment, risks double.

Source: Future Flood Explorer – based on CCRA3, Sayers et al, 2020

Summary of key risks and challenges

Agriculture is under threat…

- Some opportunities but at 4°C, staple crops like wheat show plateaus or decreases in yield.
- Potential for new crops but big challenges in adapting farming systems, supply chains and markets

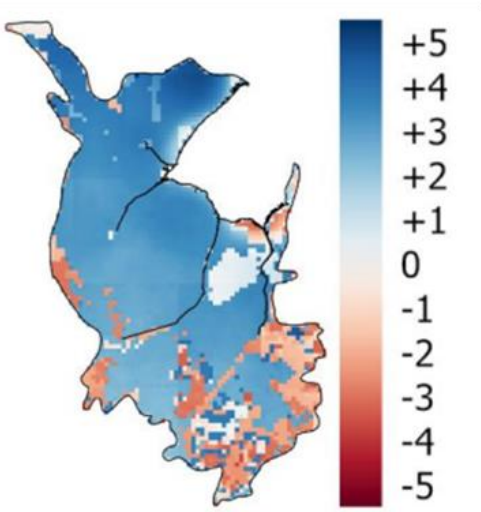
… Drought and water stress…

- Drought frequency and duration increases. River flows could fall by >25% under 4°C warming.
- Investment and innovation in water resource management needed.

… Biodiversity faces critical losses

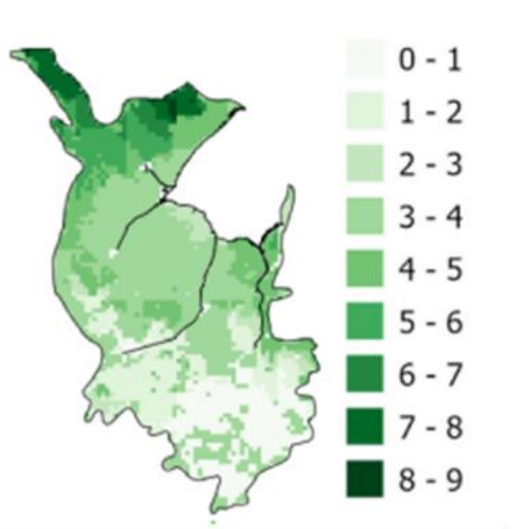
- Even at 2°C, biodiversity refugia in the Fens vanish— including insect pollinators, crucial to agriculture.

Wheat, 4°C



Change in average potential yield (t/ha)

All crops, 4°C

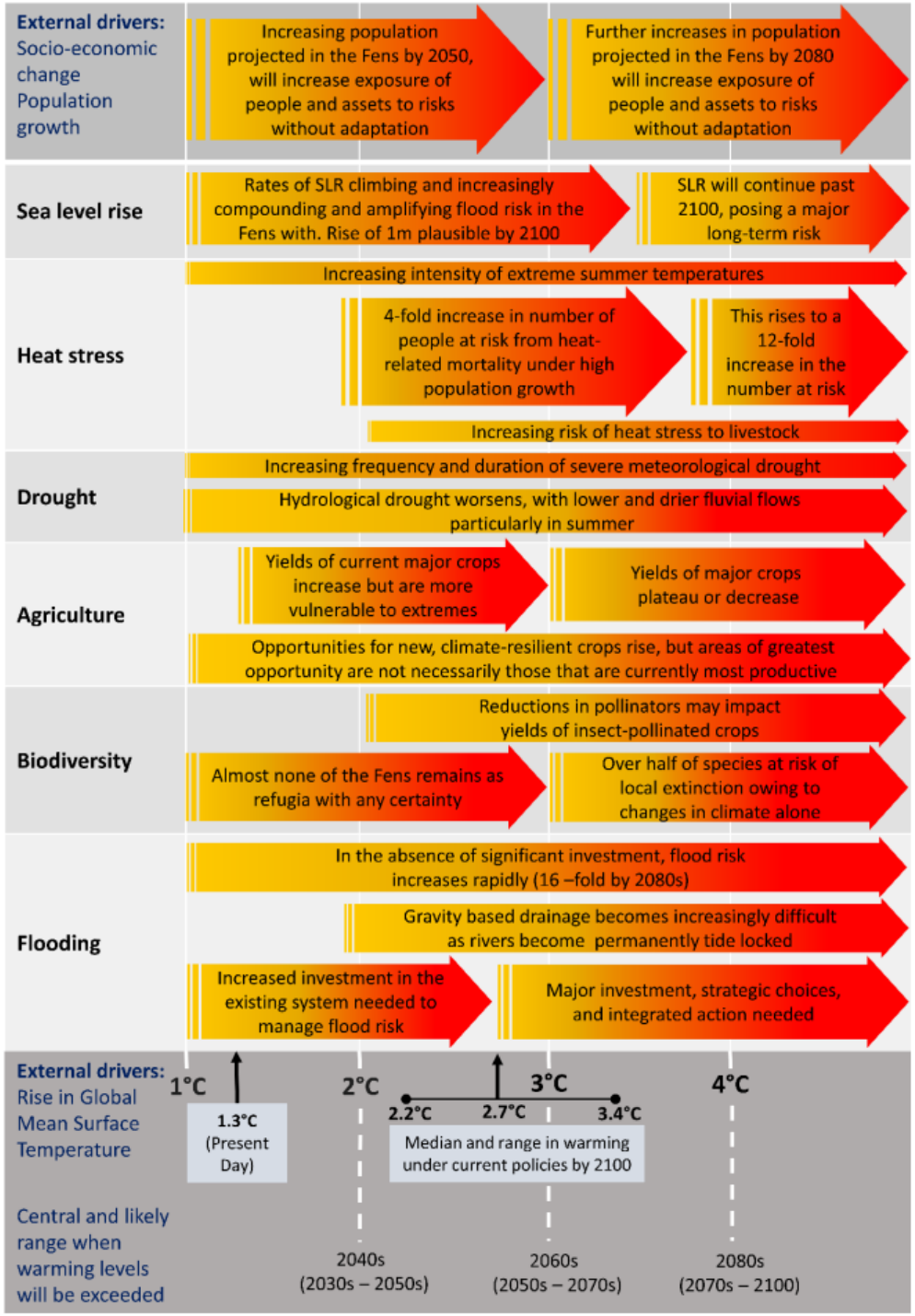


Change in suitability across all crops

Urgency and opportunity: There is a limited window to act

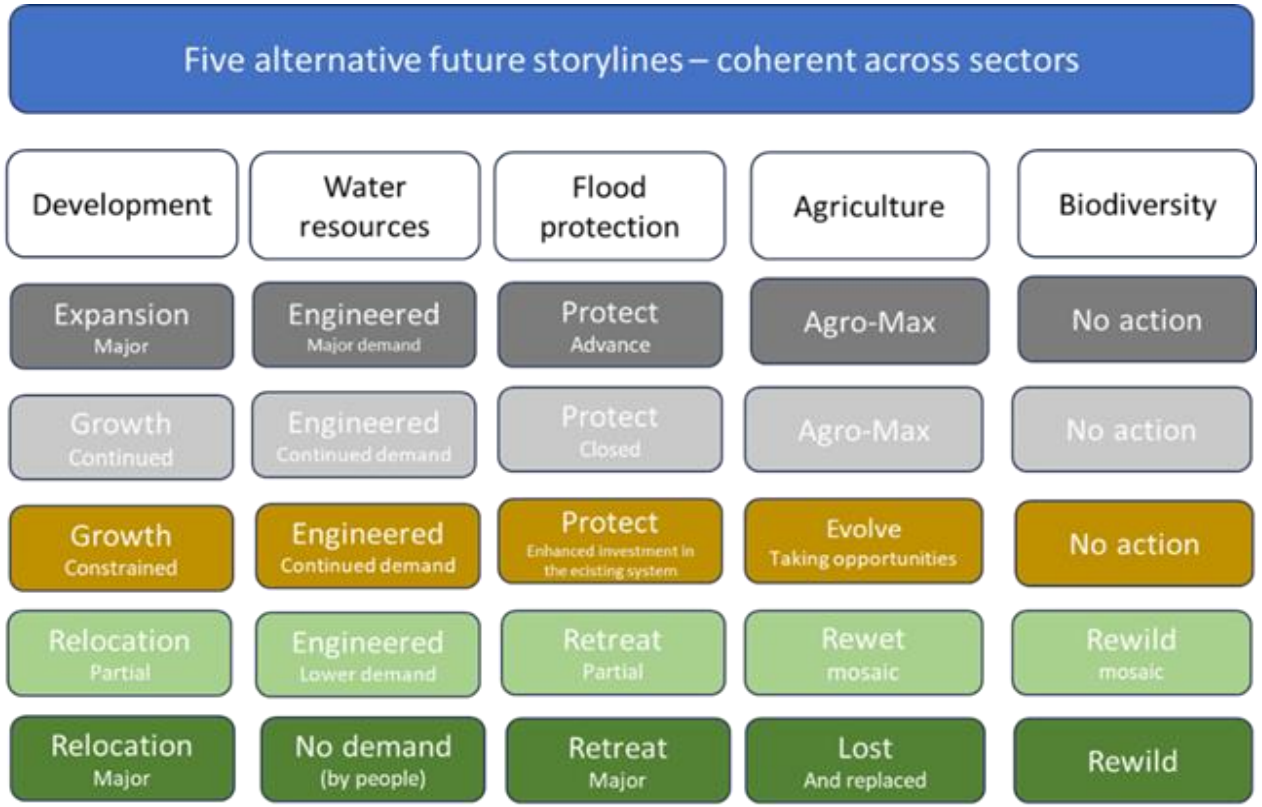
- In a **2°C** future **serious management challenges** emerge
- In a **4°C** future the challenge will be considerably greater – demanding **radical action**.

- The decisions we make today about where to build, farm, and invest will define the Fens' future.



Supporting adaptation

- Need to understand ‘full picture’ of climate risks - each sector relies **on choices** made by others.
- No one-size-fits-all adaptation approach.
- Developing a **shared vision** is not trivial but is necessary. Supported by assessing multi-hazard risks.
- A mosaic of strategies—from reinforced defences in some areas to wetland restoration in others
- Longer-term change requires **transformational adaptation** thinking.



Imagining the future of the Fens

- Science based evidence and creation of future ‘storylines’ helps encourage thinking about what the Fens ***could*** look like if we move away from Business-as-Usual adaptation.
- Supporting cross-sectoral stakeholder thinking and engagement to develop a radical new vision.
- This is needed **TODAY**!
- Placed-based, system-wide and longer-term thinking are needed – not just in the Fens.

An innovative multi-hazard climate change risk assessment framework: Evidence from a place-based assessment of challenges and solutions in the UK Fens

Sharing is encouraged

EGU25-18584

Thank you!

For further details please see:

Download the report

Watch the Video

University of East Anglia

Tyndall Centre for Climate Change Research

UK Centre for Ecology & Hydrology

SAYERS AND PARTNERS