



The UK Fens Climate Change Risk Assessment: Big challenges and big solutions

ADA Environment Day 2025

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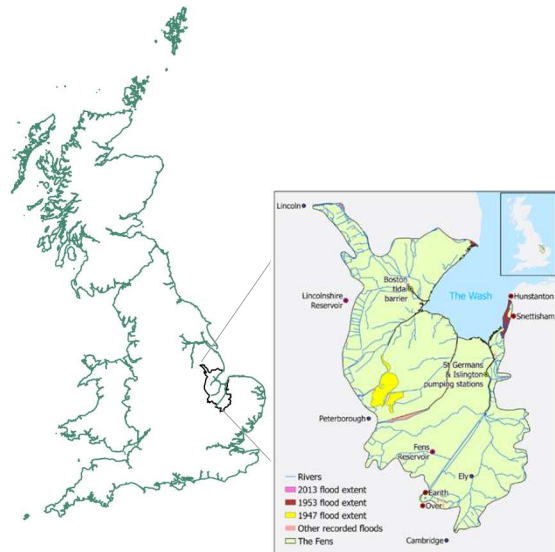
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The need for a Fens Climate Change Risk Assessment

- Climate change is already having an evident impact on the Fens.
- It will continue to drive frequent and intense surface, river and coastal flooding, compounded by a future of ongoing sea-level rise, as well as heatwaves and drought.
- The UK Government have produced three **UK-level** Climate Change Risk Assessments (CCRA).
- The aim of this work is to provide a scientific evidence base on climate risks **specific to the Fens** to support future adaptation decision making.



The timing of this Fens CCRA is significant

- Global average surface temperature has already **risen by 1.3°C** since the preindustrial period.
- Global average surface temperature could exceed:
 - **2°C** between the 2030s and 2050s
 - **3°C** between the 2050s-2070s
 - **4°C** between the 2070s to 2100
- Even if all current policies and action are considered projections suggest we would reach **2.7°C** by the end of the century
- Plausible that the region will face sea level rise of **1-metre** by the end of the century.

(Sources: Climate Action Tracker (2023); Carbon Brief (2020); IPCC (2023))



Key focus and outputs from the risk assessment models

Sectors / themes included:

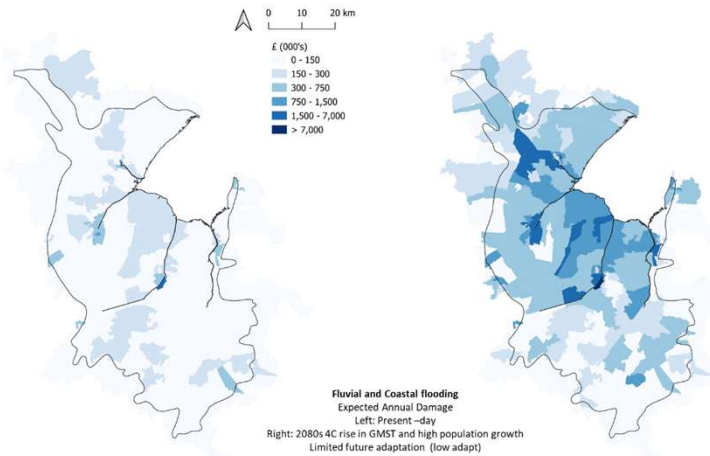
- **Heat stress and heat-related risks**
 - Mortality, exceedance of key temperature thresholds, livestock heat stress
- **Agriculture**
 - Changes in potential crop yield (wheat, OSR, grass), climatic suitability for >180 potential crops
- **Biodiversity**
 - Species richness, local extinction rate, 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

Flood related risks and challenges

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

- Present day flood risks in the Fens may **double** by the 2080s given a 4°C rise and a high population growth projection.
- But, with no further upgrades to existing defences and limited maintenance, flood risk may increase **~16-fold** over that period.
- Risk is underestimated as agricultural impacts and other impacts on e.g., critical infrastructure such as roadways are not included in the modelling.

Taking action to mitigate climate change will be an important part of flood risk management



Water related risks and challenges

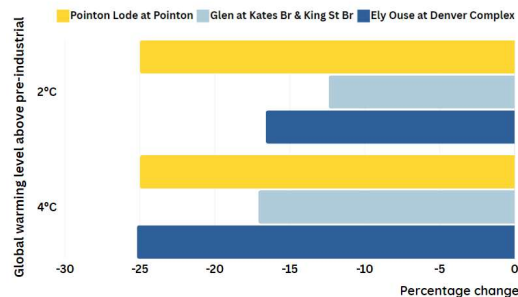
Droughts are projected to become more frequent and persist for longer.

- The Fens will become drier.
- Meteorological drought projected to increase, with evapotranspiration a main driver compounded by higher temperatures.
- Low flows in particular are projected to decrease in the region under climate change.

Projected average monthly change in precipitation (mm) from 1961-1990 for global warming levels of 2 and 4°C

Month	2°C	4°C
June	-2.8	-6.2
July	-4.1	-8.7
August	-3.6	-7.6

Projected percentage change in low flow river discharge for three catchments in the Fens



Investment and innovation in water resource management will be needed.

- Need to consider and adapt to multifaceted climate risks, environmental and habitat degradation and socio-economic pressures (e.g., growing population).

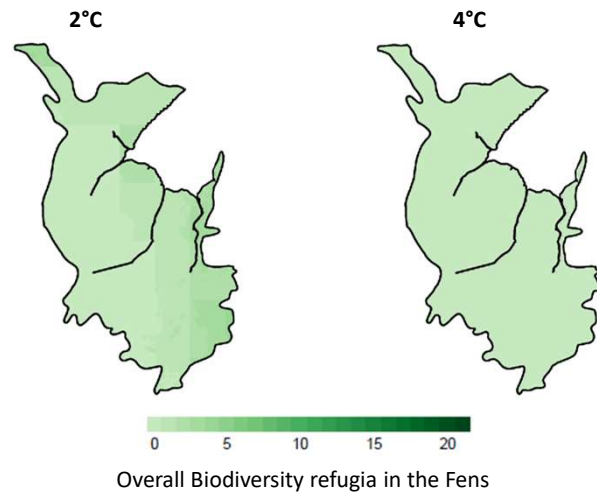
Terrestrial biodiversity related risks and challenges

Even limited global warming poses a significant threat to terrestrial biodiversity in the Fens

- At 2°C almost none of the Fens remains as refugia (defined as areas remaining climatically suitable for >75% of the species) with any certainty
- The risk to insect pollinators, even at lower levels of warming could have serious implications for insect-pollinated crops and wild plants.

Careful planning to support biodiversity is needed

- Making more space for terrestrial biodiversity will require stringent mitigation, consideration of climate change and careful planning and siting of restoration projects.

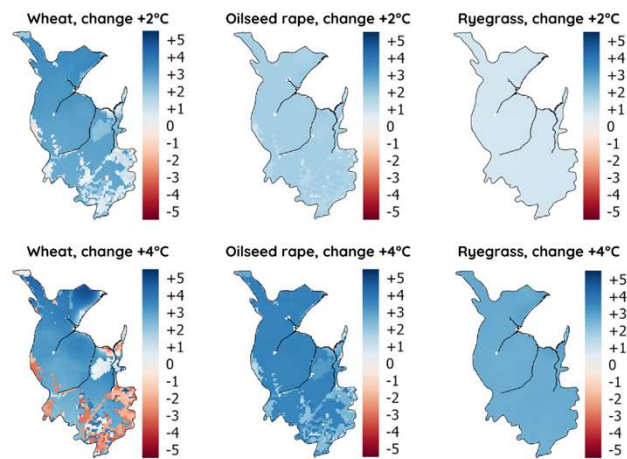


Agricultural related risks and challenges

Yields of current crops

Significant agricultural challenges arise as temperatures increase

- Moderate levels of warming (up to 2°C) bring potential increases in yield for several current, major crops. However, these are conditional on adequate water availability and the ability to manage crops optimally
- At 4°C, some major crops are projected to show plateaus or decreases in yield/climatic suitability
- Southern, deep peat areas of the Fens are at greatest risk of these yield declines under climate change

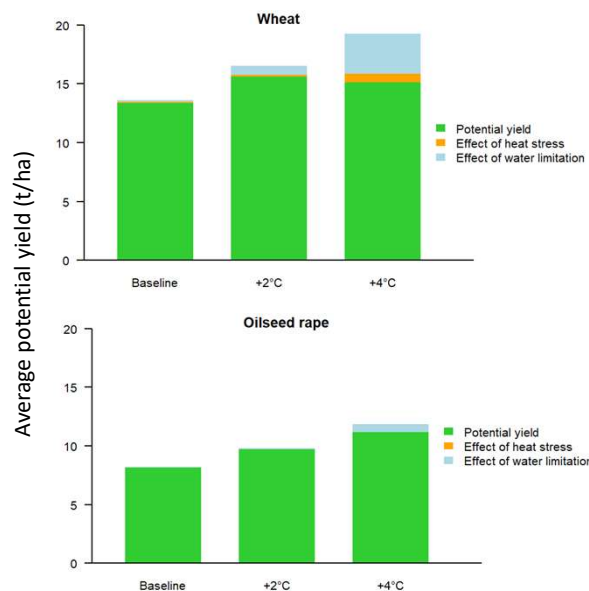


Change in average potential yield (t/ha)

Hayman et al. (2024) A framework for improved predictions of the climate impacts on potential yields of UK winter wheat and its applicability to other UK crops, *Climate Services*, 34, 100479
<https://doi.org/10.1016/j.cliser.2024.100479>

Yields of current crops

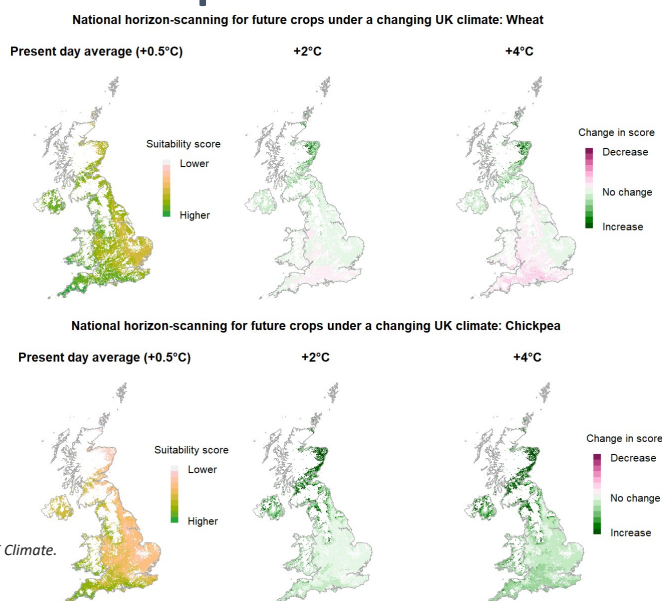
- Where yield levels off this is mostly due to water limitation (though some direct impacts of heat stress, esp. on wheat)
- Most pronounced for wheat, whilst OSR and grass mostly see increases even under +4°C warming
- Note that model is 'potential' yield – assumes optimal crop management of pests, diseases, nutrients, sowing, harvest etc



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Horizon scanning for future crops

- One route towards improving resilience is to adopt new crops
- Harder to model yields – models and data lacking
- Alternative is to use a simpler model to 'horizon scan' a wide range of crops for climatic suitability
- Model based on EcoCrop database, calculates proximity to optimal T° and precipitation ranges within growing season for over 160 crops



Redhead et al. (2025) *National Horizon Scanning for Future Crops Under a Changing UK Climate*. *Climate Resil Sustain*. 4: e70007.
<https://doi.org/10.1002/clr2.70007>

Horizon scanning for future crops

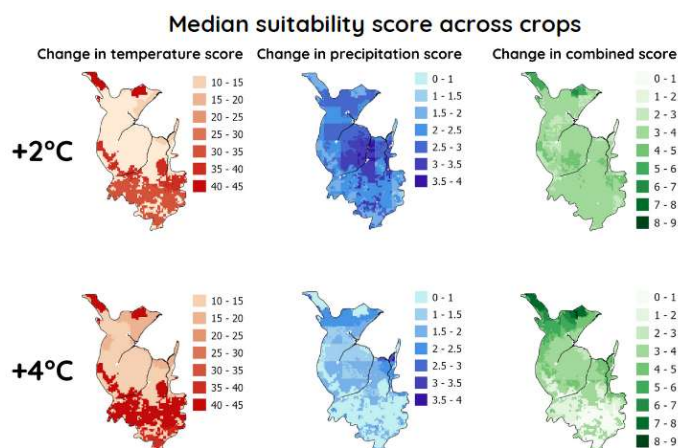
	+2°C	+4°C
Current crops showing increases in suitability	Horseradish, sugarbeet, broad bean, blueberry, maize, potato, cabbage, linseed, asparagus, rye, barley, oats, rhubarb, celery	Horseradish, sugarbeet, blueberry, potato, cabbage, asparagus, celery
Current crops showing decreases in suitability	Onion, parsnip, wheat, strawberry, beetroot	Onion, parsnip, barley, beetroot, wheat, maize, rye, strawberry, oats, rhubarb
Example future crops showing strong increases in suitability	Durum wheat, bulbous barley, sesame, grape, sunflower, hemp, safflower, cow pea, buffalo bean, okra, oca, Algerian oat, bur-reed	Sunflower, hemp, durum wheat, bulbous barley, okra, sesame, chickpea, oca, tef, club rush, grape, safflower, cow pea, buffalo bean, cranberry, wild rice, Algerian oat, sweet potato, bur-reed

Redhead et al. (2025) National Horizon Scanning for Future Crops Under a Changing UK Climate.
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Horizon scanning for future crops

Some agricultural opportunities may emerge

- Resilience could be improved by exchanging current crops that show declines in suitability (e.g. onion, parsnip, barley, wheat) for those that show increases (e.g. safflower, sunflower, hemp, chickpea, common bean)
- Opportunities are not spatially uniform across the Fens - northern areas show the greatest increases in cross-crop suitability



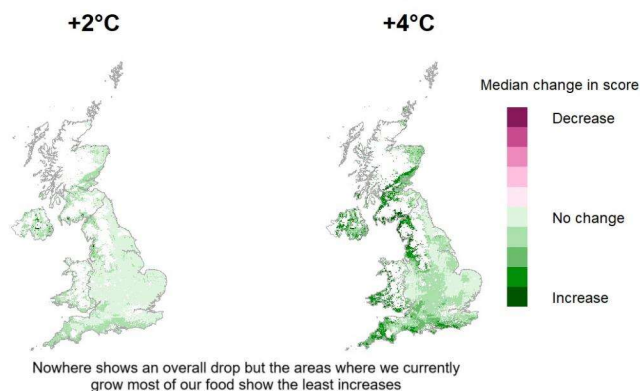
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Horizon scanning for future crops

But big challenges remain

- The Fens is among the most climatically constrained regions in terms of opportunities in comparison to many other parts of the UK
- Realising opportunities will require adaption of farming systems, supply chains and markets
- Climatic suitability does not capture economic or agronomic viability – but does highlight targets for further research

Results showing the median change in suitability across crops



Redhead et al. (2025) National Horizon Scanning for Future Crops Under a Changing UK Climate.
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Exploring novel farming systems

- Several paludiculture or high-water table crops show increases in suitability (e.g. cranberries, blueberries, club rush, wild rice, celery)
- UKCEH are working with Fens farmers to trial these systems
- Wet field experiment tests various endpoints for re-wetted peat:
 - **Nature** – wet grassland, tall herb fen, wet woodland
 - **Biomass** – Willow, Miscanthus, Typha, Reeds
 - **Paludiculture** – annual + perennial crops



An integrated risk assessment for the Fens

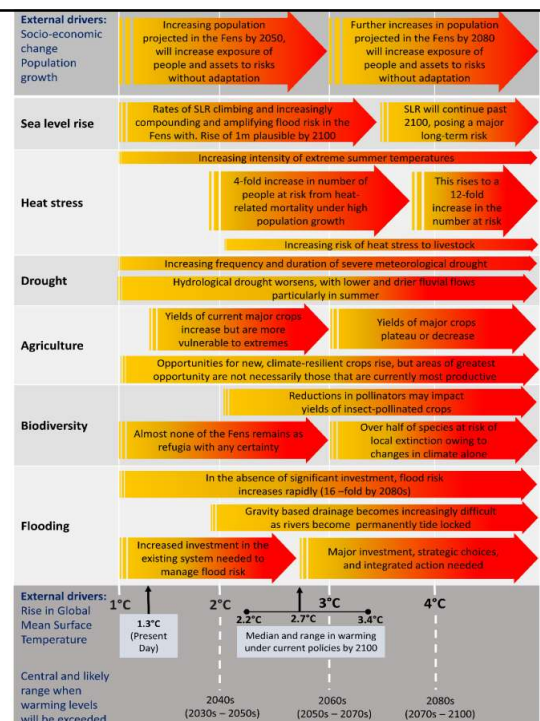
Climate-related risks are increasing across the Fens

Multiple climate related risks and challenges

- The Fens is highly vulnerable to multiple interacting climate related risks, including sea level rise
- In a **2°C** future serious management challenges emerge
- In a **4°C** future the challenge will be considerably greater – demanding radical action.

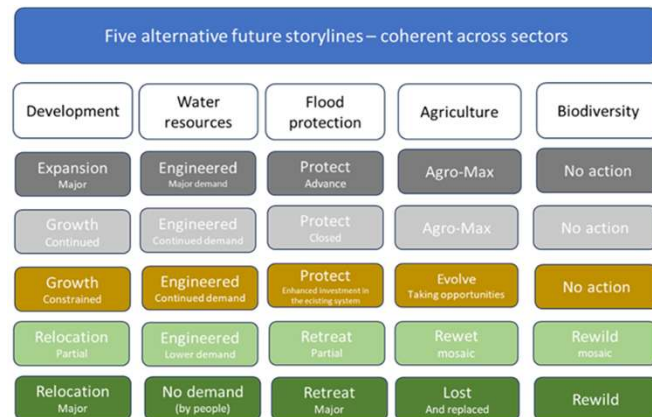
A sectoral assessment lens misses multiple and cascading impacts

- Understanding the **‘full’** picture of climate related risks will be an important next step to exploring choices.
- Both significant and early **adaptation choices** and continued progress in **mitigation** will be important in determining the future of the Fens.



A shared long-term strategic vision will be needed

- Flood management choices **are fundamental** to all aspects of the Fens.
- **Each sector relies on choices made by others.**
- **Alignment across sectors** will lead to some being constrained but can also present opportunities.
- Developing a **shared vision** is not trivial but is necessary to guide coherent future investment and development choices.
- There are a range of possible adaptation futures for the Fens depending on societal and management decisions in the face of climate and other changes.
- Opportunities exist to provide diverse and targeted adaptation approaches that reflect this mosaic.



Big challenges need strategic solutions

In summary:

- Climate change is already influencing risks, and even a **2°C** world poses significant challenges.
- Risks exist across all sectors requiring significant investment in adaptation.
- A shared vision can scale up investment in support of the 'right' strategy
- Time is of the essence. There is a critical window for action.

For Further info see:
[Future Fens Integrated Adaptation \(FFIA\)](#) |
[Innovation Hub AW](#)



<https://youtu.be/HKQQDugsU7M>



Download the [report](#).