UK National Climate Crop Modelling Capability (UKNCCC)

Integrated assessment frameworks

Assessing and informing more holistic climate–food–environment decisions

Call to action:

We need active collaboration between researchers, data providers, and end-users. This capability outlines the foundations for integrating advanced modelling systems, remote sensing, and scenario analysis into practical decision-making.

Why we need integrated assessment frameworks in UKNCCC:

- Bringing together state-of-the-art quantitative and qualitative knowledge and using it in co-production environments to target stakeholder needs.
- To move beyond yield-only metrics for food production and food security, and predict changes to:
  1. Human nutrition
  2. Emissions
  3. Trade
  4. Land-use
- Enabling assessment of the trade-offs associated with agricultural and environmental policy decisions

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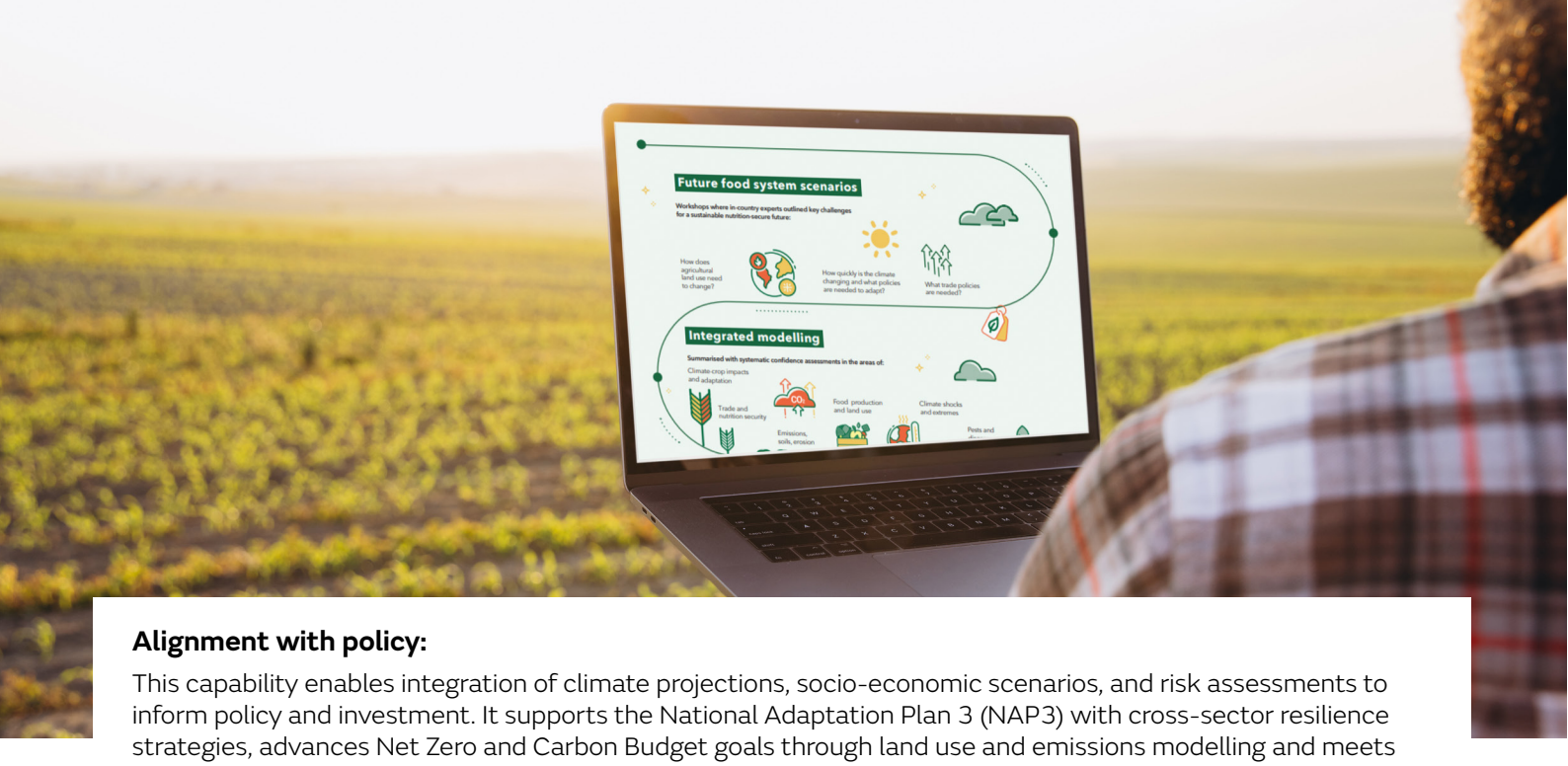
Benefits:

Enables scenario-based planning for climate, food, and emissions adaptation	Supports policy development through integration of climate projections, socio-economic scenarios, and risk assessments	Assesses trade-offs in agricultural and environmental policy, including nutrition, emissions, trade, and land-use	Targets stakeholder needs through co-production and collaborative modelling



Alignment with policy:

This capability enables integration of climate projections, socio-economic scenarios, and risk assessments to inform policy and investment. It supports the National Adaptation Plan 3 (NAP3) with cross-sector resilience strategies, advances Net Zero and Carbon Budget goals through land use and emissions modelling and meets the UK Government's 2025 Climate Change Committee objectives by addressing priority risks in agriculture, ecosystems, and infrastructure. These frameworks help stakeholders make decisions that are consistent, evidence-based, and meet Climate Change Risk Assessment 3 (CCRA3) and UK Food Security Report requirements.

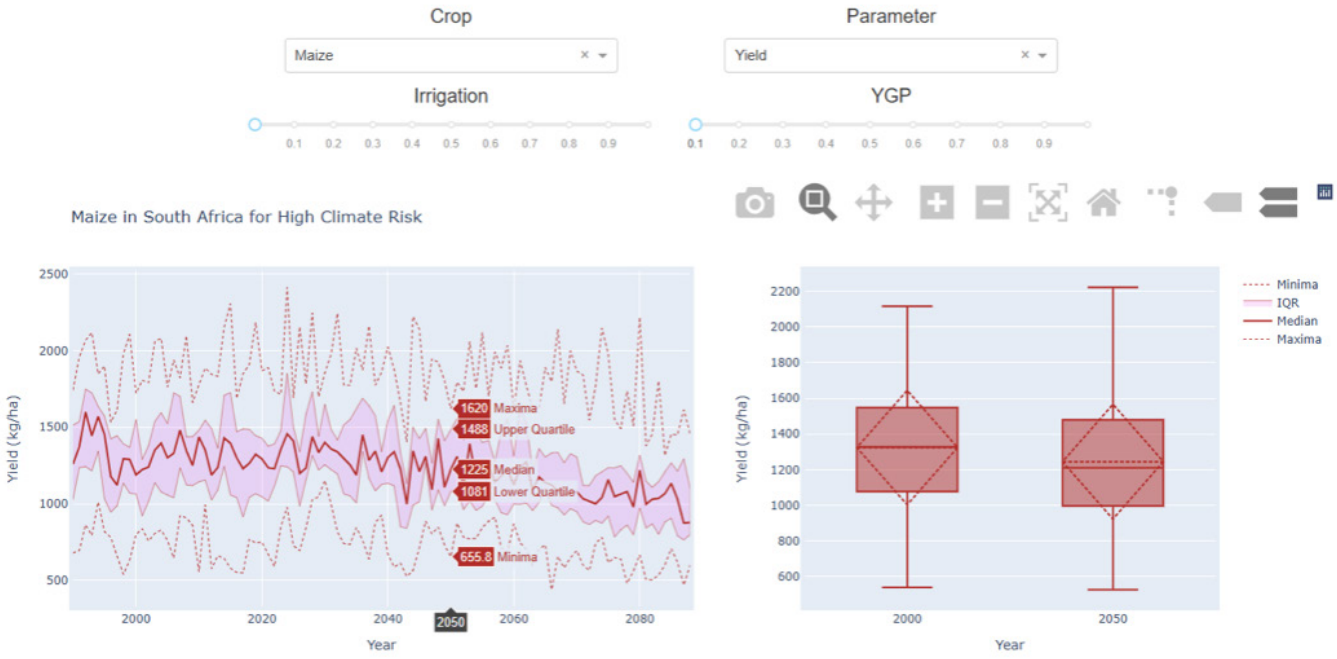
Priority Actions and Recommendations for UKNCCC:

iFEED (integrated Future Estimator for Emissions and Diets) has been applied across a range of African environments, including Malawi, South Africa, Tanzania, and Zambia. A UK-tailored approach could bring domestic policy insights.

What are Integrated assessment frameworks?:

- Integrated assessment frameworks (IAFs) combine crop-climate modelling with other modelling and expertise to more comprehensively assess the future of the food system and associated implications for climate change mitigation and adaptation. These are commonly co-designed with stakeholders and typically assess climate hazards, food production, trade, diets and nutrition, as well as environmental variables such as Global greenhouse gas (GHG) emissions, water use, soil health, and biodiversity. IAFs can help to turn complex model outputs into decision-ready narratives
- UK Centre for Ecology and Hydrology (UKCEH) is leading on Spatial models for predicting the impacts of land use change and climate change on species abundance, distribution, and ecosystem services. Through the UK Status, Change and Projections of the Environment (UK-SCAPE) SPEED - Spatially explicit Projections of Environmental Drivers UK-SCAPE SPEED project, which delivers spatially explicit projections of environmental drivers, including land use change, climate, and socio-economic pathways, at 1 km resolution through to 2070. These models integrate biophysical constraints (soils, climate, topography) with socio-economic narratives using an agent-based modelling framework (CRAFTY-UK). This enables scenario-based assessments of how land allocation shifts under combined climate and socio-economic pressures, supporting predictions of species abundance, distribution, and ecosystem services. Spatially explicit Projections of Environmental Drivers (SPEED) also links these projections to biodiversity case studies, modelling future changes in pollinators, decomposers, and pest control agents, which are critical for ecosystem functioning
- The University of Leeds is leading the development of the integrated Future Estimator for Emissions and Diets (iFEED), a framework designed to assess future scenarios related to climate, food, and emissions
- iFEED combines climate, food, and emissions models with stakeholder input to evaluate different possible futures. It uses "calibrated statements" to present evidence in a way that is both robust and easy to understand. Additionally, "Implication Statements" are used to highlight important insights that may not be captured directly by the models, helping to expand and clarify the outcomes in a structured manner

Data Exploration for South Africa with High Climate Risk from [iFEED]:



University of Leeds (2021.) iFEED data exploration: South Africa (ZAFHigh).
Available at: https://ifeed.leeds.ac.uk/data_exploration/ZAFHigh (Accessed: 10 Jan 2026).

The tool pictured above shows how yield and growing season duration change with irrigation and the yield gap parameter (YGP) under high climate risk scenarios. 'Zero irrigation' means rainfed crops, while '1' indicates full irrigation with no water stress. YGP of 1 reflects potential climatic yields; default YGP values represent observed yields from the year 2000 for each crop.

Across all iFEED scenarios, crop-level outputs are generated for a selected set of major crops relevant to each country context. The model evaluates key agronomic parameters, including crop duration, yield, biomass production, and planting dates, providing a consistent basis for comparing outcomes across alternative future pathways (University of Leeds, 2021).

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