Adaptation and mitigation of wheat production in the UK to climate change

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Challenges for food systems
• Increasing global food demand: up to 70% by 2050 – e.g. population growth, economic development and poverty reduction, urbanisation, changing social structures and changing lifestyles.
• Adapting to climate change: while many world regions (mainly in lower latitudes) will face worsening conditions some may benefit out to 2050 (mainly in higher latitudes) – e.g. temperature, precipitation, length of growing season, soil characteristics, pests and diseases, extreme weather events.
• Mitigating to climate change: ~14% of total global greenhouse gases, ~60% of nitrous oxide and ~50% of methane occur from agriculture – e.g. fertiliser, manure, soil and livestock emissions, land-use change.
• Balancing an increasing food demand with changing diets and a sustainable supply.

Aim
Climate change impacts on agricultural production which, when coupled with population growth and structural changes, will make sustainably feeding the world extremely challenging. This research project looks at food supply chains to explore climate change challenges. It analyses how current and projected global production in a changing climate can match projected demand and how agricultural production can adapt and mitigate to climate change.

Closing the yield gap of wheat
• The 10 main wheat producers supply ~70% of global wheat.
• Closing the yield gaps in the main producing countries can increase wheat production by ~41%. This could meet today’s global wheat demand (~650 Mt).
• Utilising climate change benefits in main producing countries (temperature, CO2-fertilisation, land-use change) can increase wheat production in 2050 by ~35%. This rises to ~88% by closing the yield gap.
• This only applies under optimal production conditions with no interruptions, e.g. extreme weather events, severe diseases.
• Temperatures increases above 2°C will have negative impacts on wheat production. According to current emission trends globally wheat production will face significant negative impacts after 2050 with severe threats to the food system.

Conclusion
• Adaptation to climate change may increase inputs such as nitrogen fertiliser to maximise possible climate benefits.
• Yield gaps need to be narrowed and production to be increased to meet future food demands. That will, with current production technologies, lead to higher total agricultural emissions.
• Mitigation in agriculture will be challenging for meeting future food demand in a changing climate which places more pressure on other sectors to decarbonise.