

# CXC Summary Report, Impacts on Agriculture: “Climate Change and Wheat Fusarium Head Blight Epidemics: Present and Future Risks.”

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## 1. Key points

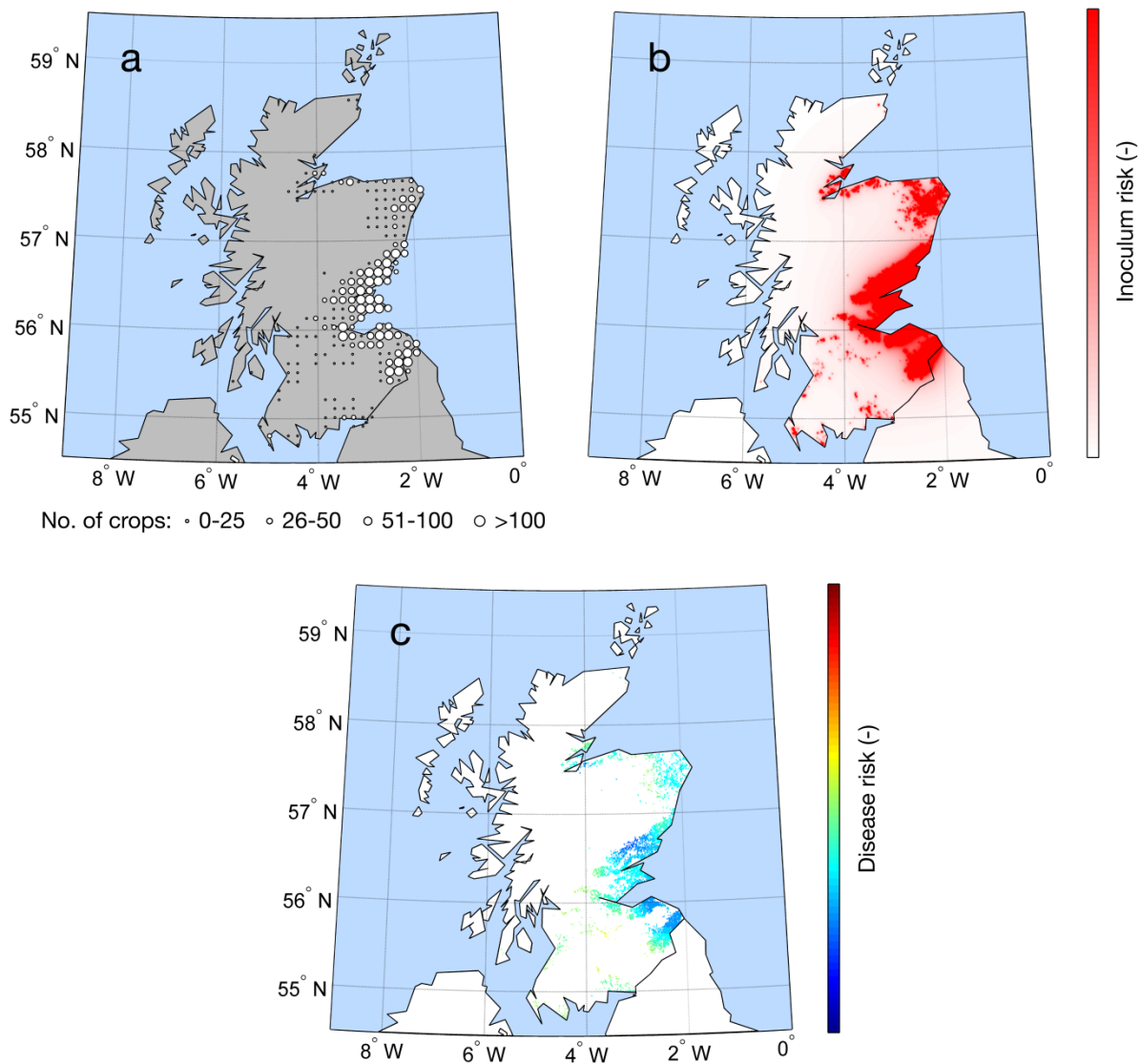
- The principal infection problem of wheat is Fusarium head blight (FHB) and the associated serious mycotoxin contamination.
- Wheat is vulnerable to FHB infection mainly at flowering, when heavy rainfall splashes inoculum from the soil up the plant and onto the emerging wheat heads.
- Our projections show that warmer temperatures will cause the dates of wheat flowering and grain ripening to occur earlier in Scotland, when the weather is expected to be drier than today.
- The risk of wheat FHB epidemics is expected to decrease in Scotland with increasing time and CO<sub>2</sub> emissions, unless new pathogen strains evolve that can adapt to drier weather<sup>1</sup>.
- These predictions are more robust than other Fusarium model outputs as they are based on detailed spatial crop records (IACS), spatially-coherent climate projections, a verified epidemiological model and advanced atmospheric dispersion modelling.

## 2. Introduction

Fusarium head blight (FHB) is a major disease of wheat. It's one of the top food safety concerns associated with a changing climate in Europe, because the infected grain contains mycotoxins that are hazardous to human and animal health. In this study, high resolution data defining the spatial coverage of wheat crops in Scotland were combined with spatially-coherent, probabilistic climate change data to project the future risk of FHB in wheat. This unique combination of data enabled a test of the robustness of our current wheat production systems to future disease threats, and an investigation of adaptation strategies regarding potential climate-change-driven shifts in agricultural patterns and practices.

## 3. Research undertaken

Annual data defining the spatial coverage of wheat crops in Scotland (over 50,000 crop locations in total) were derived from the Scottish Integrated Administration and Control System and June Scottish Agricultural Census (Fig. 1a). Future climate variables were obtained from the UK Met Office Climate Projections database (UKCP09 SCPs). These data provide probabilistic projections through multiple samples of future climate, enabling an estimation of the likelihood of realising various impacts. The risk of inoculum from over-wintering refugia was calculated with the aid of an atmospheric dispersion model from the meteorological sciences (Fig. 1b). A crop-disease-climate model considered as 'best practice' for predicting the risk of FHB in wheat was used to project the subsequent risk of disease development (Fig. 1c).



**Fig. 1.** Example maps showing (a) a distribution of wheat production areas, (b) the risk posed to those production areas by overwintering sources of inoculum, and (c) the risk of FHB development under a high CO<sub>2</sub> emissions scenario in the 2080s.

#### 4. Policy implications

- Food security<sup>2</sup>: Wheat production could be increased in Scotland with little additional risk of FHB.
- Common Agricultural Policy<sup>3</sup>: Opportunities exist to diversify and grow cereals considered as more potent sources of fusarium inoculum, such as maize, with little additional risk of FHB. This will contribute towards the proposed 'greening' of direct payments, by strengthening the environmental sustainability of agriculture. [Climate change is predicted to cause the summer months to become warm enough for grain maize to be economically viable in the UK]

- Water<sup>4</sup>: Reduced disease threat will enable better-targeted crop protection delivering improved disease control using less fungicides, thereby reducing the likelihood of runoff and pollution of water courses.
- Land use<sup>5</sup>: Should the need arise, crop production could be moved away from coastal areas vulnerable to sea-level rise, with little additional risk of FHB.

## 5. References

1. Skelsey, P., Newton, A.C. 2014. Future environmental and geographic risks of fusarium head blight of wheat in Scotland. *European Journal of Plant Pathology*, *in press*.
2. Recipe for Success - Scotland's National Food and Drink Policy: <http://www.scotland.gov.uk/publications/2009/06/25133322/0>
3. The Common Agricultural Policy after 2013: [http://ec.europa.eu/agriculture/cap-post-2013/index\\_en.htm](http://ec.europa.eu/agriculture/cap-post-2013/index_en.htm)
4. The Water Environment and Water Services (Scotland) Act 2003: <http://www.legislation.gov.uk/asp/2003/3/contents>
5. Land Use Strategy Progress Statement and Refreshed Action Plan 2014: <http://www.scotland.gov.uk/Publications/2014/05/4575>

## 6. Further information

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