

# PhD Research Proposal

The impacts of climate change and land degradation on global food production.

In 2014, 50% of global cereal production came from just four countries: China, USA, India and Russia (The World Bank, 2016). By 2050, an increased population and changes to diets mean that food production is likely to have to increase by 60% to meet demand (Bruinsma, 2009).

Yet food production, both now and in the future, is likely to be adversely affected by two interacting processes that are already established and ongoing. One6(0-95(sc)4(i(of nee)t(e)is)11 t(e)s)3-8

s in the future.

Land degradation through loss of top-soil reduces crop water availability and increases nutrient requirements, and leads to increased eutrophication and N<sub>2</sub>O emissions. It is not considered in the IPCC AR5, except as a note in a case study of the African Sahel. In contrast to climate change, there are few assessments of the impact of land degradation outside of Mid-West USA and Sub-Saharan Africa.

The impacts of climate change and the rate and impacts of land degradation could be reduced by adapting existing farming practices. The IPCC defines adaptation as reductions in risk and vulnerability through the actions of adjusting practices, processes, and capital in response to the actuality or threat of climate change (Porter *et al.*, 2014). Actions include changes in the decision environment, such as social and institutional structures, and altered technical options that can affect the potential or capacity for these actions to be realised. Adaptation options that have co-benefits for both land degradation and climate change would be particularly useful.

The aims of this PhD are to:

1. Understand the potential impacts of climate change on interannual cereal yield variability.
2. Examine the potential impacts of land degradation on interannual crop yields in the principal global crop-growing regions.
3. Identify how the impacts of both climate change and land degradation together compare to the individual impacts of each process, to understand the nature of the interactions between the two processes in the principal global crop-growing regions.

4. Characterise the relative impacts of adaptation options on climate change and land degradation, with a particular focus on identifying options that could substantially