

Combining bio-physical and socio-economic drivers in food production models

Elisabeth Simelton, Evan D.G. Fraser, Andrew Challinor
E.S.Simelton@leeds.ac.uk

Climate Change Impacts and Adaptation:
Dangerous rates of change

Exeter Sep 23, 2008

Outline

- What do crop models tell us?
- How to identify socio economic drivers behind sensitivity to drought?
- Results
 - Trends in drought sensitivity
 - Socio economic drivers to drought sensitivity

Crop modeling without adaptation

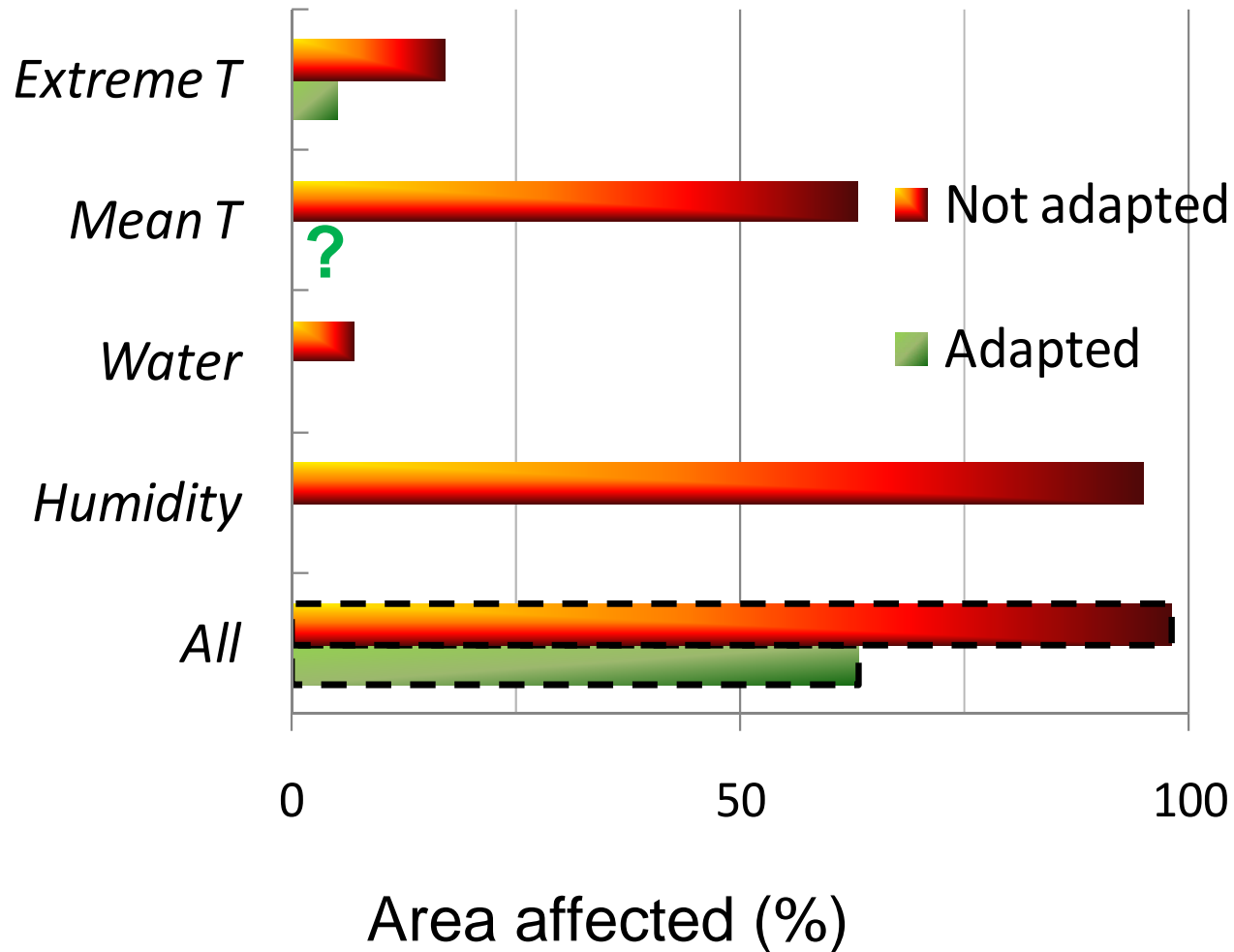
Extreme T

Mean T

Water

Area affected (%)

Crop modeling with and without adaptation



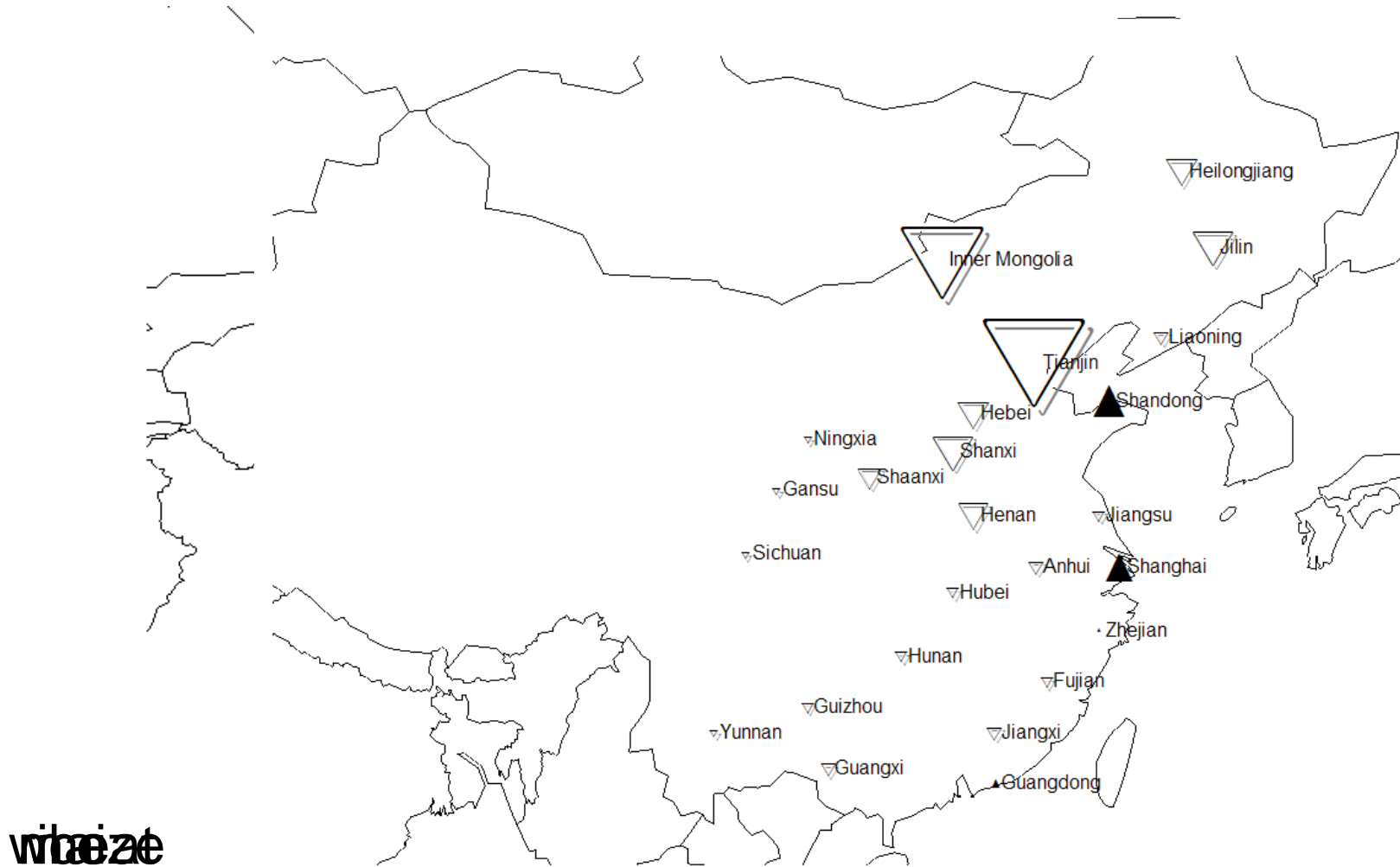
Identifying sensitivity to drought



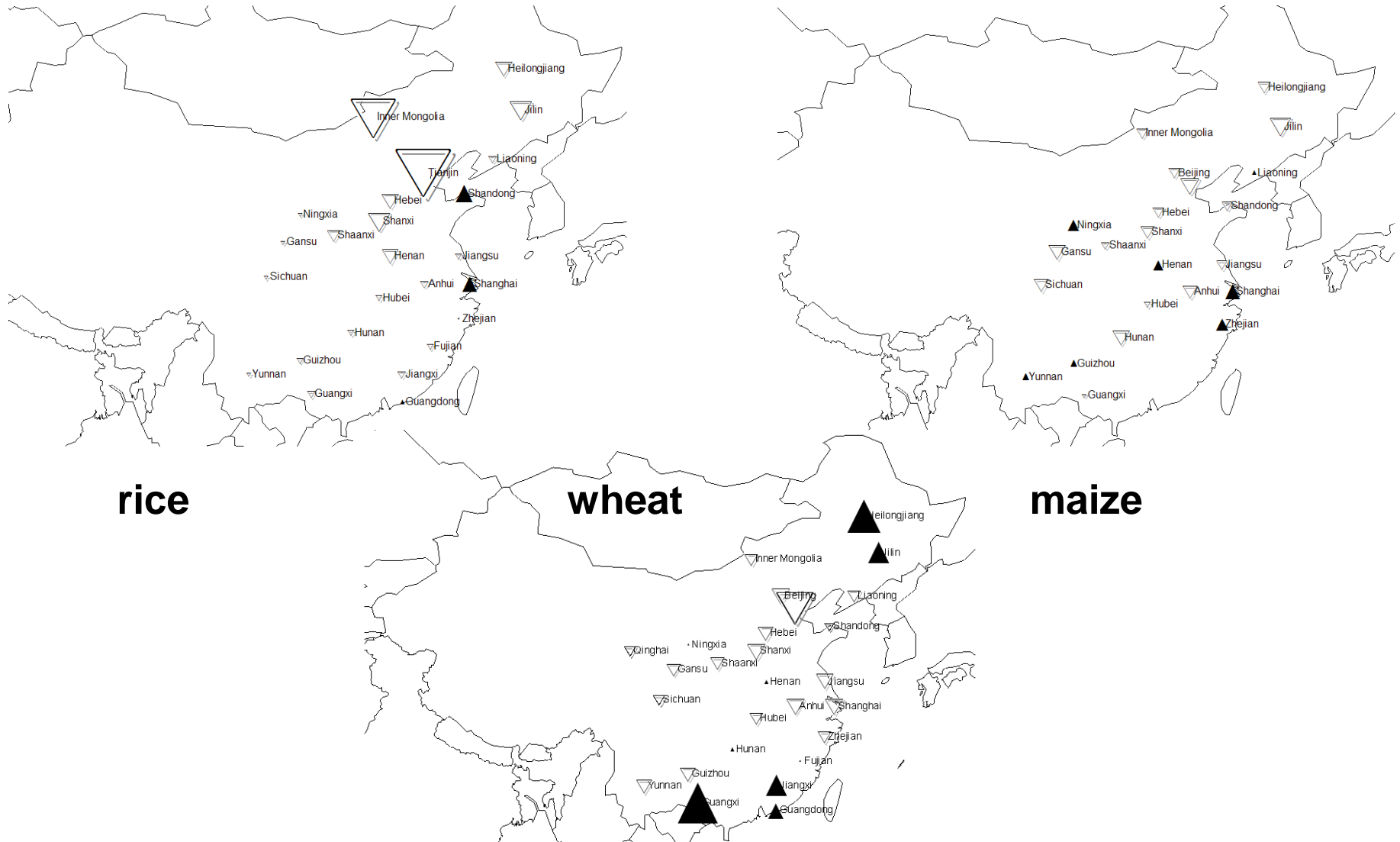
Sensitivity to drought index

$$\frac{\text{crop failure index}}{\text{drought index}} = \frac{\left(\frac{\hat{H}_{area}}{H_{area}} \right)}{\left(\frac{\bar{R}_{area}}{R_{area}} \right)}$$






Sensitivity trends 1961-2001

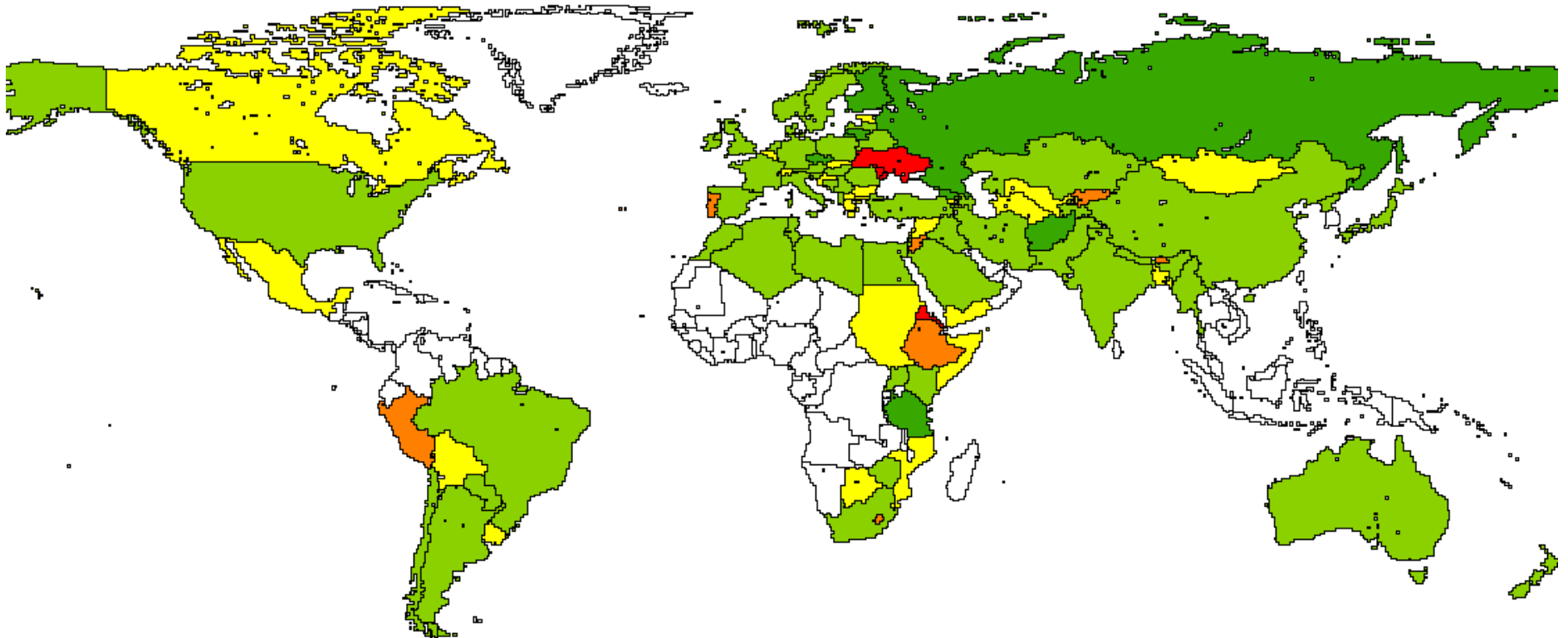


Sensitivity trends 1961-2001

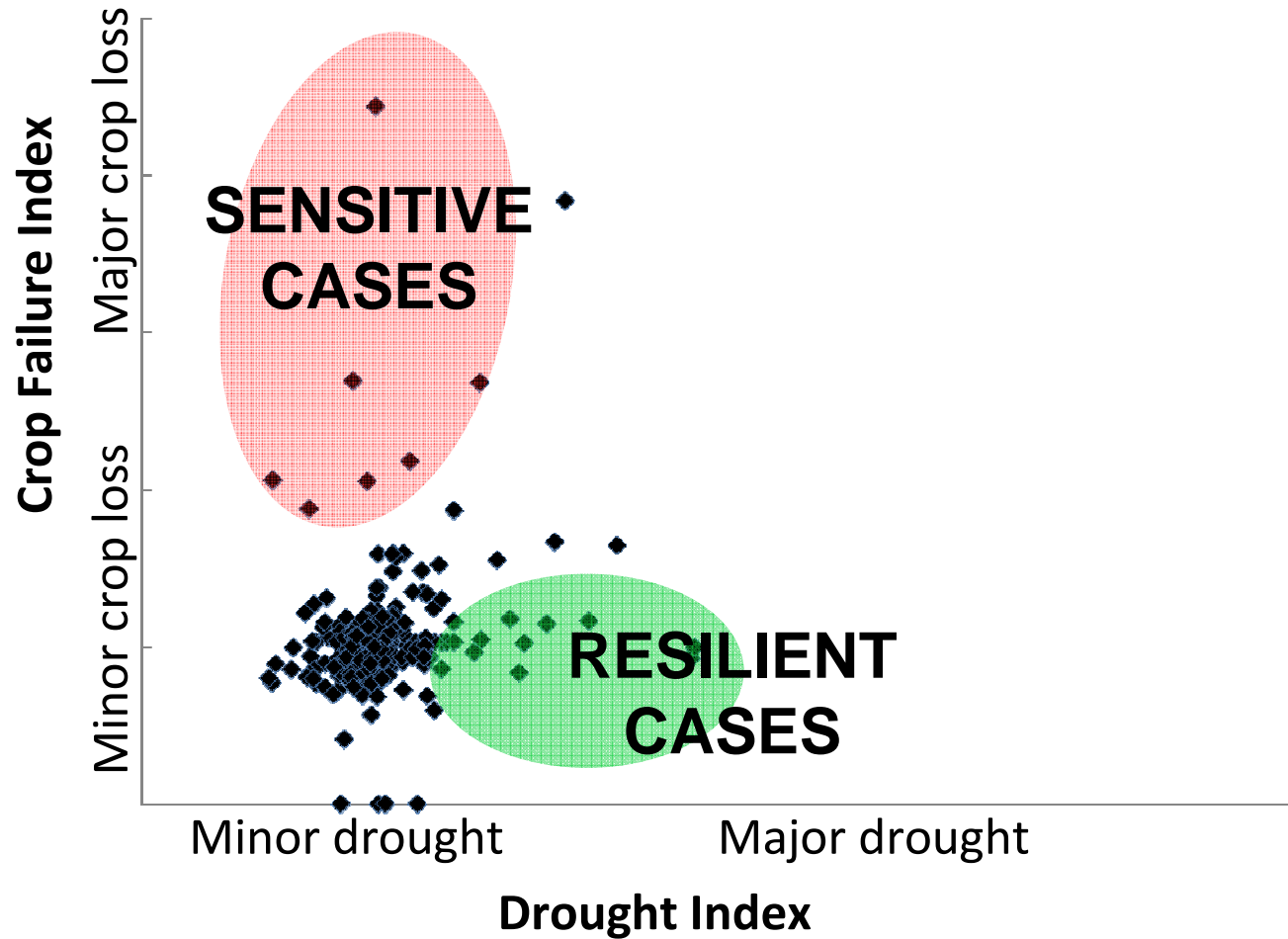


Preliminary trends - sensitivity to drought wheat 1990-2005

-  Much less sensitive
-  Less sensitive
-  No change
-  More sensitive
-  Much more sensitive



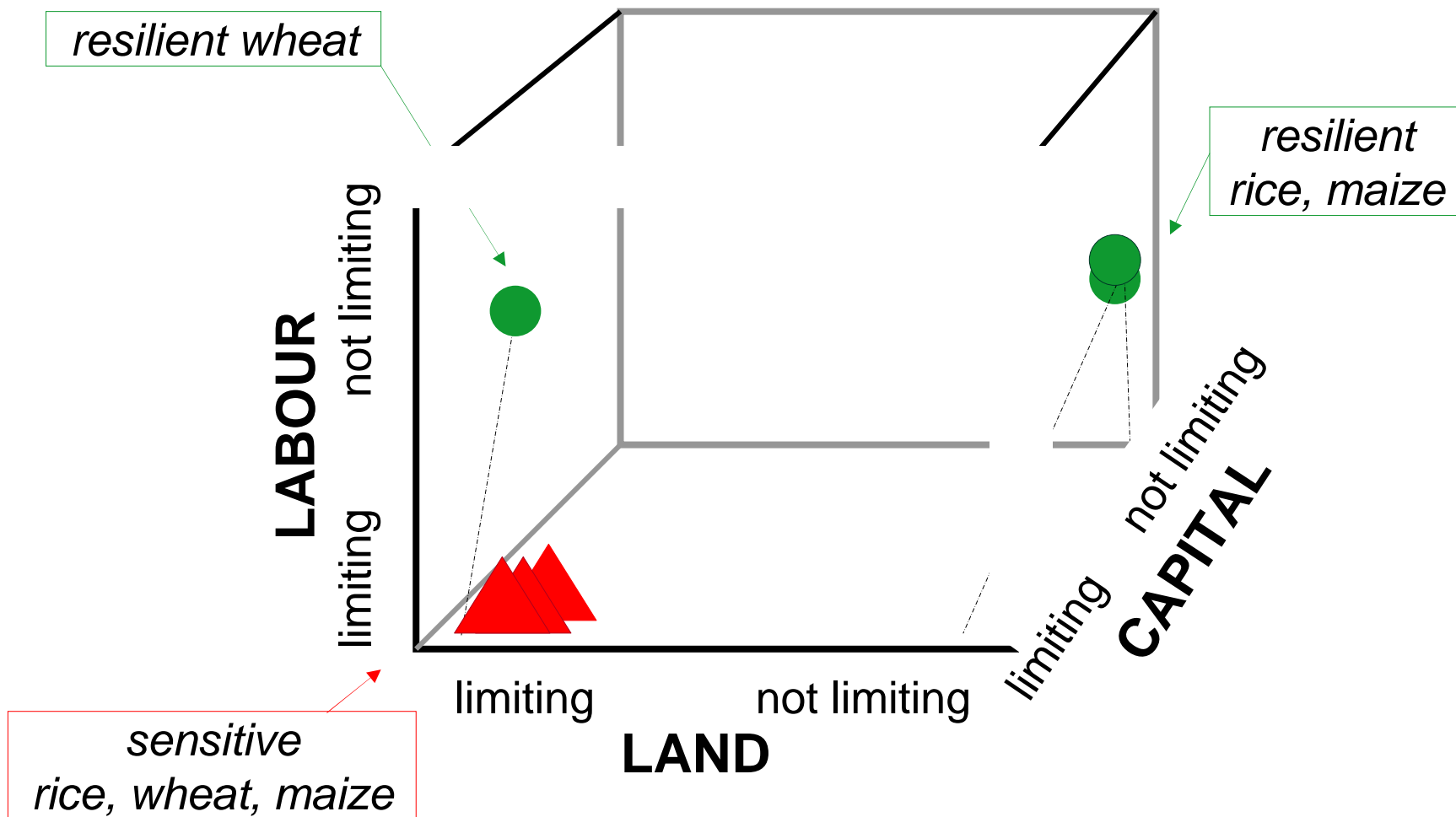
Analyse outliers



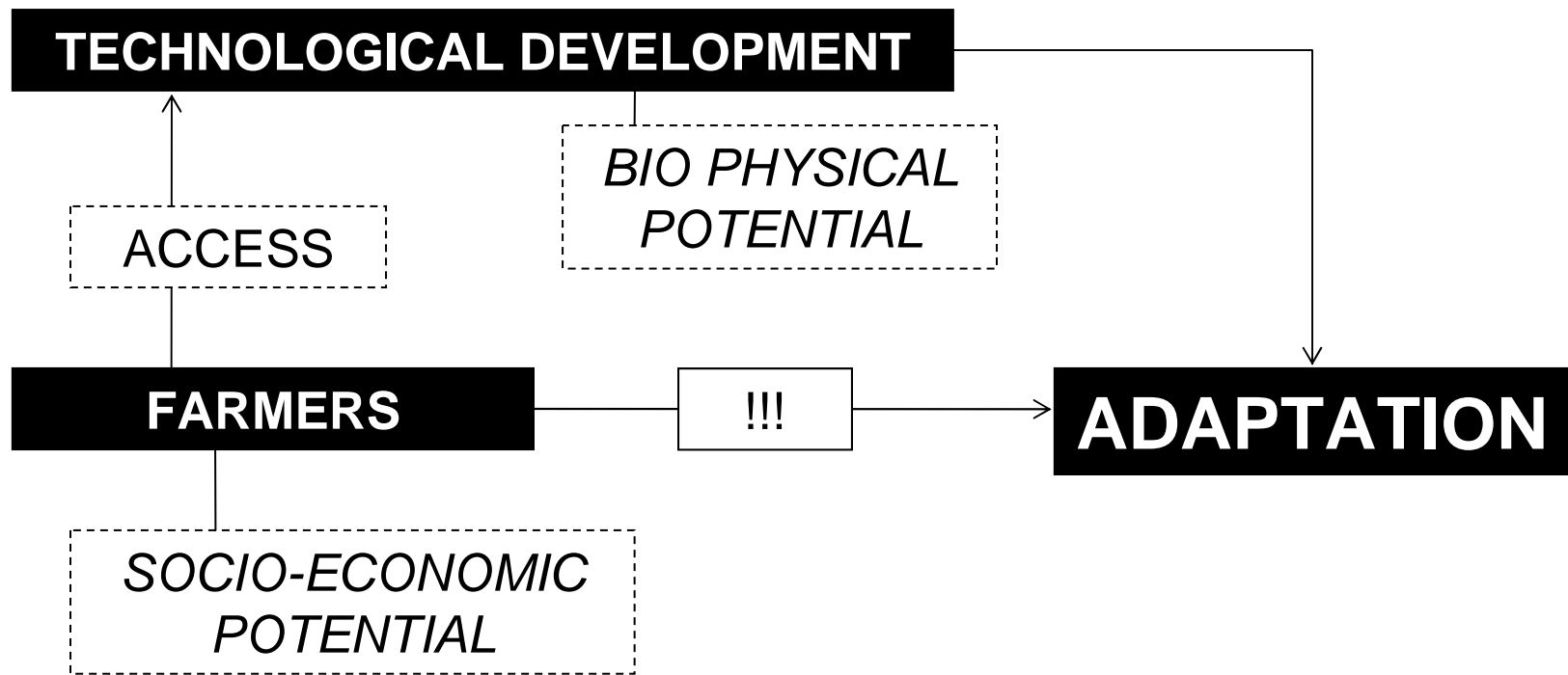
Socio-economic factors that impact sensitivity to drought

Land	Labour	Capital
<p>Area cultivated crops</p> <p>Area with more than one crop/year</p> <p>Area affected by natural hazards</p> <p>Road/railway density</p> <p>...</p>	<p>Rural/total population</p> <p>Rural households</p> <p>Agricultural labour</p> <p>Urbanization rate</p>	<p>Agriculture of GDP</p> <p>Rural investment</p> <p>Fixed capital/farmer GDP/capita</p> <p>...</p> <p>+ <i>Technical inputs</i></p> <p>Fertiliser</p> <p>Irrigation</p> <p>Tractors</p> <p>...</p>

Factors limiting resilience to drought



Conclusion



E.S.Simelton@leeds.ac.uk

E.D.G.Fraser@leeds.ac.uk

A.J.Challinor@leeds.ac.uk

Challinor (in review) Env. Science & Policy Special Issue

Fraser et al. (2008) Comptes Rendus Geoscience

Simelton et al. (in review) Env. Science & Policy Special Issue

