



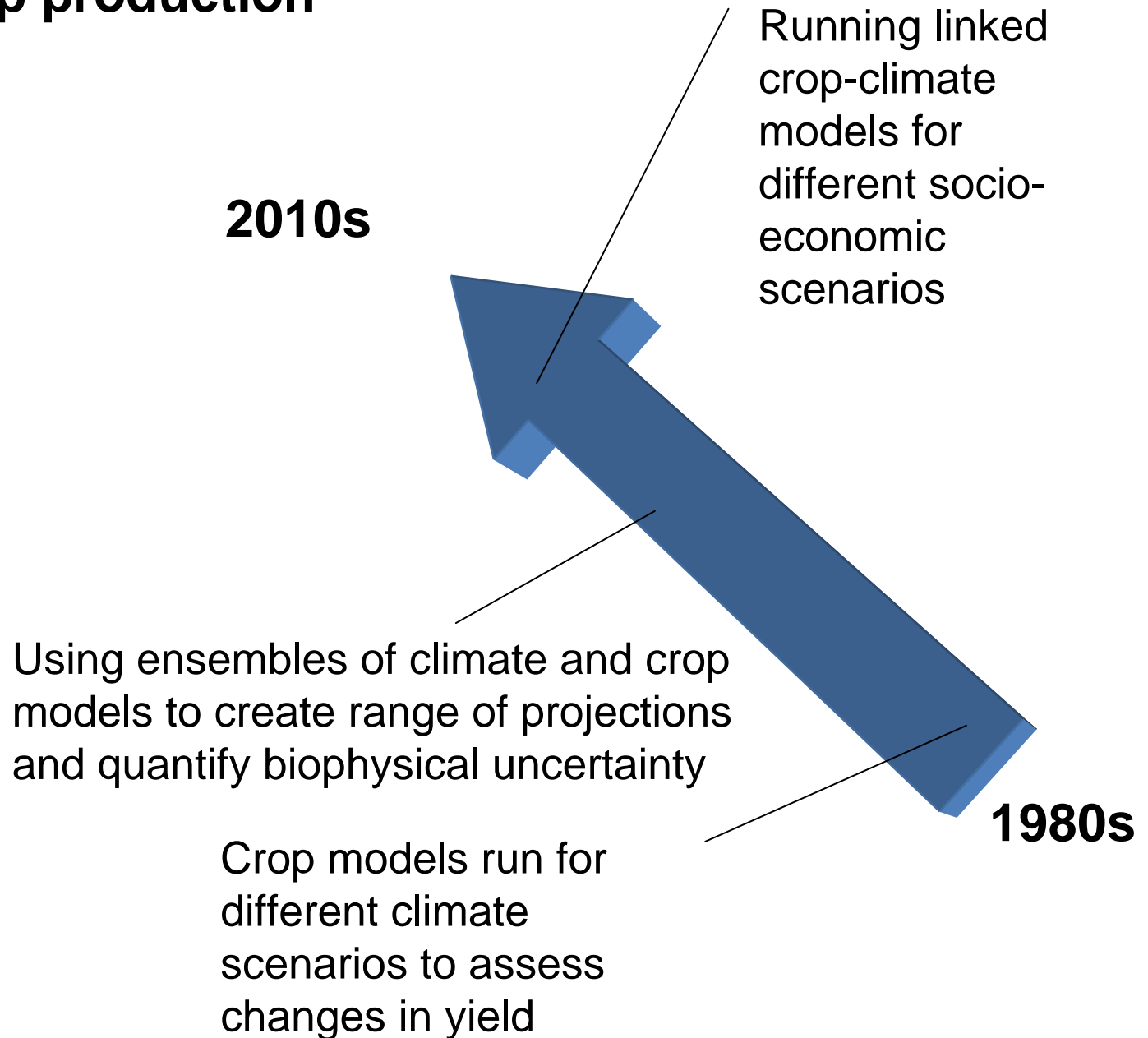
Anticipating Global Food Security Problems...

Adding some socio-economics

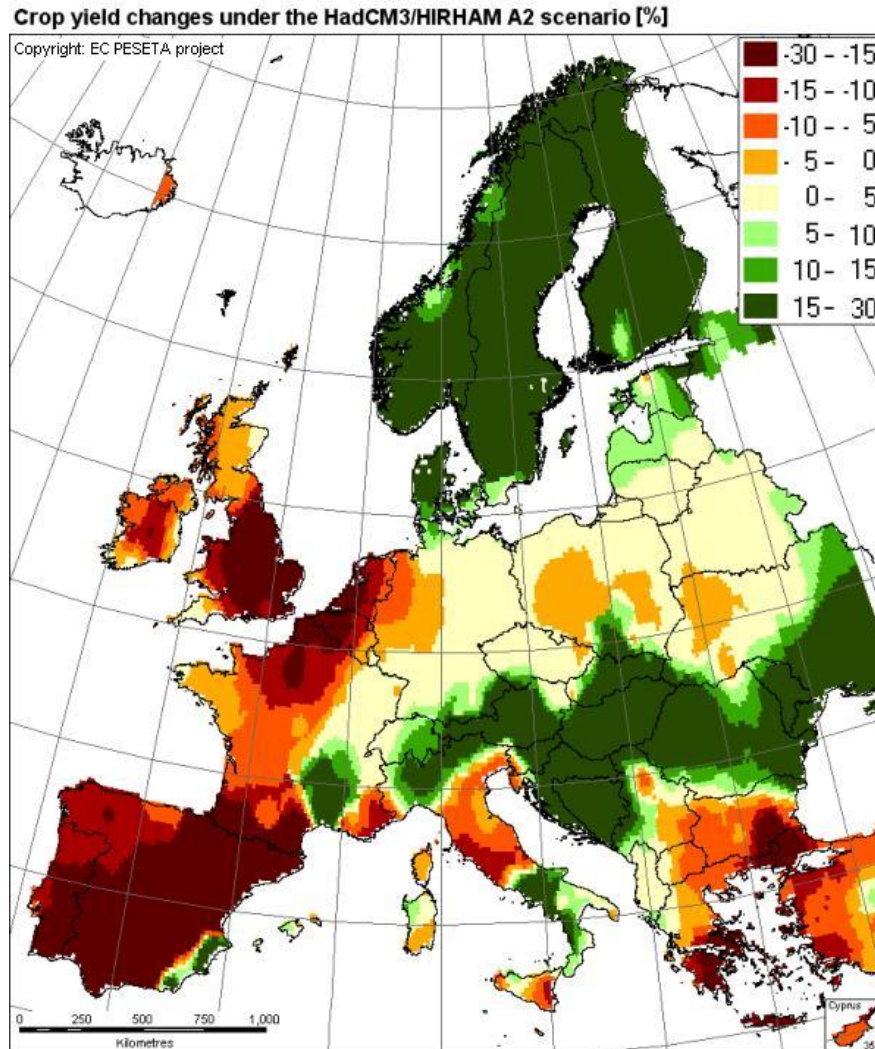
Evan Fraser

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University of Leeds

Progress in modelling climate impacts on food crop production



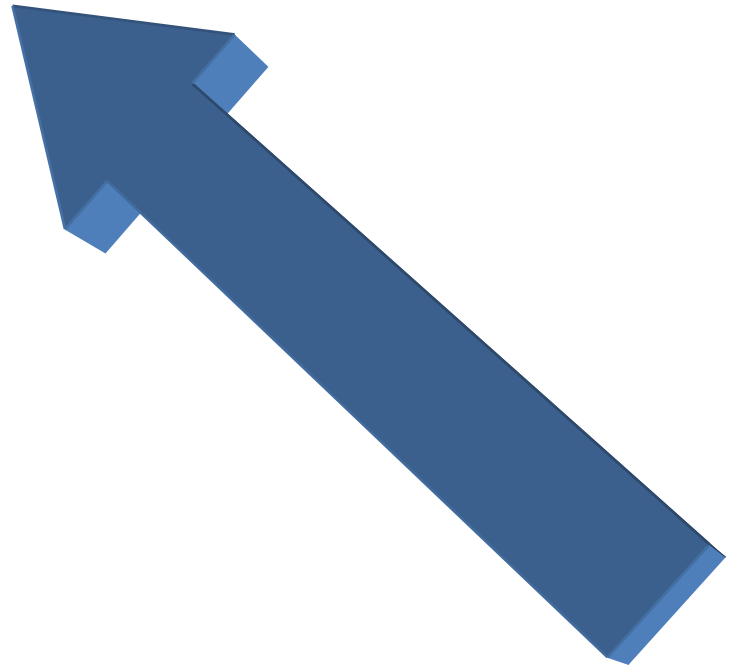
- Crop yield changes by 2080s relative to 1961-1990
 - Based on a high emission scenario (A2) & for climate model HadCM3/HIRHAM



European Commission (2009). The PESTA Project. Available at <http://peseta.jrc.ec.europa.eu/docs/Agriculture.html>



Next Steps: There is a need to include socio-economic indicators in linked crop-climate models.



A pause for critical reflection...

- To effectively do this – i.e. bring “bottom-up” socio-economic insights into “top-down” mathematical models you need to be ok with “quantifying society”
- You must make huge assumptions about the nature and strength of relations.

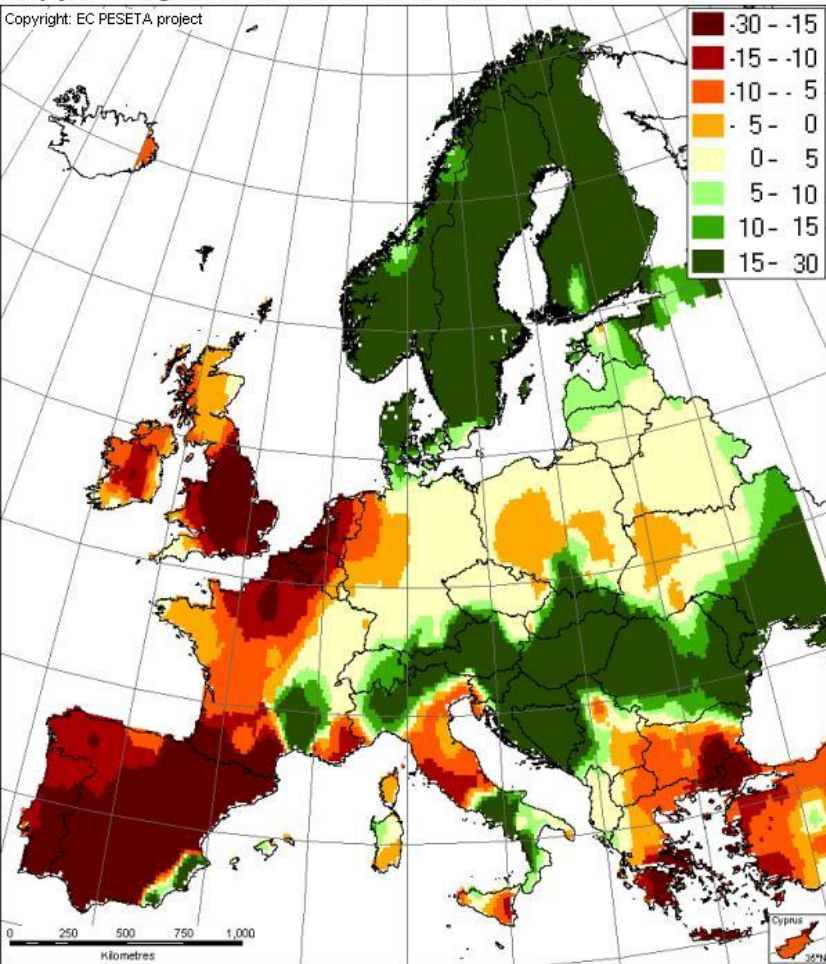
Morse, S. and Fraser, E. D. G. (2005). Making ‘dirty’ nations look clean? The nation state and the problem of selecting and weighting indices as tools for measuring progress towards sustainability, *Geoforum*. 36, 625-640.



- *...the construction of narratives around global warming remain strongly tied to roots within the natural sciences, ... which claims both global reach and universal authority.*
 - M. Hulme (2007) Geographical work at the boundaries of climate change. *Transactions of the Institute of British Geographers* 33(1): 5-11.

Crop yield changes under the HadCM3/HIRHAM A2 scenario [%]

Copyright: EC PESETA project

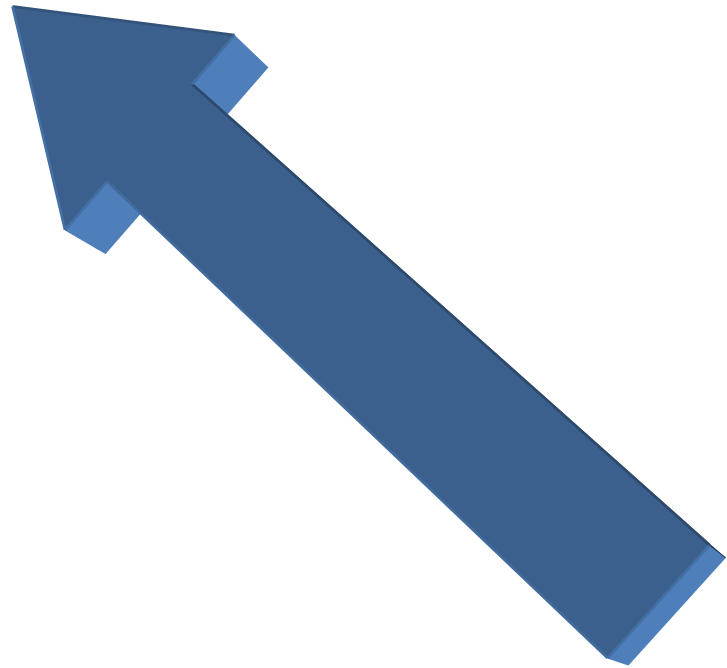


One way forward...

- For social scientists to engage with the tools of modellers
 - ...but this involves “modelling society”
- This is a challenge (to say the least)!

Large-scale data analysis

- Goal: find key socio-economic indicators that made harvests sensitive to drought using large-scale data.
- Based on collaborations across the UK through the “Quantifying and Understanding the Earth System” program
- Funded by the Natural Environment Research Council.

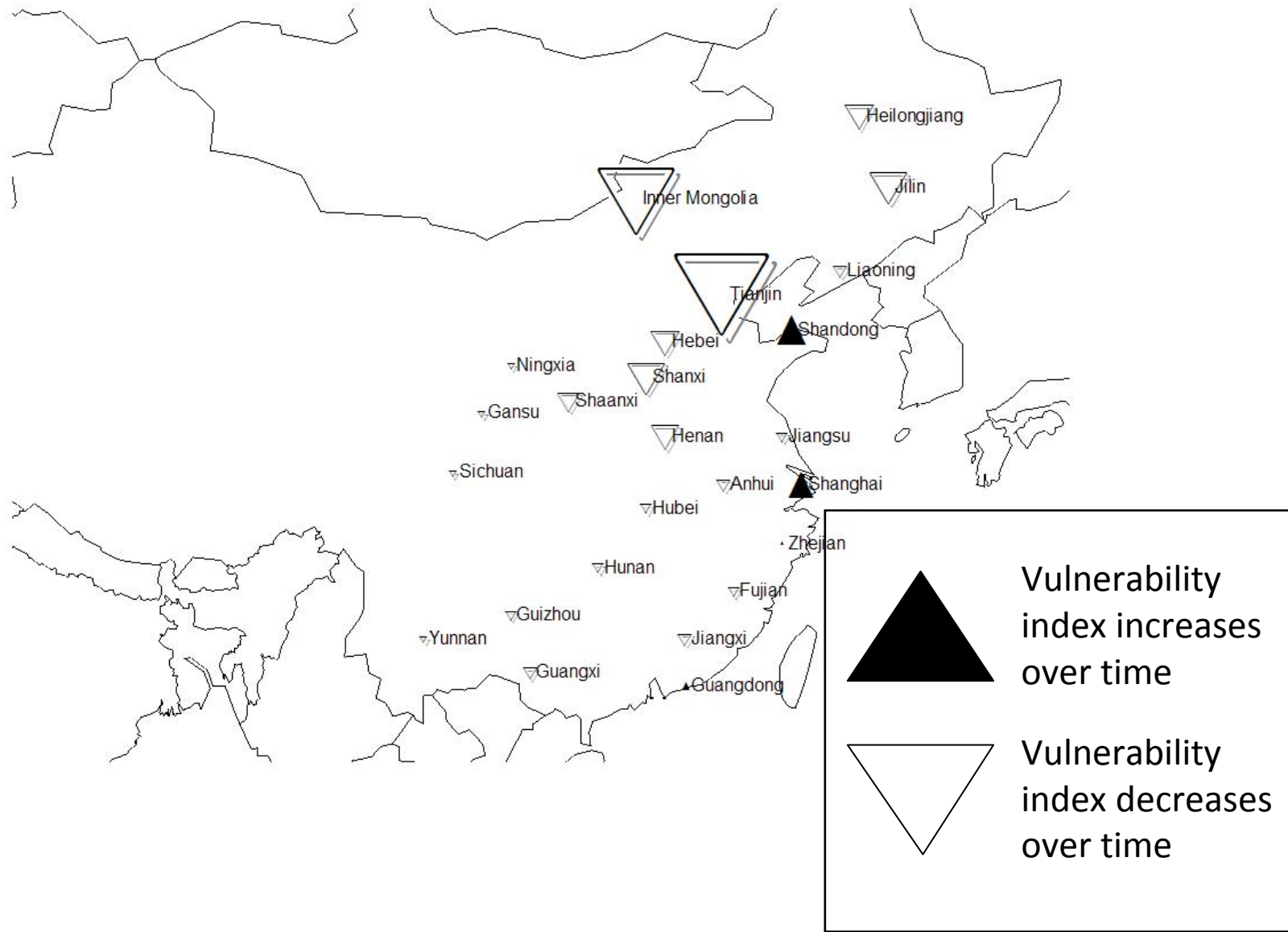


Identifying sensitivity to drought

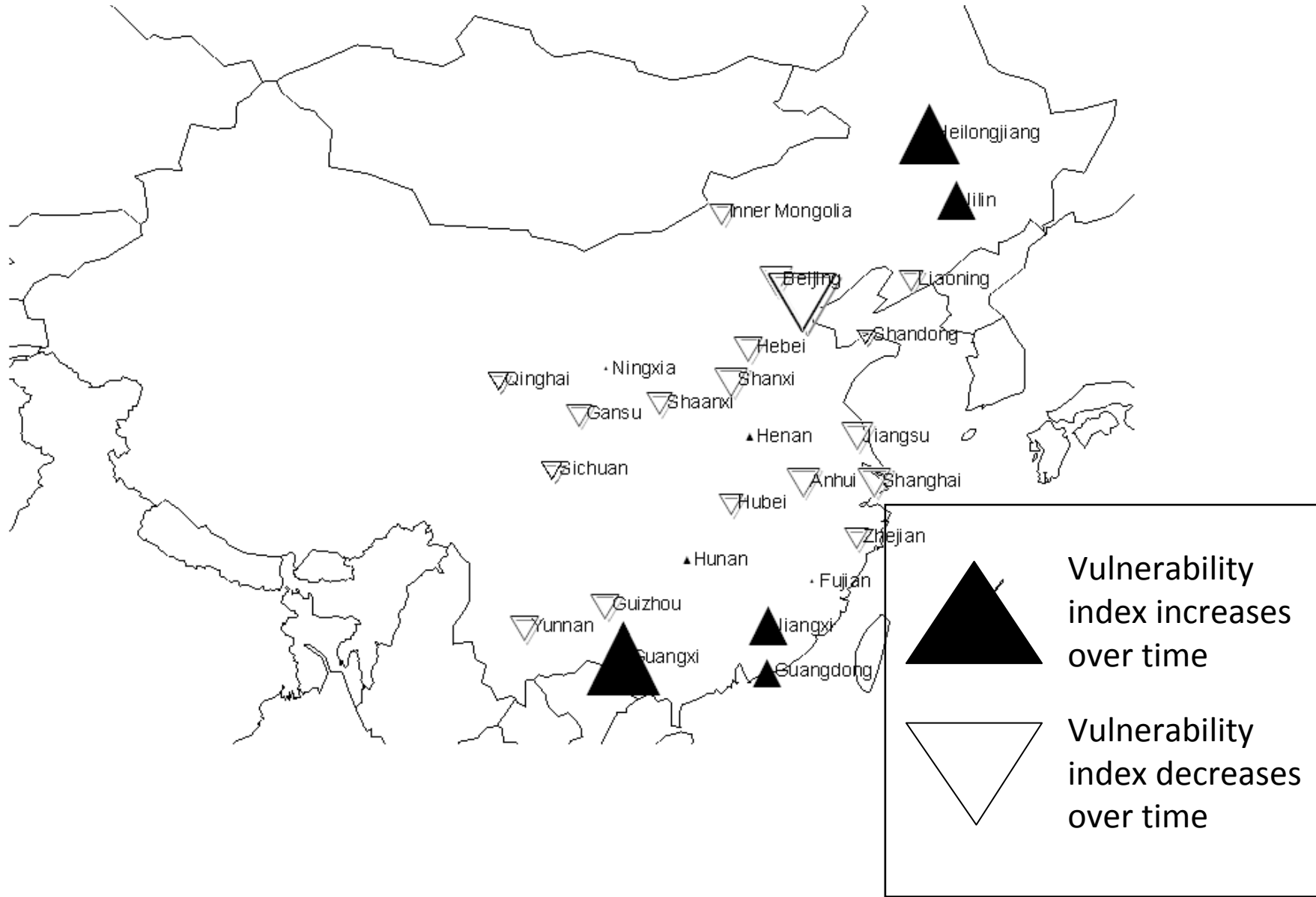


Fraser, E. D. G., Termansen, M., Sun, N., Guan, D., Simelton, E., Dodds, P., Feng, K. & Yu, Y. (2008). "Quantifying adaptation to extreme environmental events." *Comptes Rendus Geoscience*, 340, 679-688.

Vulnerability trends in China's Rice Harvest 1961-2001



Vulnerability trends in China's Wheat Harvest 1961-2001



Vulnerability trends 1961-2001



Significant socio-economic indicators

Vulnerability Index (direction of relation)

Index (direction of

Rice Paddy

Wheat

Labour

Land

Capital

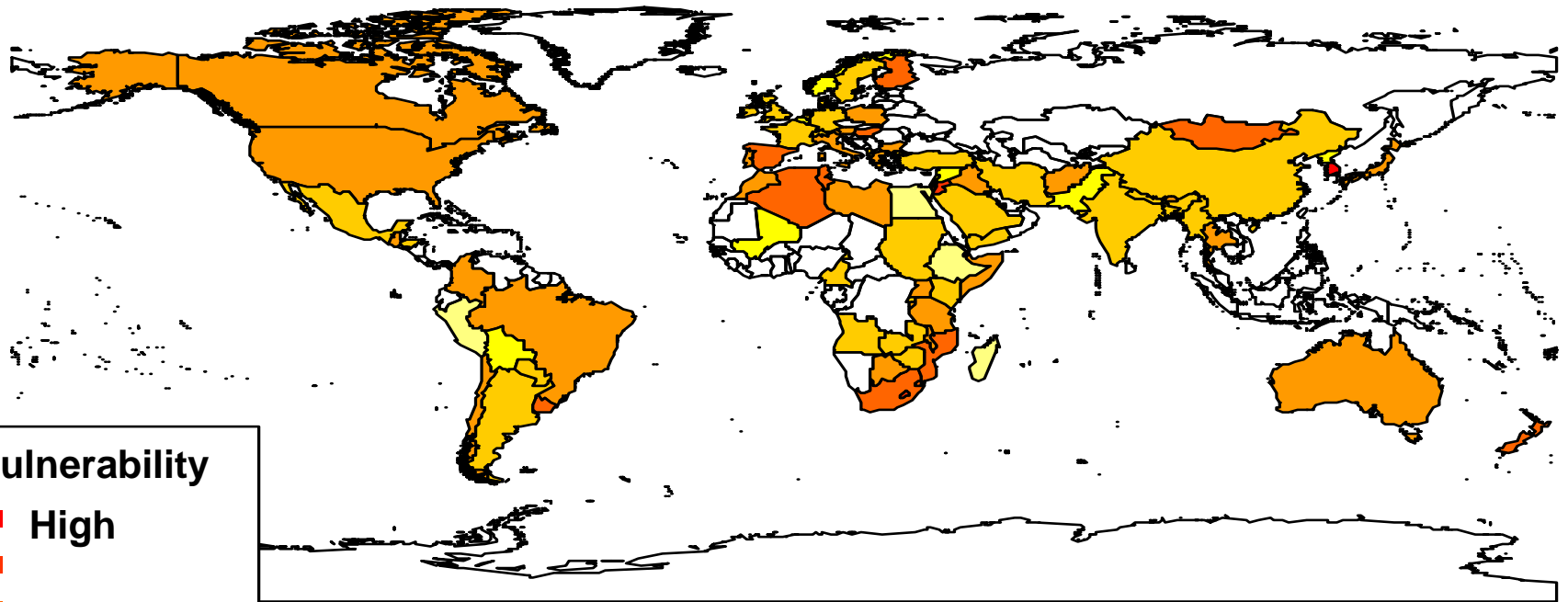
Simelton, E., Fraser, E.D.G., Termansen, M., Forster, P., and Dougill, A. (2009). "Typologies of crop-drought vulnerability." *Environmental Science and Policy*, Available on-line.



Current work...

- To use this approach to identify significant socio-economic indicators and develop “vulnerability models” that explain how different “types” of region are vulnerable to drought.
- This is being done at a range of scales (e.g. district level in Malawi and country level for globe).

Median vulnerability to drought 1990-2005 -- wheat



Vulnerability

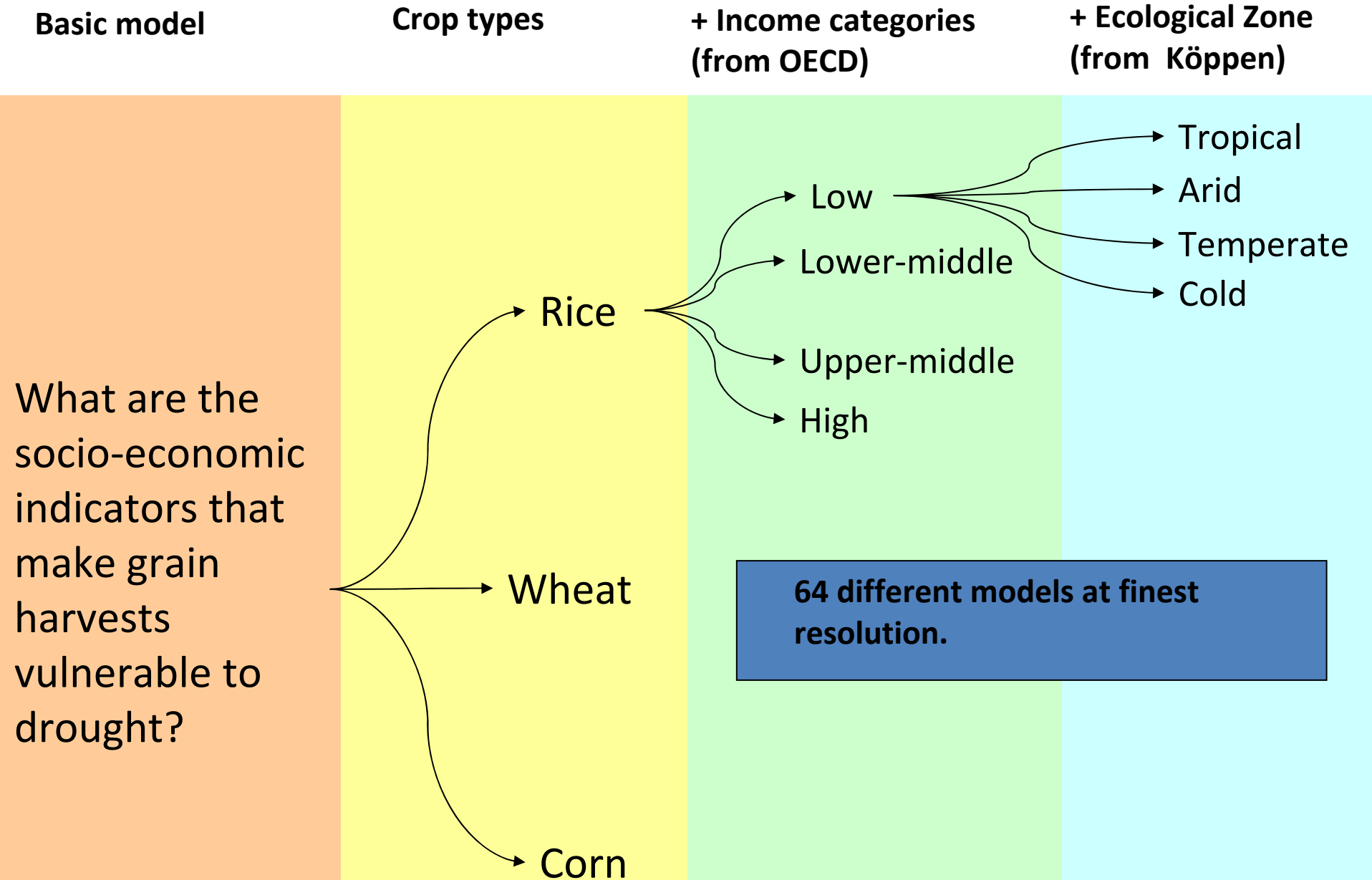
■ High



■ Low

■ no data

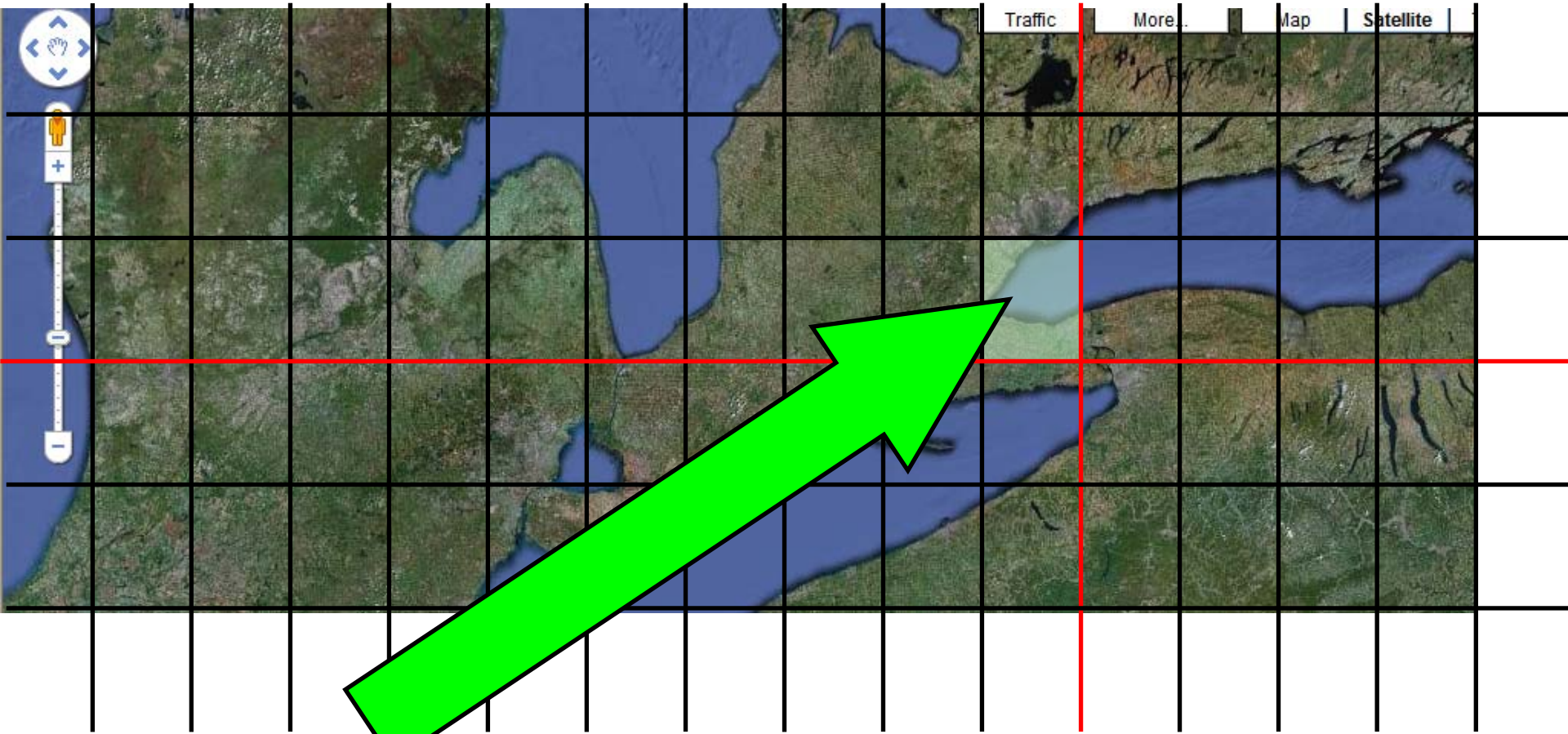
Understanding vulnerability using socio-economic factors



Next steps...Generating Vulnerability Maps

1. Divide up earth's land mass based on these 64 categories.

43 degrees N, 79 degrees W



“Welcome to Fenwick,
A Corn – High income – Temperate
Vulnerability region!”

Next steps...Generating Vulnerability Maps

1. Run models for different scenarios by changing socio-economic indicators to reflect different futures and observe changing levels of vulnerability.
2. To overlay climate prediction maps on top of vulnerability maps to identify regions (1) likely to be exposed to drought and (2) unlikely to have the capacity to adapt.

While far from perfect, these maps will represent the first significant effort to combine climatic and socio-economic indicators into a global scale projection of food production vulnerability.

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Copies of papers are available at:

www.evandgfraser.com

(or just google: evan fraser leeds)