Sustainability Research Institute
School of Earth and Environment
UNIVERSITY OF LEEDS

Climate Resilient Societies and Global Food Security: developing an interdisciplinary research programme

Wheat prices

Field events

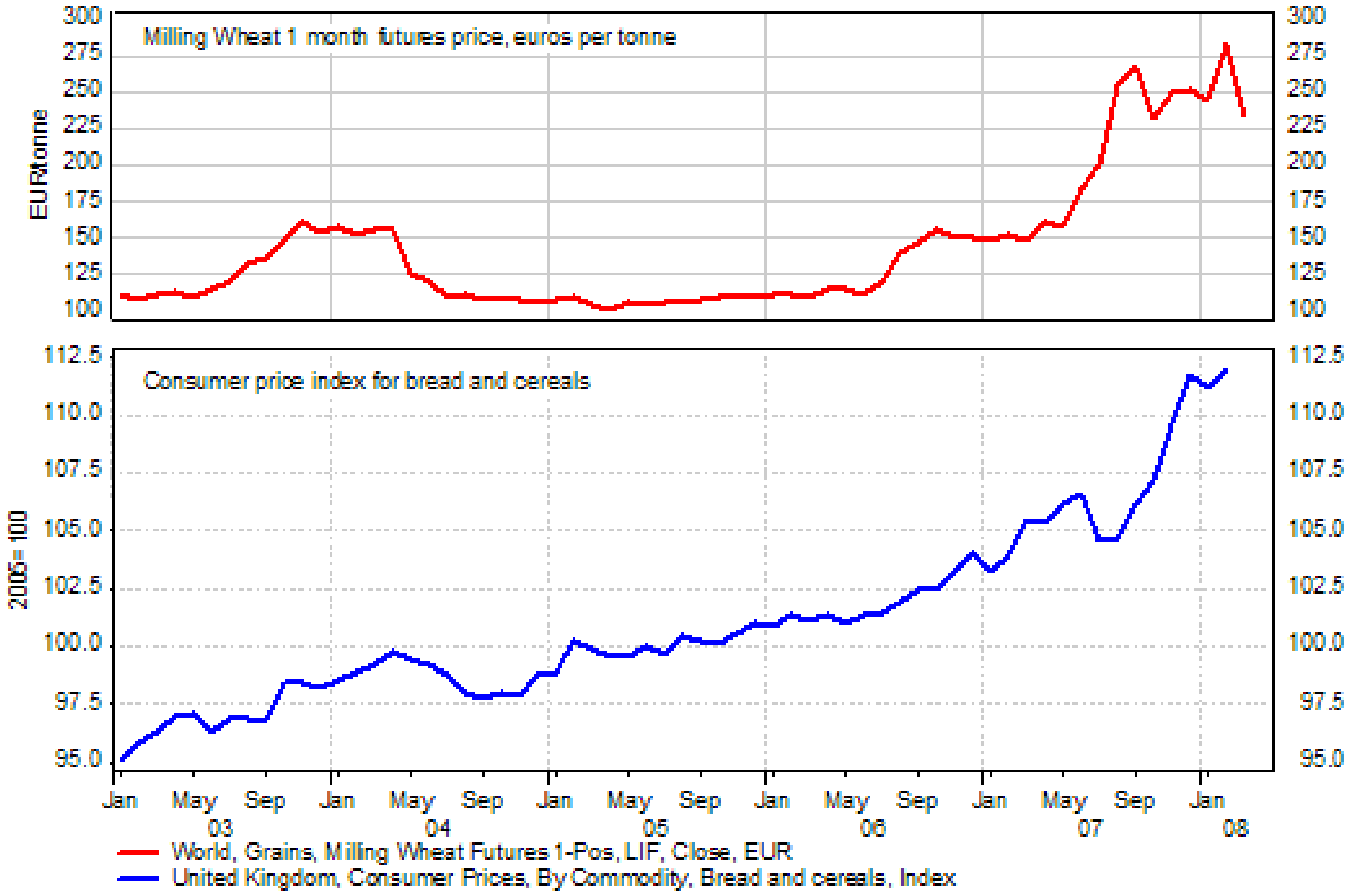
Volatile wheat prices are as much a cause for alarm as are high prices

Sep 9th 2010

FEW rural pleasures match seeing a golden field of grain, rustling and ripe for reaping. But the harvest season in the northern hemisphere is being marked by turmoil on global wheat markets.

A big reason is to be found in one of the world's largest wheat exporters, Russia. Hit by fires and drought which have wiped out a third of the grain crop, the authorities there have banned exports, first temporarily and now until next year's harvest. As a result,

Milling Wheat Prices and CPI for Bread and Cereals



Source: Reuters EcoWin

World faces 'perfect storm' of problems by 2030, chief scientist to warn

Food, water and energy shortages will unleash public unrest and international conflict, Professor John Beddington will tell a conference tomorrow

Ian Sample, science correspondent
guardian.co.uk, Wednesday 18 March 2009 17.19 GMT
Article history

Food and water shortages as a result of climate change and growing populations are likely to trigger mass migration and unrest. Photograph: AFP/Getty

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This leads to a question (or rather a series of questions)…

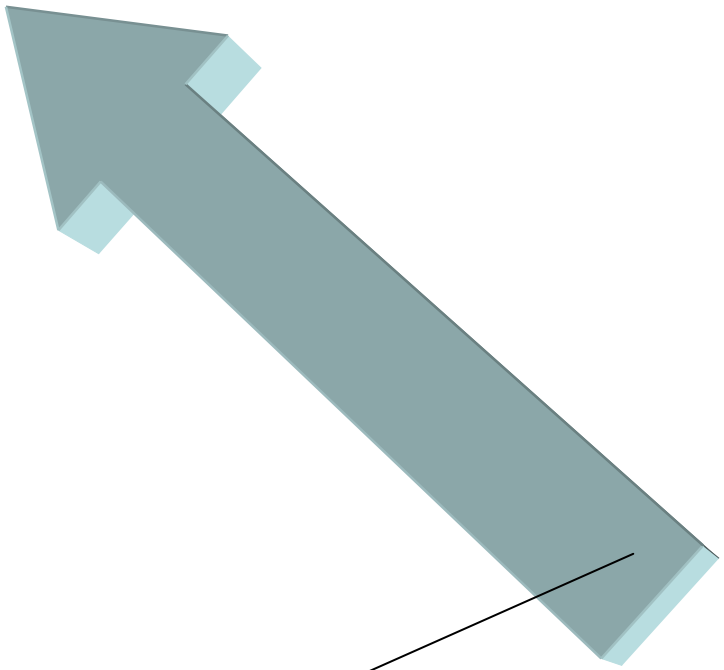
- Will we have enough food to eat in the future?
- Will climate change destroy the world's food supply?
- Will we starve?

Approaching these questions as research…

- Statistical methods used from the top-down.
- Bottom up and more qualitative methods.
- Using history as an analogy.

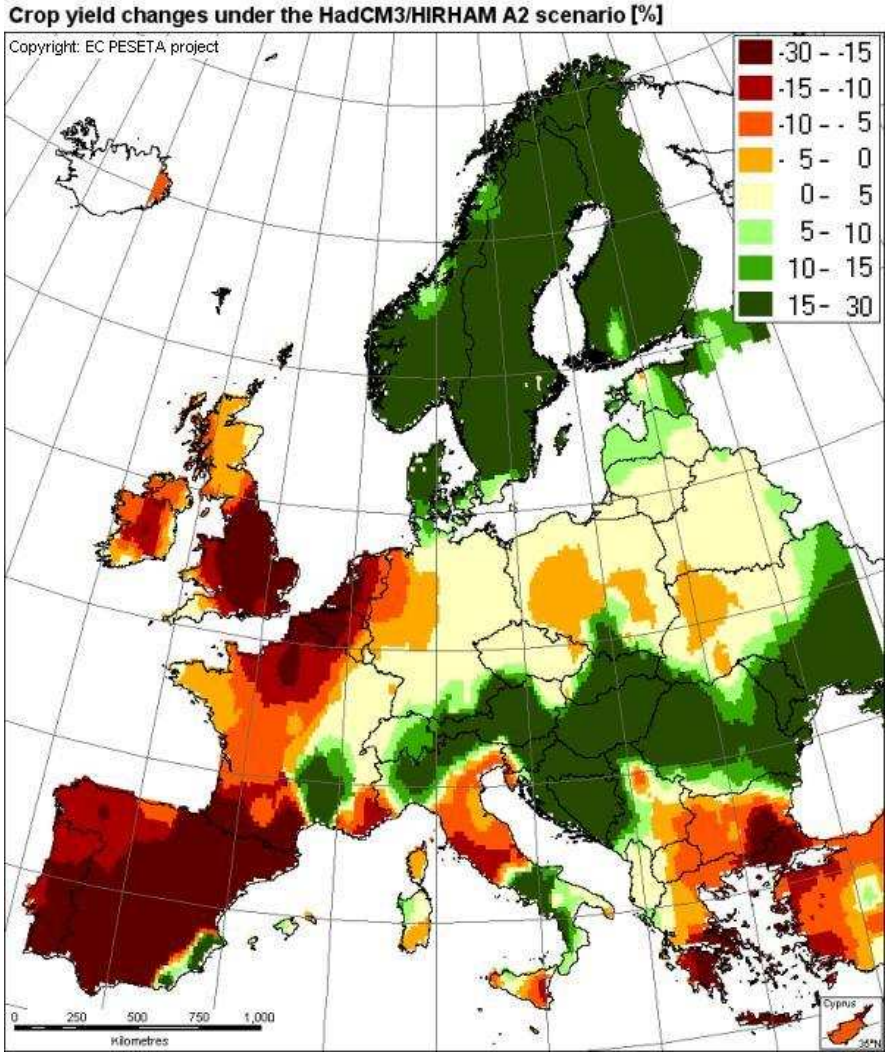
Statistical “top-down” and quantitative methods

Progress in modelling climate impacts on food crop production



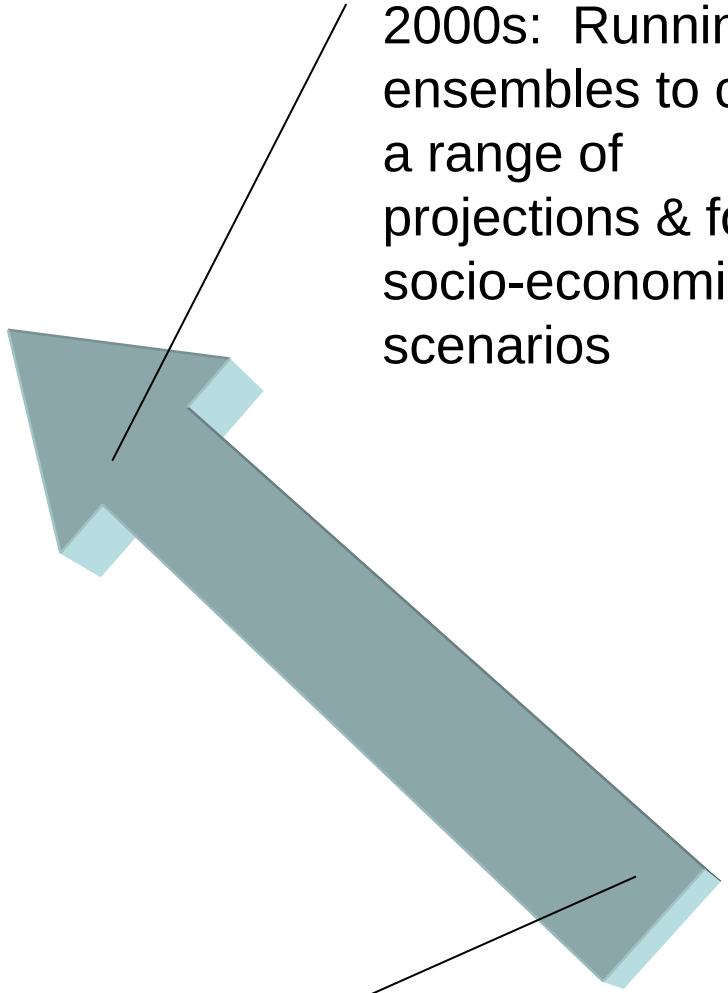
1980s: Crop models run for different climate scenarios to assess changes in yield

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



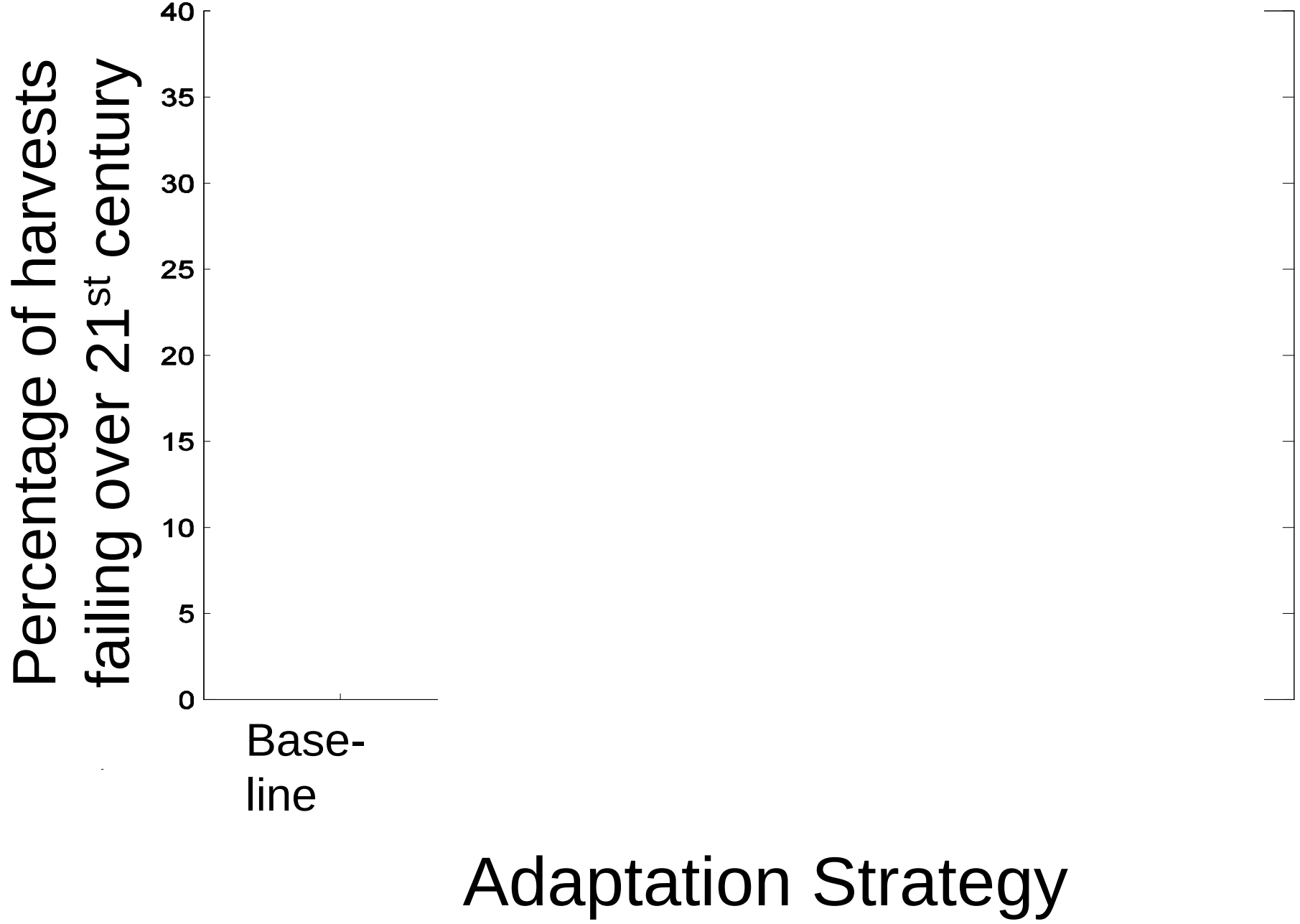
European Commission (2009). The PESTA Project. Available at http://peseta.jrc.ec.europa.eu/docs/Agriculture.html

Progress in modelling climate impacts on food crop production



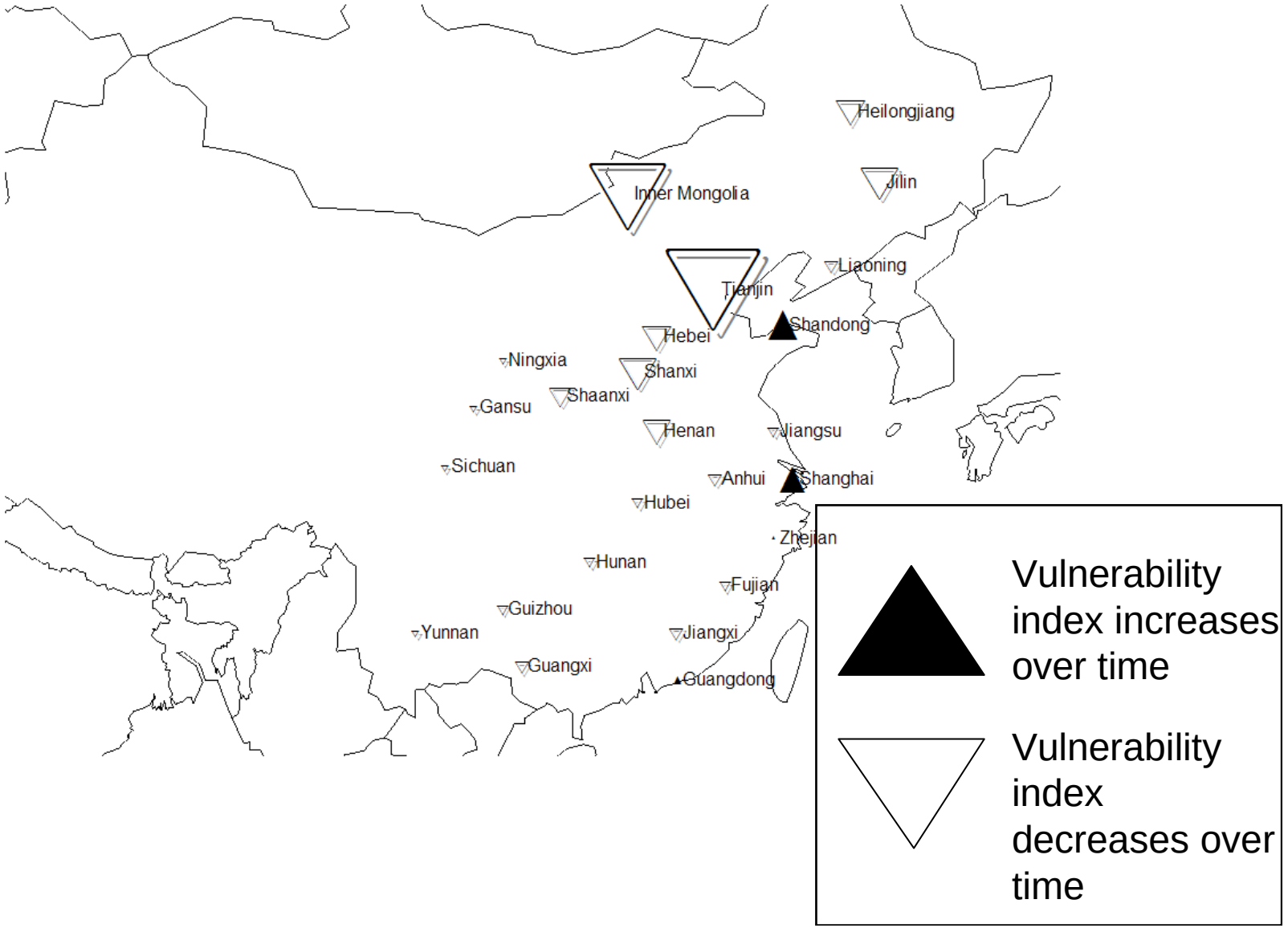
2000s: Running ensembles to create a range of projections & for socio-economic scenarios

1980s: Crop models run for different climate scenarios to assess changes in yield

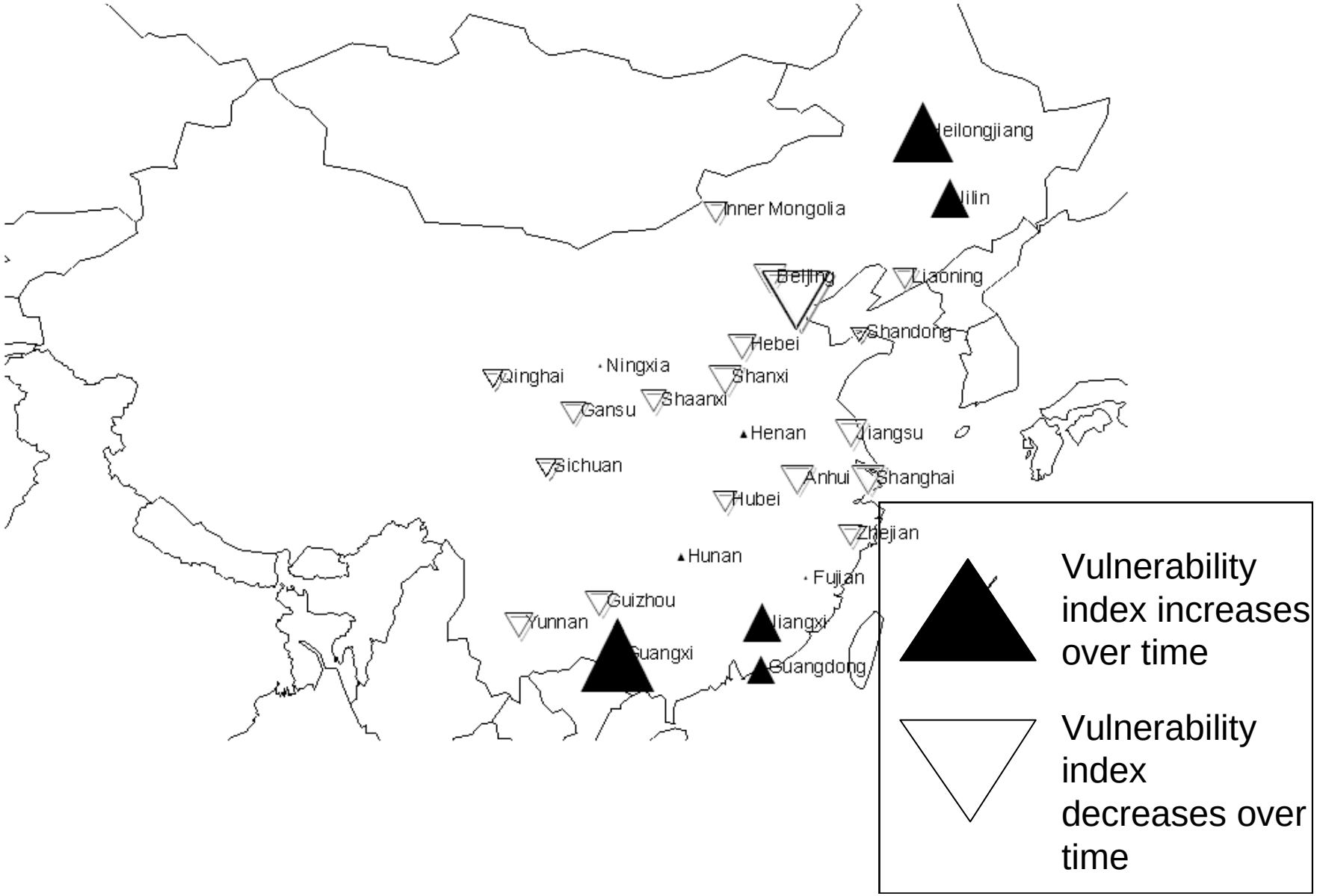

Percentage of harvests failing over 21st century
40
35
30
25
20
15
10
5
0
Base-line
Adaptation Strategy

Identifying sensitivity to drought

Vulnerability trends in China's Rice Harvest 1961-2001

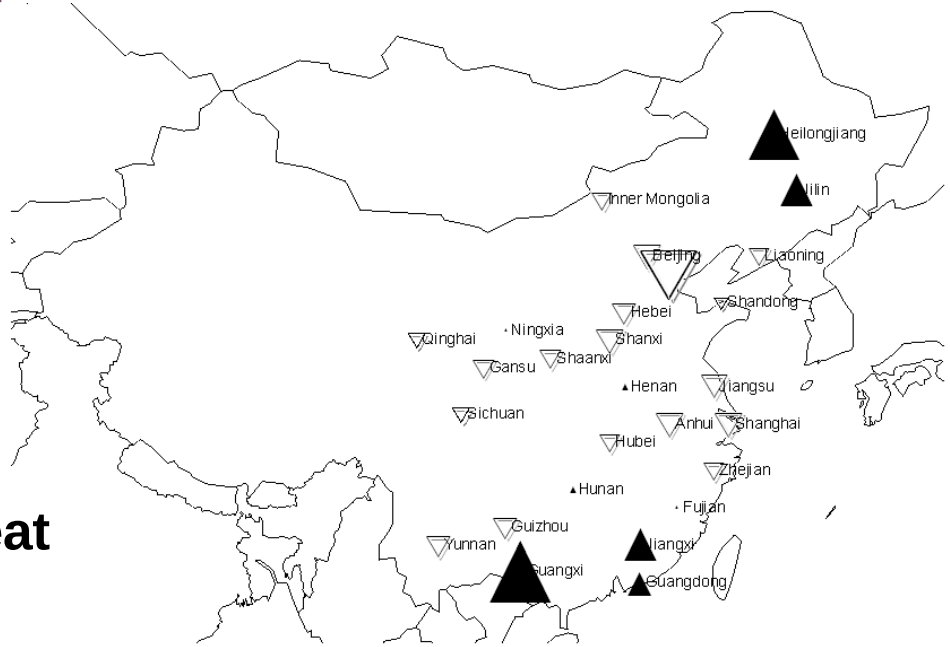


Vulnerability trends in China's Wheat Harvest 1961-2001



Vulnerability trends 1961-2001

rice



wheat

	Significant socio-economic indicators	Vulnerability Index (direction of relation)	
		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.

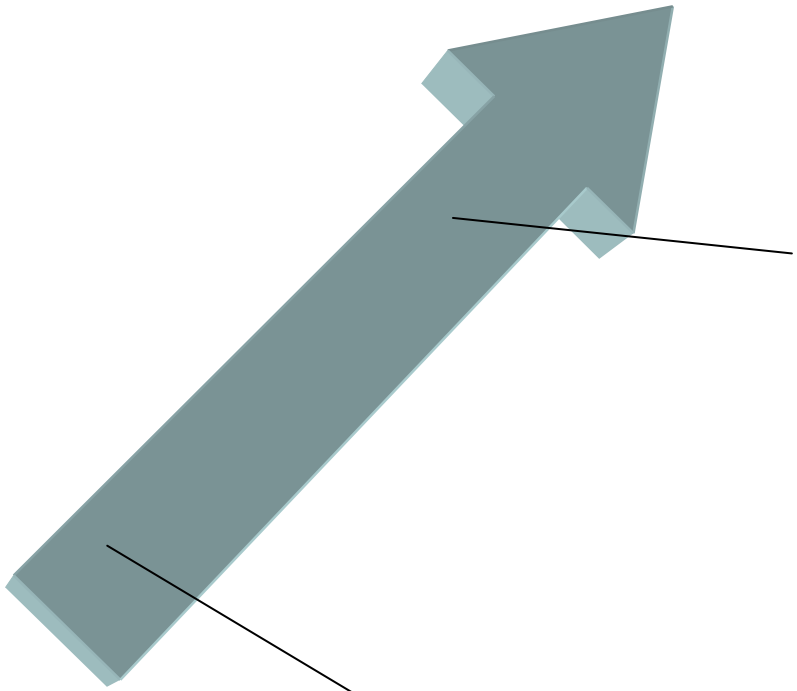

Mean national crop-drought vulnerability score
(1990-2006)
1
25
25
75
.5
Tropical
Arid
Temp
Cold
Author reg
Hybrid reg
Flawed dem
Full dem
Low
Lower mid
Upper mid
High

Criticisms

- While sophisticated methodologically, and lending itself to policy recommendations, this approach struggles due to (1) limits to what we know. (2) data quality, scale, and period.

Approach 2: more qualitative, more economic.

Understand food security qualitatively and from the “bottom up”



1990s and 2000s: The “sustainable livelihoods approach” that looks at how different types of capital are used to obtain food during crises (e.g. drought/storm etc.)

Early 1980s: Focus on ways people obtain food


Ph
e 2003
UNITED
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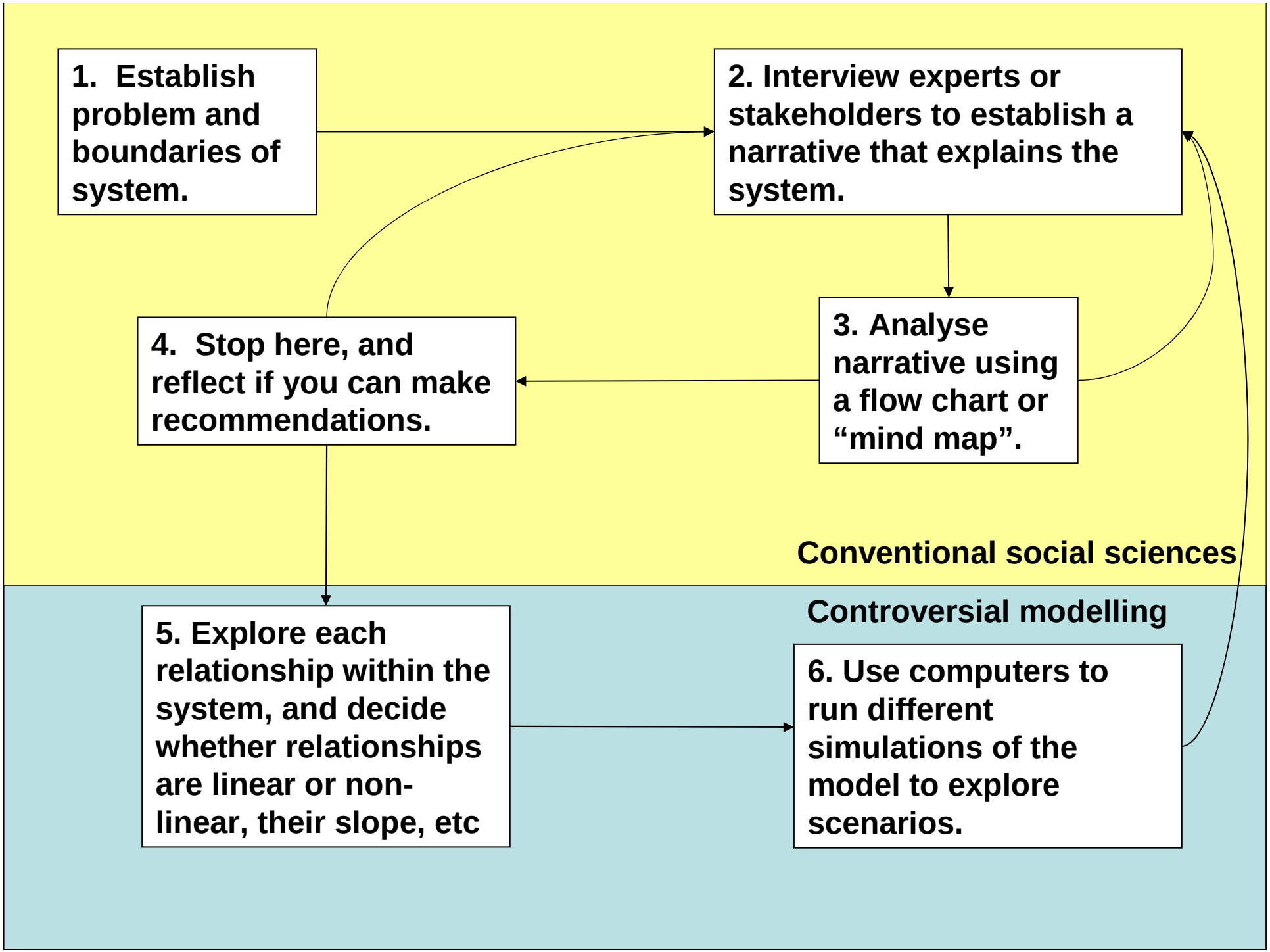
Antarctica

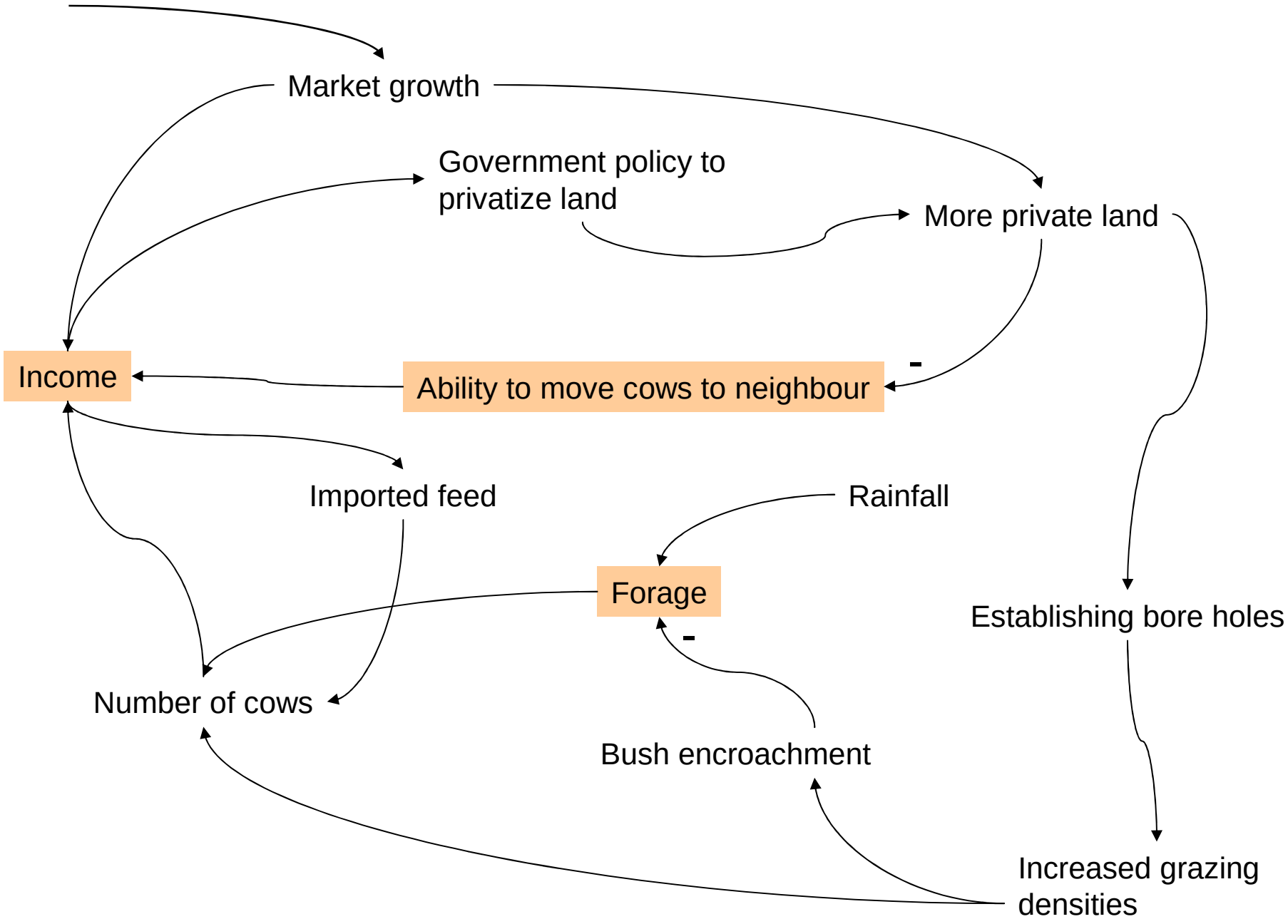
Pastoral Botswana

Private Ranch (Left) versus Communal Grazing Land (Right)

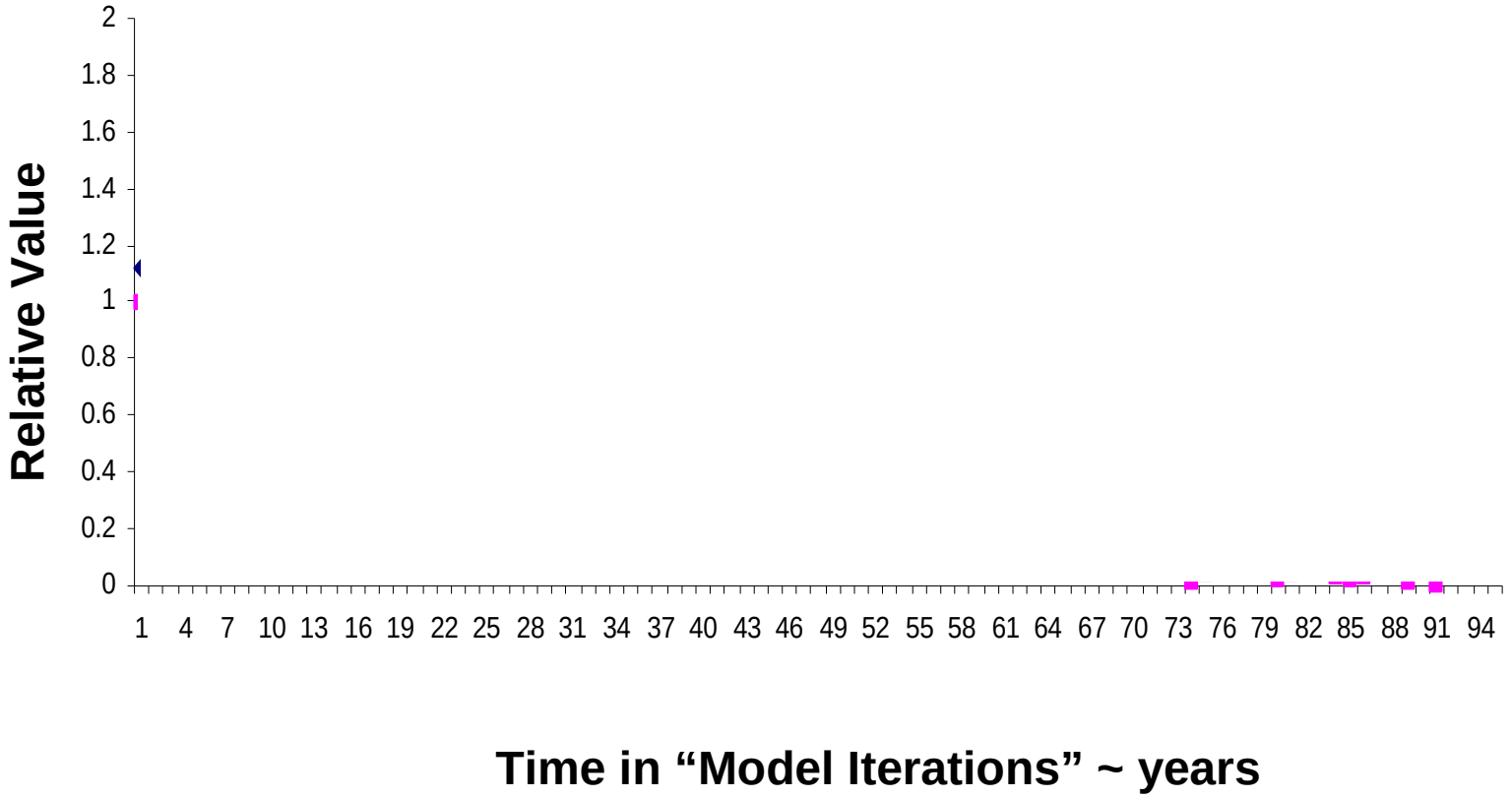
Bush Encroached System

Method: system dynamics modelling

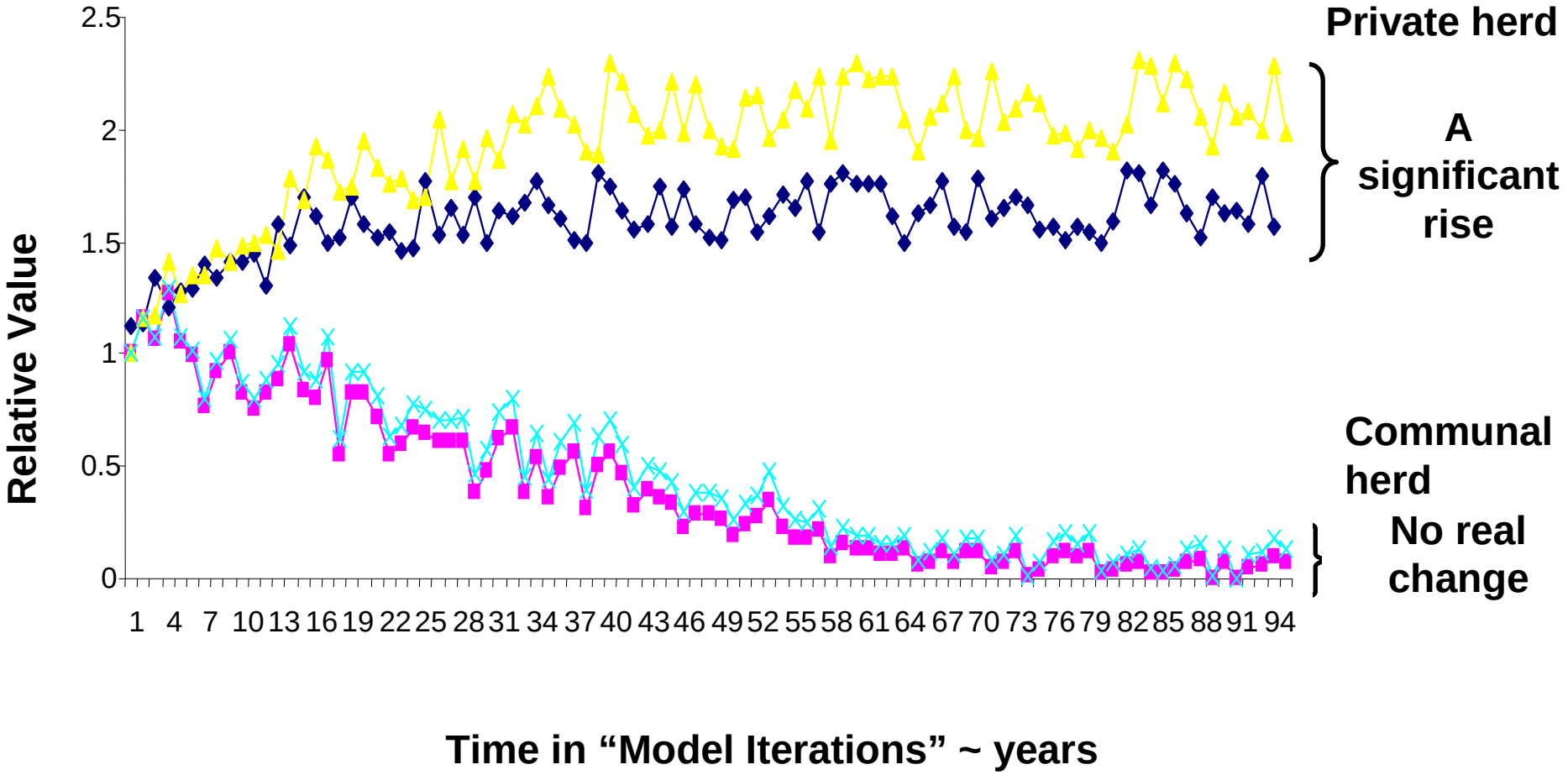

1. Establish problem and boundaries of system.
2. Interview experts or stakeholders to establish a narrative that explains the system.
3. Analyse narrative using a flow chart or "mind map".
4. Stop here, and reflect if you can make recommendations.
Conventional social sciences
Controversial modelling
5. Explore each relationship within the system, and decide whether relationships are linear or non-linear, their slope, etc
6. Use computers to run different simulations of the model to explore scenarios.


Market growth
Government policy to privatize land
More private land
Income
Ability to move cows to neighbour
-
Imported feed
Rainfall
Forage
Establishing bore holes
-
Number of cows
Bush encroachment
Increased grazing densities

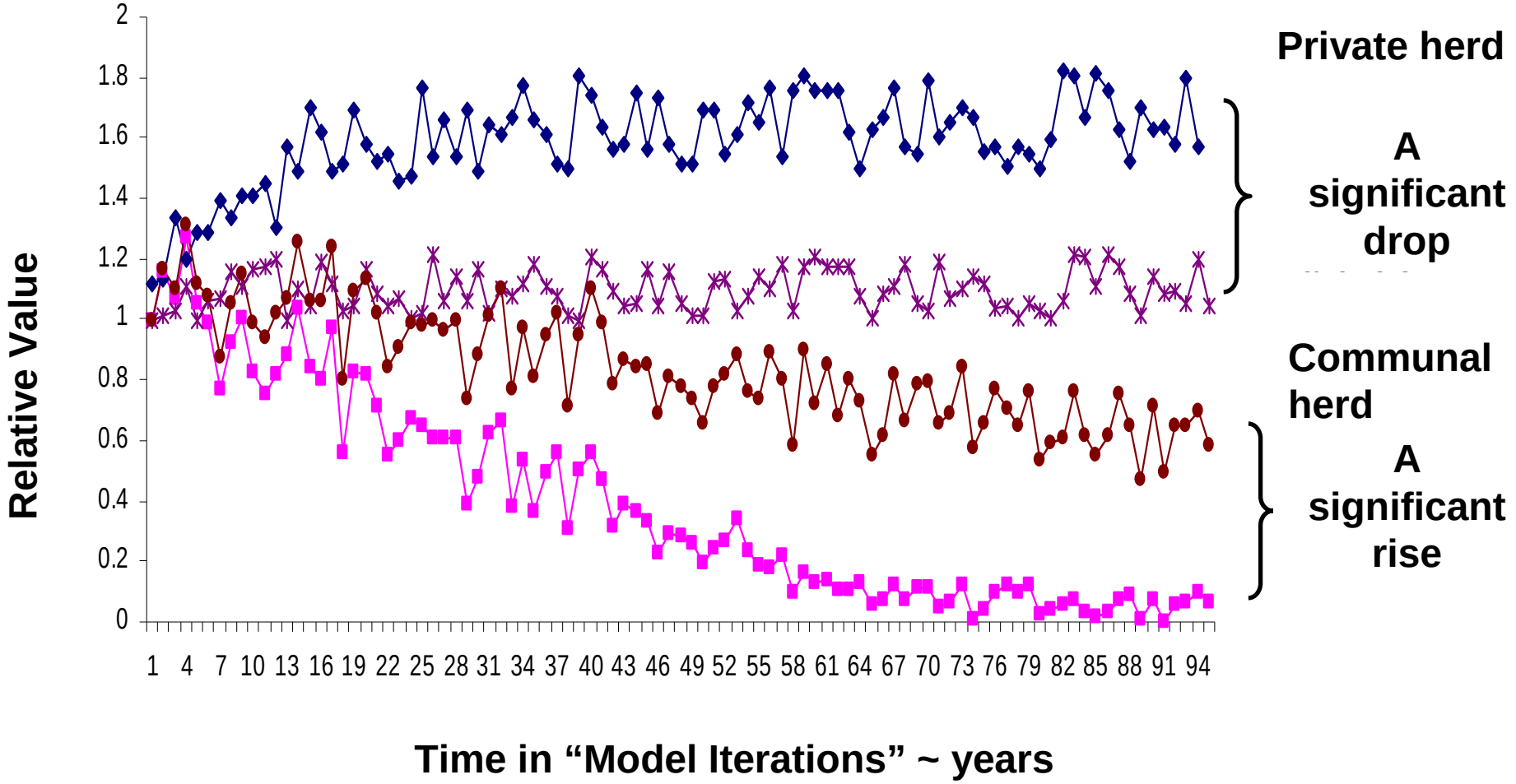
Using models to explore implications of stakeholder recommendations … (a) A baseline showing effect of climate change



The effect of “Agricultural Best Management” scenario to help reduce impact of climate change



Pro-poor land reform scenario



One implication (of ***this*** model)

- Enacting pro-poor land reform is more effective at helping communal farmers maintain incomes in light of climate change than promoting agricultural best management.
- Outputs of the model should be used to stimulate discussion rather than direct policy.
- All our case studies will be published as part of a special issue in *Ecology and Society* that will be out in late 2010.

Criticism of this approach

- Still very small scale and difficult to generalize.
- Models may look accurate but really they aren’t.
- Difficult to validate or test models.

A Final Approach: Historic Analysis

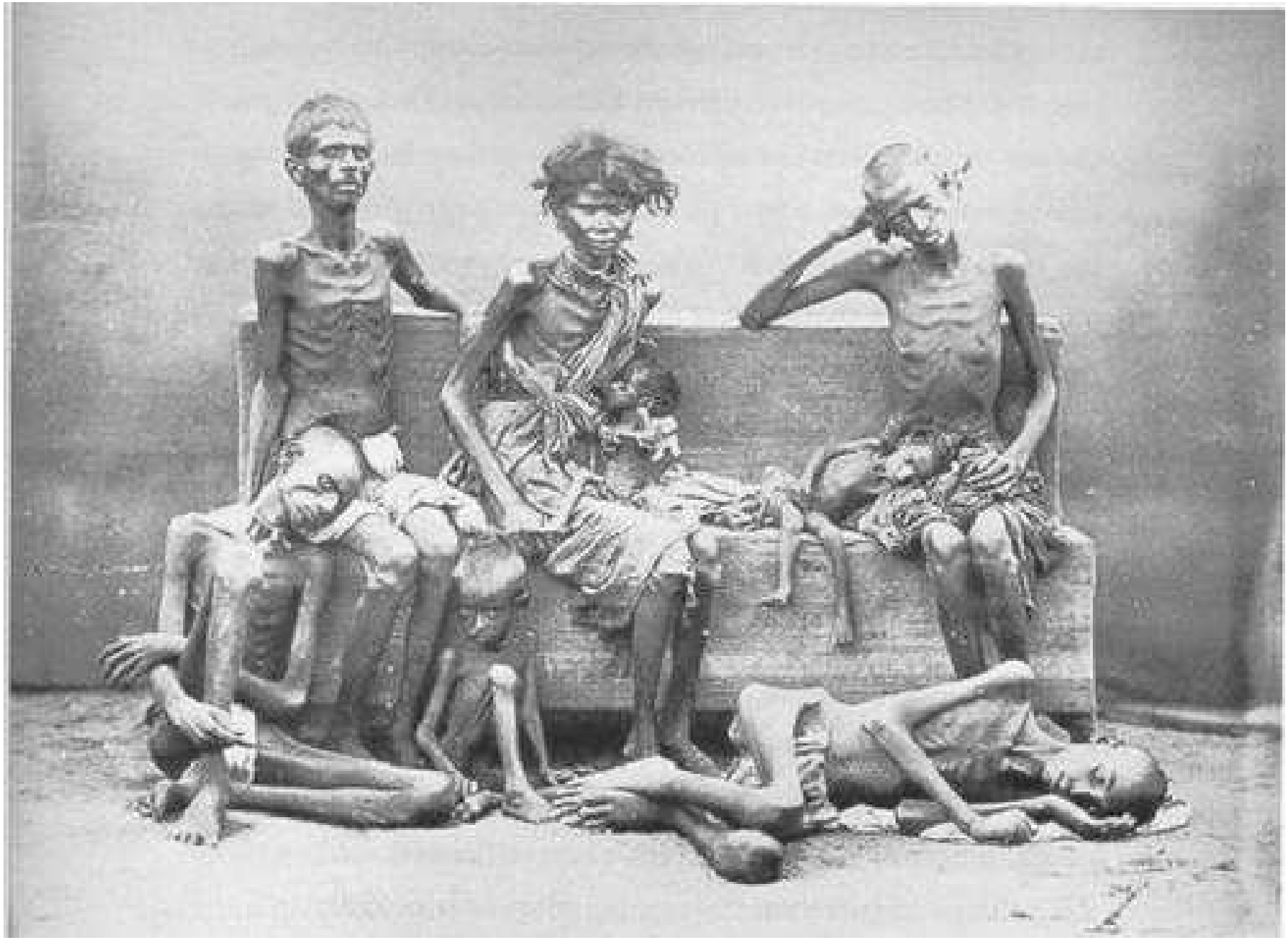
- Fall of the Maya Civilization (circa 800)
- Collapse of Medieval Civilization (circa 1300)
- Fall of Rome (Circa 300)
- And famines in both “global” versus a local food systems – in the 19th century.

http://uts.cc.utexas.edu/~marl/images/Tikal.JPG

http://www.yorku.ca/kdenning/vikings/greenland4greathall.jpeg

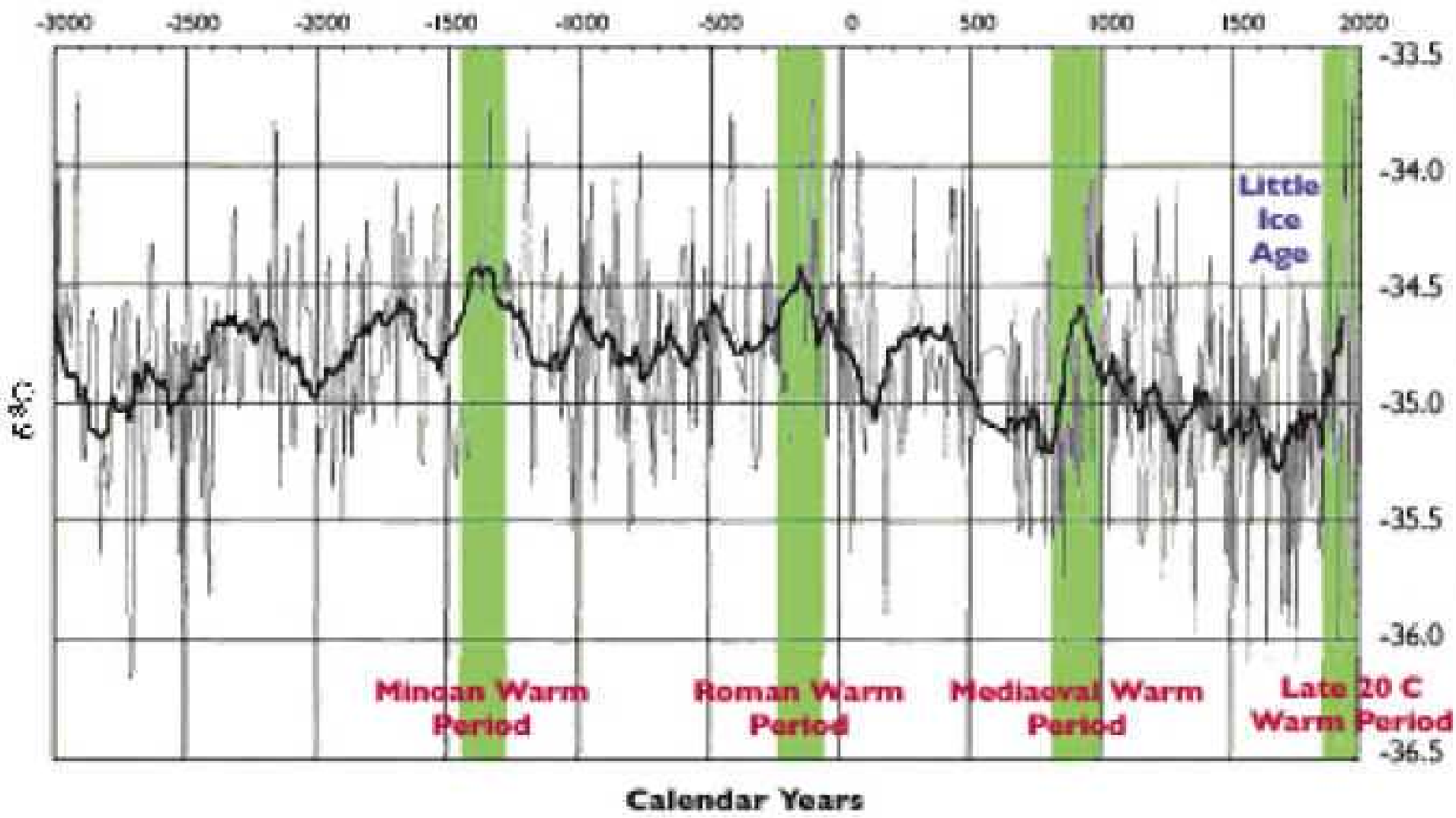
http://www.romalitorale.org/gallery/ostia_scavi_1.jpg

http://www.internationalyearofthepotato.ie/images/irish_potato_famine_bridget_odonnel_smaller.jpg



http://farm2.static.flickr.com/1367/536844657_e0bc02a6a3.jpg

The “good weather” trap.



Source: Grootes, P. M. (*et al.*), 'Comparison of oxygen isotope records from the GISP2 and GRIP Greenland ice cores', *Nature*, 366, 1993, pp. 552-4.

The “farmer specialization” trap

Allegory of Good Government by Ambrogio Lorenzetti, Sienna,
(c.1290 – c.1348)


http://it.stlawu.edu/~ptalag37/images/new/ireland/images/Untitled-22_jpg.jpg

http://www.garwood-voigt.com/catalogues/20816TeaBritishIndia.JPG

http://static.colourlovers.com/uploads/2008/04/582429985_05ac0e0d55.jpg

The poor and marginalized trap

Photo from cover of: Davis, M. (2001) *Late Victorian Holocausts: El Niño famines and the making of the third world,* London, Verso.

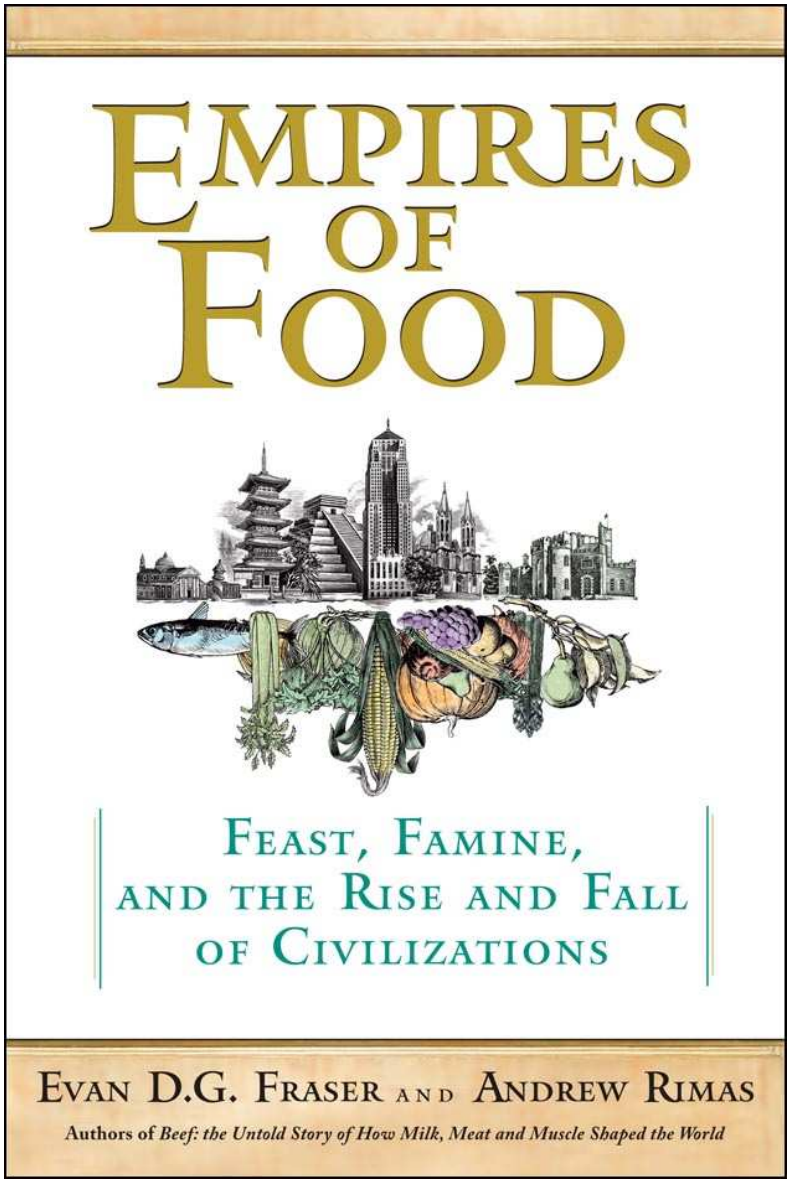
"[Any policy to] mitigate the effects of famine …serve but to enhance the evils resulting from overpopulation"

- Sir Evelyn Baring (then England's finance minister referring to the 1876-79 famine in India)


http://www.rootsweb.com/~irlker/images/glenevict.jpg


D&G

Of course, we've made these same three mistakes today…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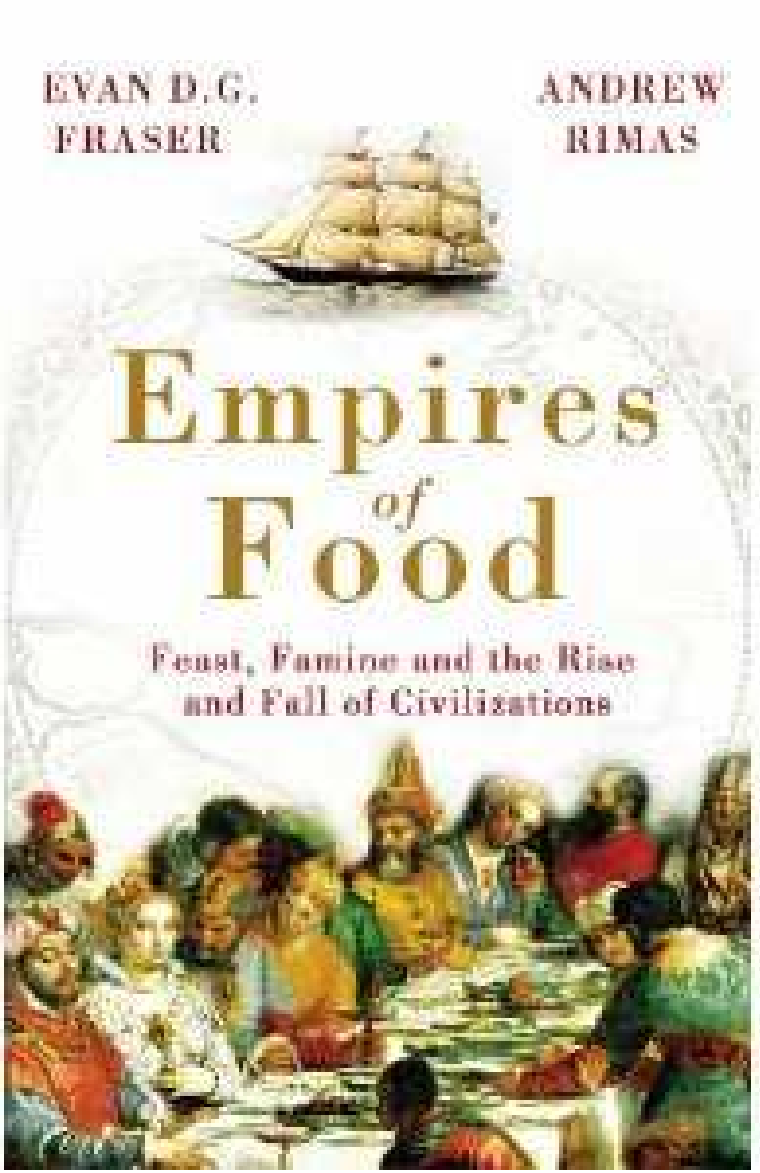
EVAN D.G. FRASER
ANDREW RIMAS
Empires of Food
Feast, Famine and the Rise and Fall of Civilizations

"Beddington said a major technological push is needed to develop renewable energy supplies, boost crop yields and better utilize existing water supplies."

To me this is too much techno-centrism.

- We need multi-integrated, and trans disciplinary research to approach this problem from a holistic perspective.

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For more information, copies of papers, etc.:

Evan Fraser (evan@env.leeds.ac.uk)