Understanding water security in UK agriculture: how can science help?

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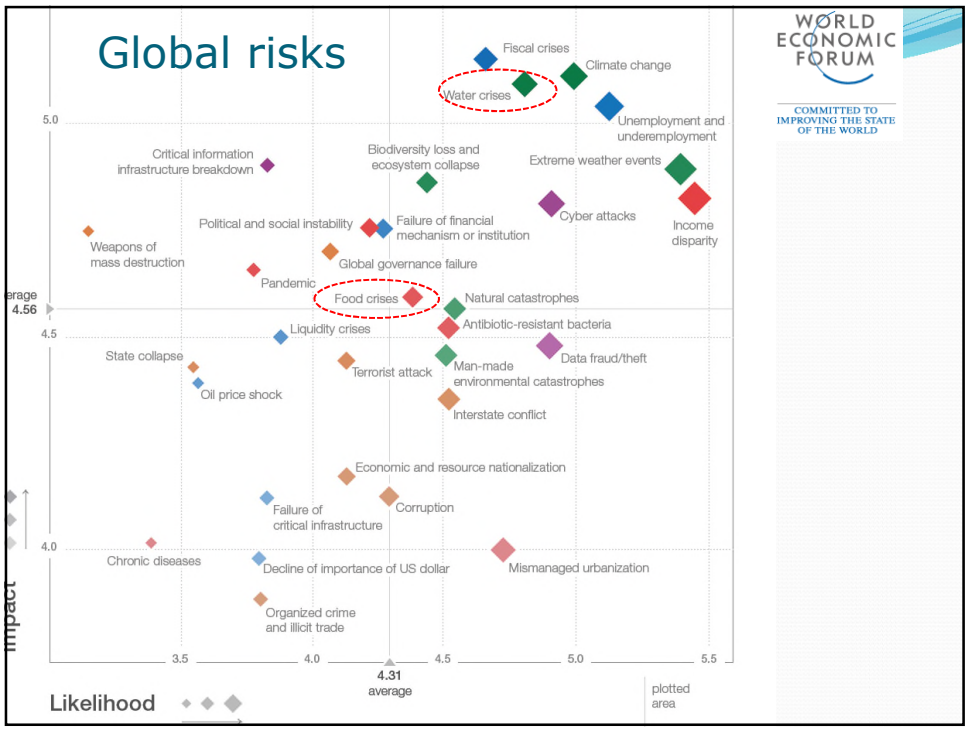
Presentation outline

1. Water risks: international and national dilemma
2. Drivers for improving water and energy efficiency in UK irrigated agriculture
3. Way forward – how can science drive innovation in agricultural water management?


Global risks
WORLD ECONOMIC FORUM
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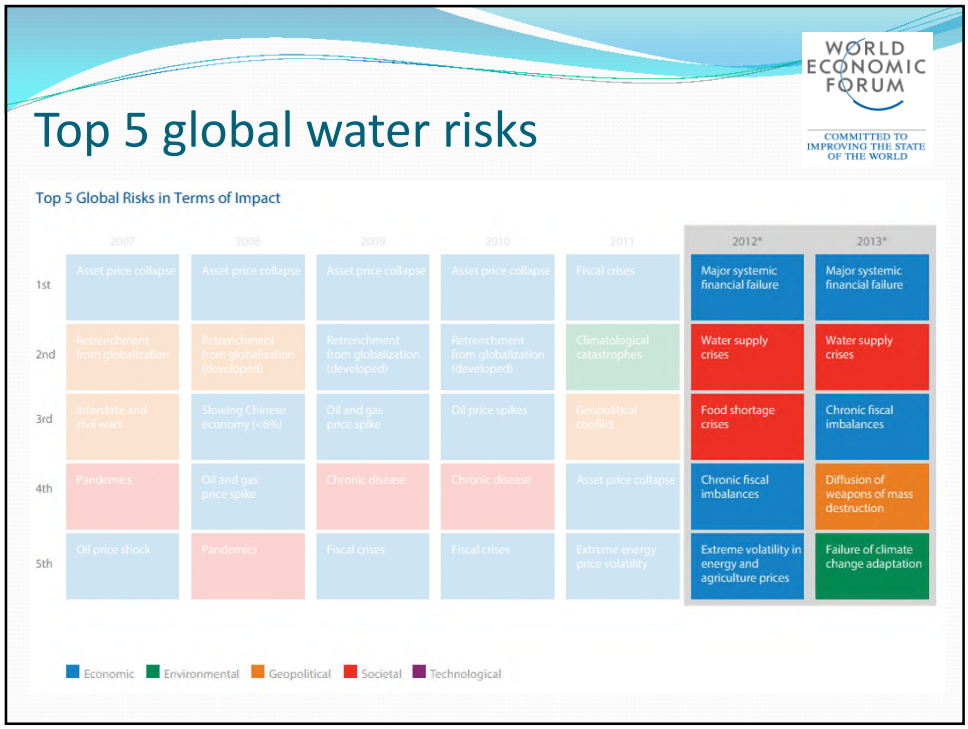
Fiscal crises
Climate change
Water crises
Unemployment and underemployment
Critical information infrastructure breakdown
Biodiversity loss and ecosystem collapse
Extreme weather events
Cyber attacks
Income disparity
Political and social instability
Failure of financial mechanism or institution
Weapons of mass destruction
Global governance failure
Pandemic
Food crises
Natural catastrophes
Antibiotic-resistant bacteria
Liquidity crises
State collapse
Data fraud/theft
Terrorist attack
Man-made environmental catastrophes
Oil price shock
Interstate conflict
Economic and resource nationalization
Failure of critical infrastructure
Corruption
Chronic diseases
Decline of importance of US dollar
Mismanaged urbanization
Organized crime and illicit trade
5.0
4.5
4.0
erage 4.56
Impact
3.5
4.0
4.5
5.0
5.5
4.31 average
plotted area
Likelihood


Top 5 global water risks
WORLD ECONOMIC FORUM
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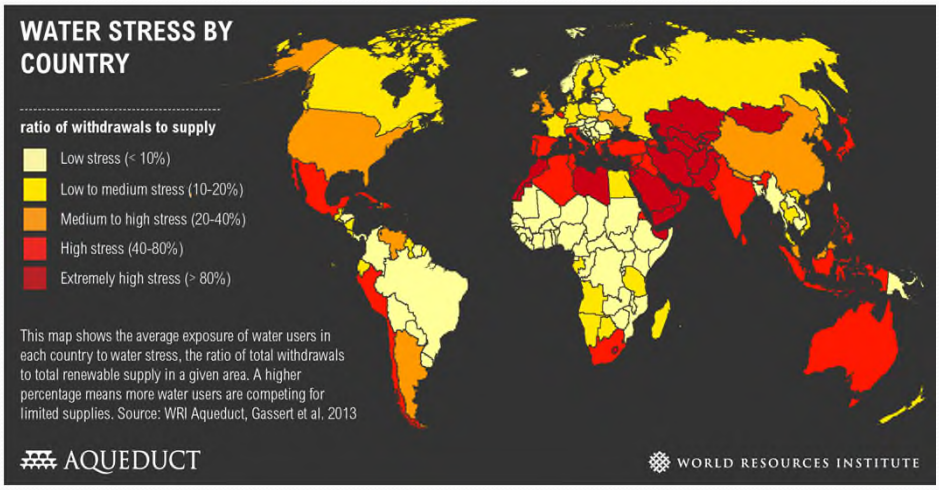
Top 5 Global Risks in Terms of Impact
2007
2008
2009
2010
2011
2012*
2013*
1st
Asset price collapse
Asset price collapse
Asset price collapse
Asset price collapse
Fiscal crises
Major systemic financial failure
Major systemic financial failure
2nd
Retrenchment from globalization
Retrenchment from globalization (developed)
Retrenchment from globalization (developed)
Retrenchment from globalization (developed)
Climatological catastrophes
Water supply crises
Water supply crises
3rd
Interstate and civil wars
Slowing Chinese economy (<6%)
Oil and gas price spike
Oil price spikes
Geopolitical conflict
Food shortage crises
Chronic fiscal imbalances
4th
Pandemics
Oil and gas price spike
Chronic disease
Chronic disease
Asset price collapse
Chronic fiscal imbalances
Diffusion of weapons of mass destruction
5th
Oil price shock
Pandemics
Fiscal crises
Fiscal crises
Extreme energy price volatility
Extreme volatility in energy and agriculture prices
Failure of climate change adaptation
Economic
Environmental
Geopolitical
Societal
Technological

Global water stress



Exporting drought - blue water stress

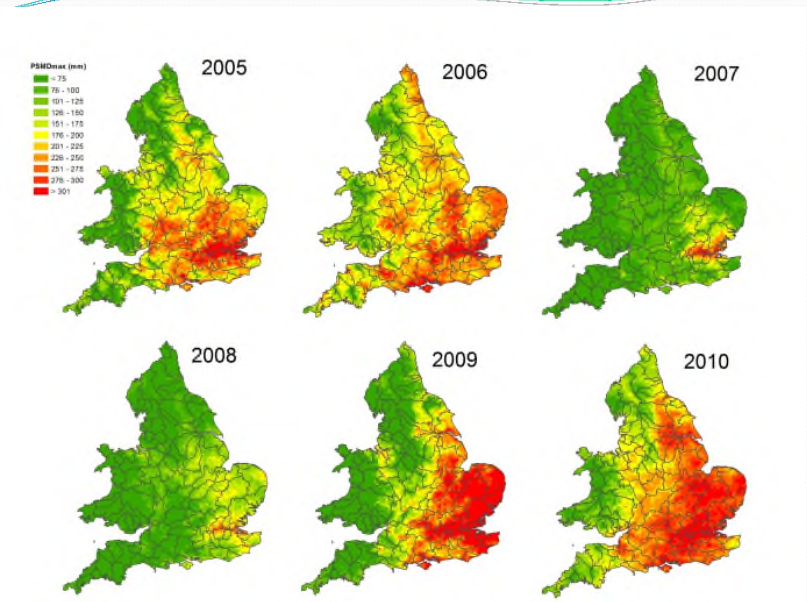
Commodity	VWb	Internal	External	Major source
Milk	0.62	0.49	0.13	UK, Ireland
Rice	0.43		0.43	Spain, India
Oranges	0.31		0.31	Egypt, Spain
Pig meat	0.27	0.15	0.12	UK, Belgium
Sugar crops	0.22		0.22	Zimbabwe, Cambodia
Fruit, misc.	0.17		0.17	Spain, South-Africa
Beef	0.16	0.13	0.03	UK, Ireland
Grapes as wine	0.12		0.12	Australia, USA
Sheep/ goat meat	0.10	0.10		UK, New Zealand
Potatoes	0.10	0.08	0.02	UK, Israel

Hess, T.M., Andersson, U., Mena, C. and Williams, A. (2015) The impact of healthier dietary scenarios on the global blue water scarcity footprint of food consumption in the UK. *Food Policy*, 50: 1-10

Key points - International dilemma

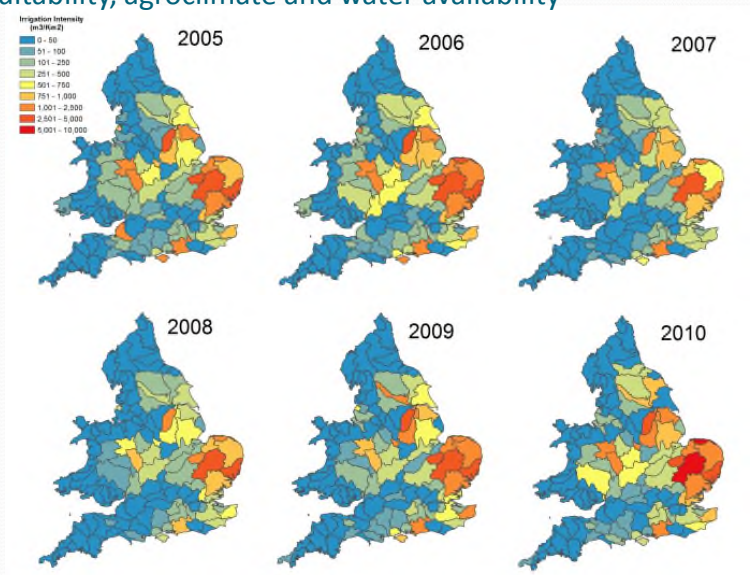
1. Significant proportion of our fresh produce is imported from particularly water stressed regions
2. Increased UK consumption of fruit and vegetables is being encouraged (Eatwell Plate campaign)
3. Increased consumer demand for fresh produce all year round
4. Changing our diet toward more fresh fruit and vegetables will increase our bluewater footprint
5. Reduce food waste would help save water and energy

Agroclimate (aridity index) in E&W 2005-2010



Knox, JW., Rickson, RJ., Weatherhead, EK, Hess, TM, Deeks, LK, Truckell, IJ, Keay,CA., Brewer, TR, Daccache A (2015) Developing the evidence base on soil erosion and water use in agriculture. *Committee on Climate Change (CCC)* Progress in preparing for climate change Report to Parliament Committee on Climate Change 2015

Irrigation intensity (m^3/km^2) is a function of the crop mix, land suitability, agroclimate and water availability



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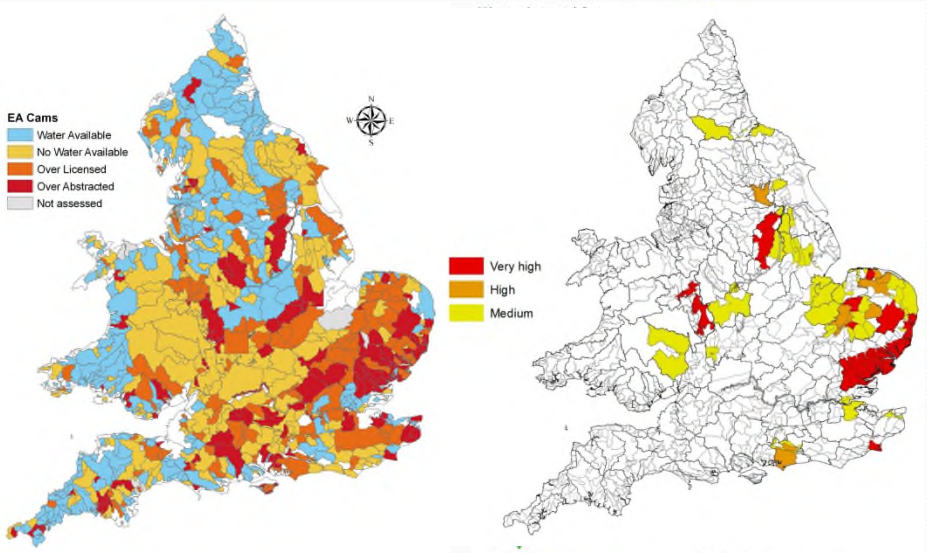
Spatial relationship between water resource stress, agricultural water demand and irrigation 'hotspots'



Knox, JW, Daccache, Weatherhead, EK, Groves, S and Hulin, A (2013). Assessment of the impacts of climate change and changes in land use on future water requirement and availability for farming, and opportunities for adaptation (Defra R&D Technical Report FFG1129/TR).

Key points - national / regional dilemma

1. 85% of UK irrigation is for fresh fruit and vegetables, with 75% of the irrigated area in water stressed catchments
2. Volumetrically, agricultural water demand has a small shoe size but a large environmental and social footprint
3. Abstraction 'hotspots' becoming subject to WFD scrutiny re groundwater impact
4. Concerns regarding future water availability and reliability are constraining business growth and investment

Weatherhead, E.K., Knox, J.W, Hess, T.M., and Daccache, A (2015) Exploring irrigation futures - developments in demand forecasting. *Outlook on Agriculture* 44(2): 119-126

Where can science support innovation in agricultural water management?

Field-farm

1. By combining agri-informatics with improved soil (sensor) and application technologies to promote precision irrigation
2. By improving medium-term weather forecasting approaches to help de-risk agricultural production systems

Industry-sub sector

3. By helping to understand how to increase the resilience to water-related risks in fresh produce supply chains
4. By understanding the trade-offs between improving water efficiency and energy consumption

Daccache A., Ciurana J.S., Rodriguez Diaz J.A. and Knox J.W (2014) Water and energy footprint of irrigated agriculture in the Mediterranean region *Environmental Research Letters* 9 124014.

Daccache, A, Knox, J.W., Weatherhead, E.K., Daneshkhah, A, Hess, T.M. (2015). Implementing precision irrigation in a humid climate: recent experiences and on-going challenges *Agricultural Water Management* 147: 135-143.

Embrace Fonske and “put water into the minds of people”

Thank you

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