



# Agriculture and Water Resources East (WRE)

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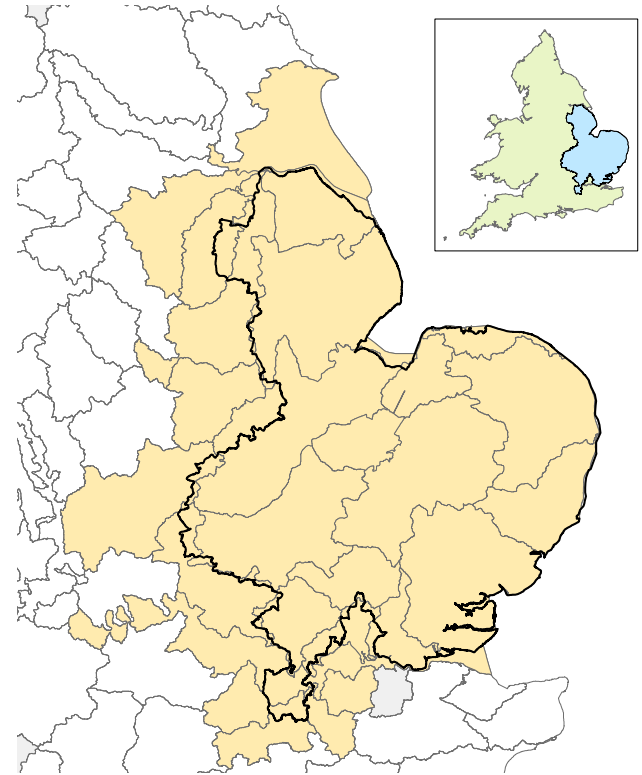


UKIA Conference. 1<sup>st</sup> March 2017



## Presentation outline

1. Context - where and how does agriculture fit into WRE?
2. Brief update on research progress completed and underway
3. What synergies does WRE Agriculture have with other ongoing research?





## Context: WRE and agriculture

Growing supply-demand imbalance for PWS in Eastern England

Increasingly unreliable summer water and threat of abstraction restrictions

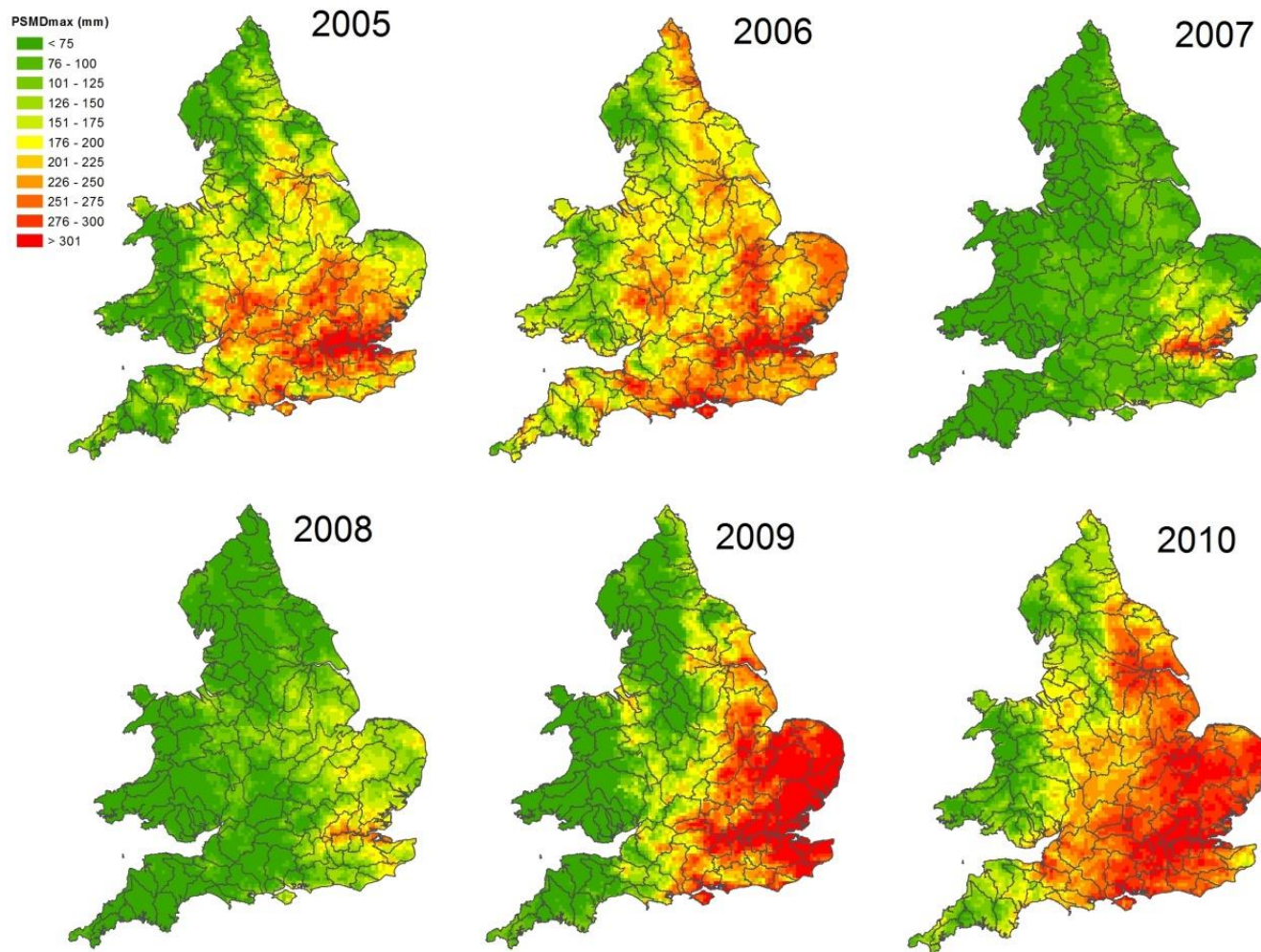
Abstraction licensing reform

Future climate uncertainty, increasing drought risk (multi-year)

Reliability of rainfed production

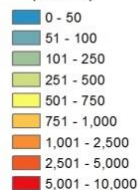


# Agroclimate variability (PSMD) is a driving determinant of 'agronomic' irrigation demand

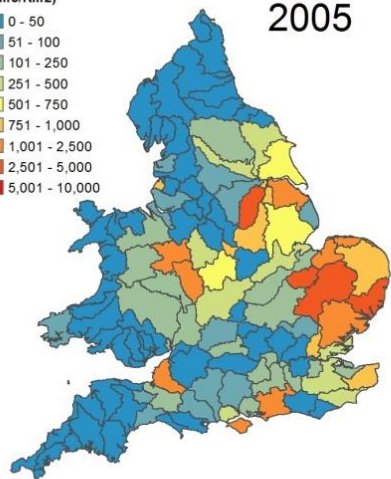


# Irrigation intensity ( $\text{m}^3/\text{km}^2$ ) in England and Wales

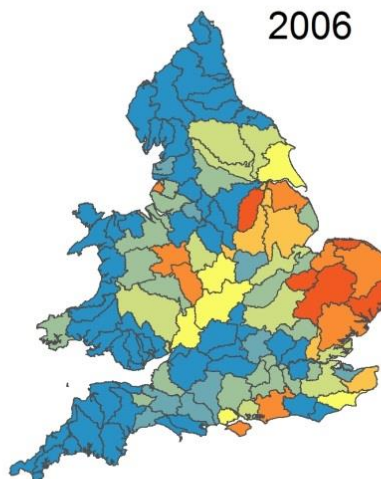
Irrigation Intensity  
( $\text{m}^3/\text{km}^2$ )



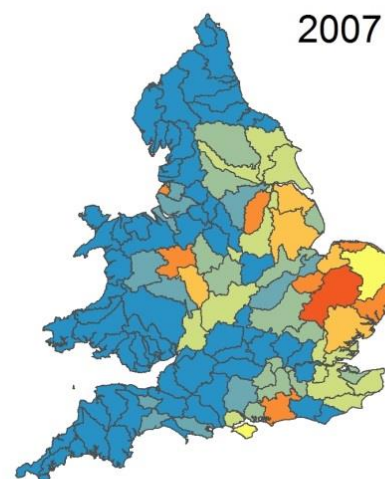
2005



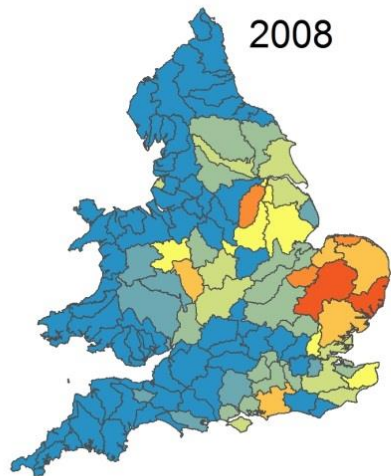
2006



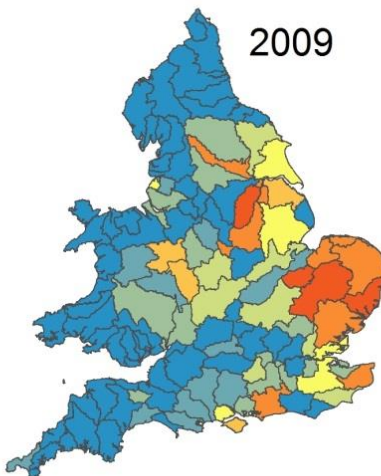
2007



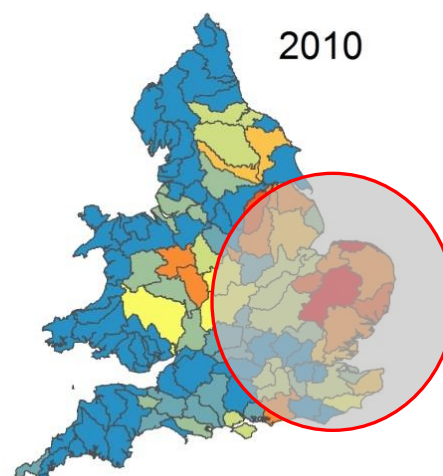
2008



2009

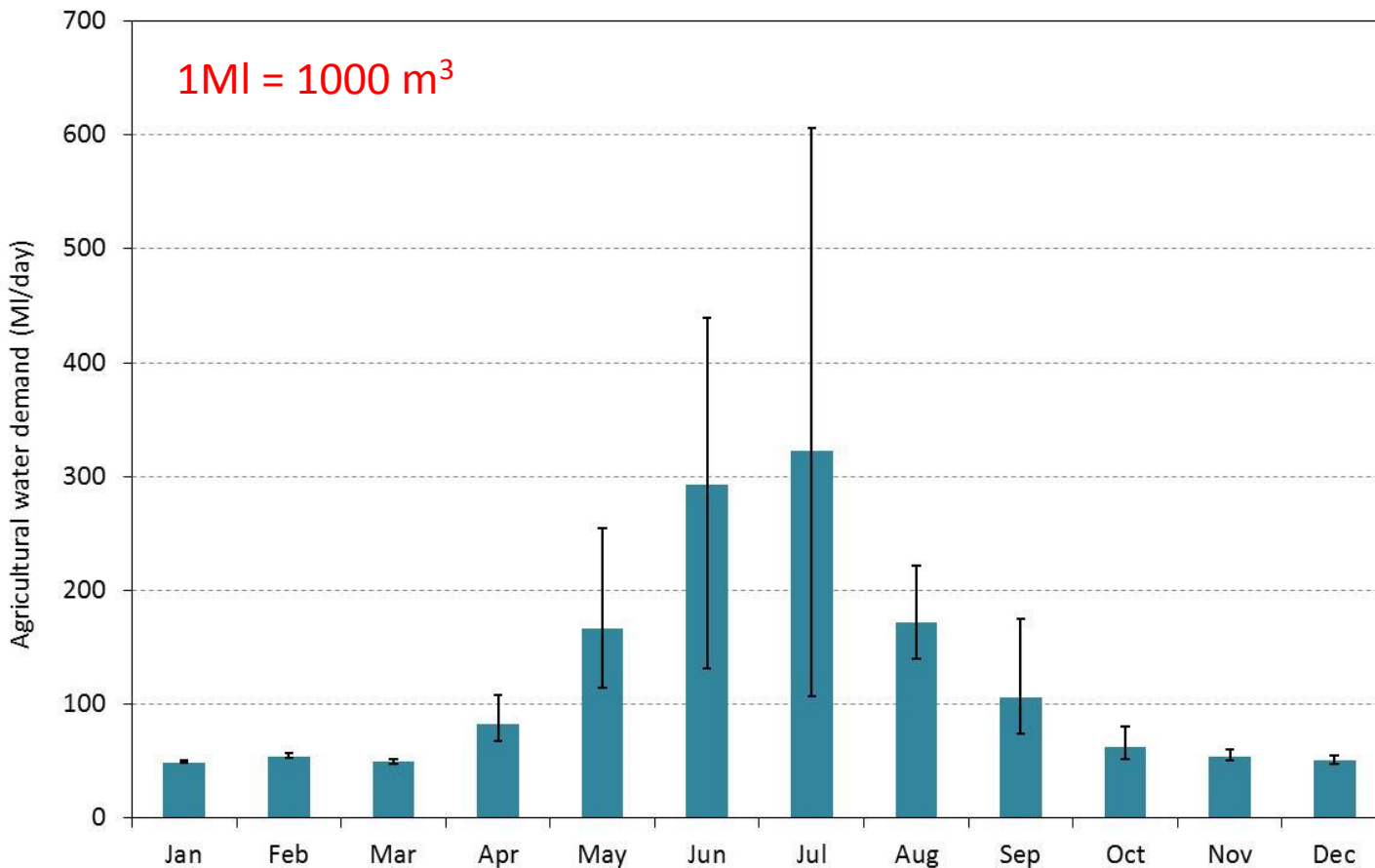


2010





## Mean monthly timing of irrigation demand in WRE region, showing variation between 2005-2010



Source: Knox et al., (2015)



## WRE Agriculture objectives

- Estimate unconstrained agricultural irrigation demand (MI) by catchment, by water source for any historic climate year (**baseline**);
- Estimate equivalent changes in demand (MI) for defined **future** climate and socio-economic scenario;
- Evaluate resource **options** including (i) collective action in strategic investment and (ii) catchment level interventions;
- Provide **evidence** to support agricultural stakeholders in WRE engagement



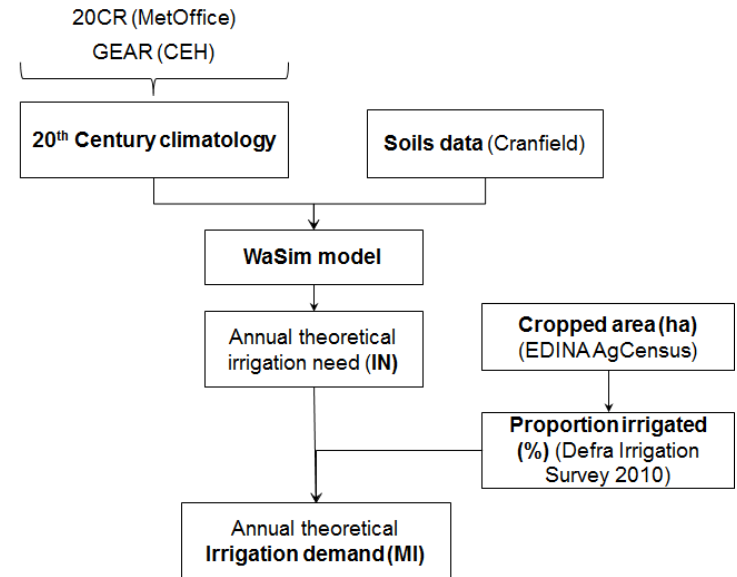
# Baseline unconstrained irrigation demand estimation

Seasonal demand is a function of:

- Agroclimate (rainfall and ET)
- Land use and irrigated crop mix
- Soil available water
- Proportion of the crop irrigated (%)

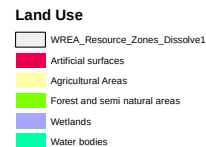
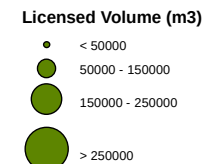
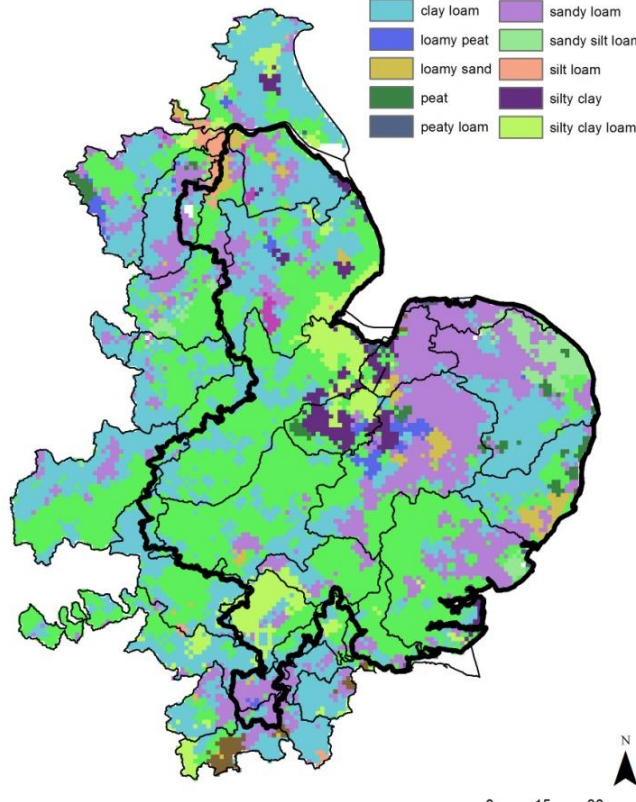
Then needs to be related to:

- Abstraction licence limits within each catchment
- Surface and groundwater dependence
- Timing of demand (weekly)

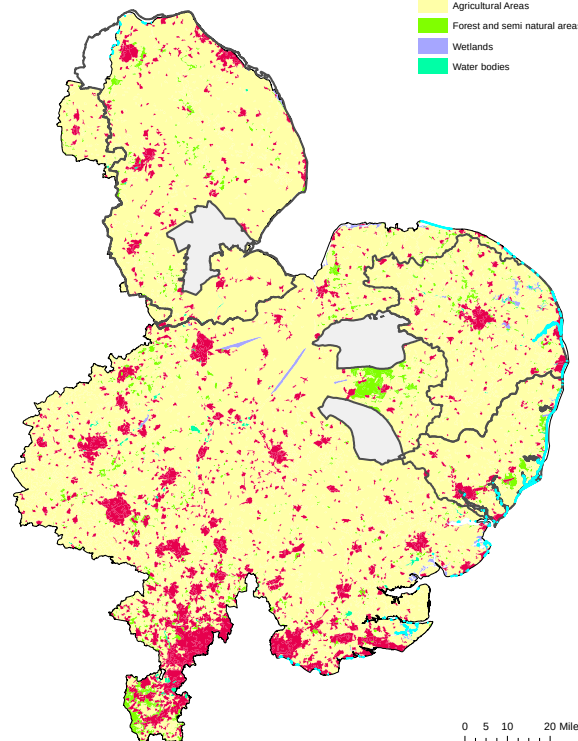




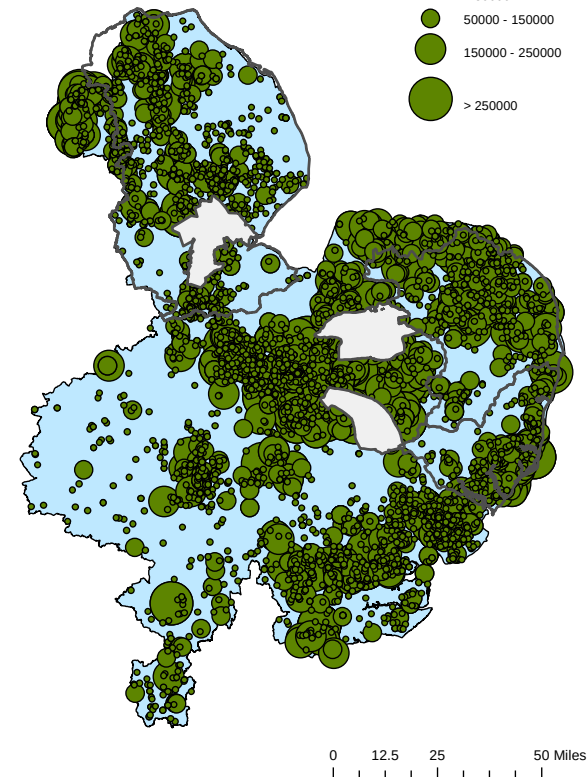
# GIS integrated data to estimate unconstrained irrigation demand, by catchment, by water source



Soils



Land use

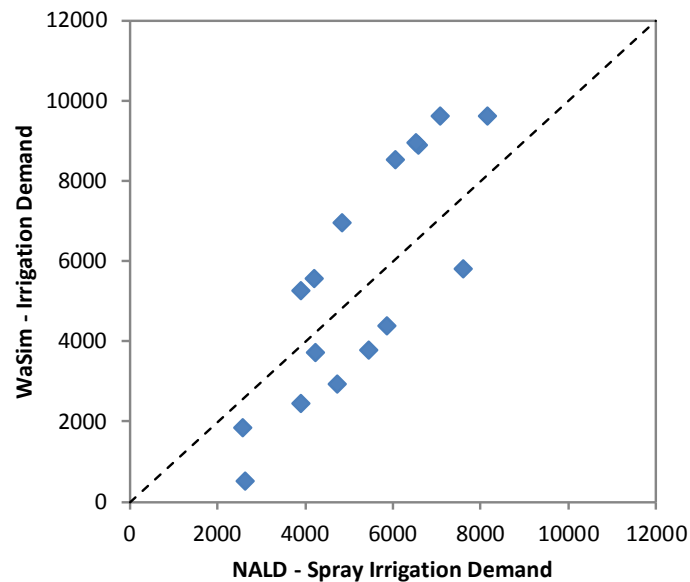


Abstractions

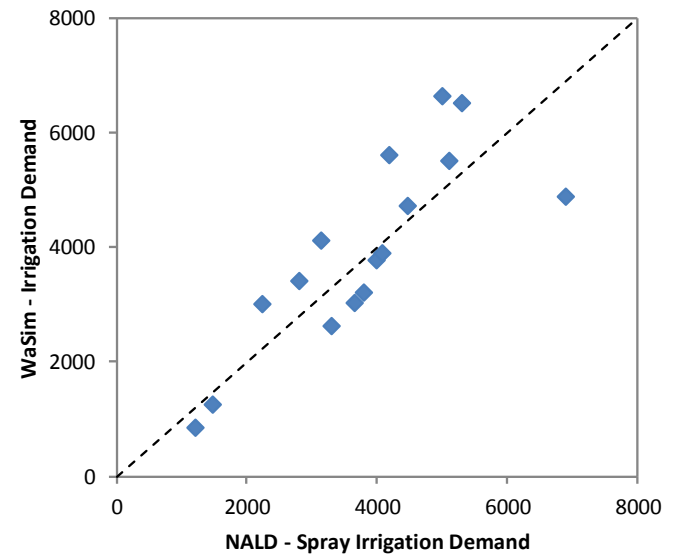


# Irrigation demand validation at catchment scale (comparing modelled v reported)

**Broadland Rivers**



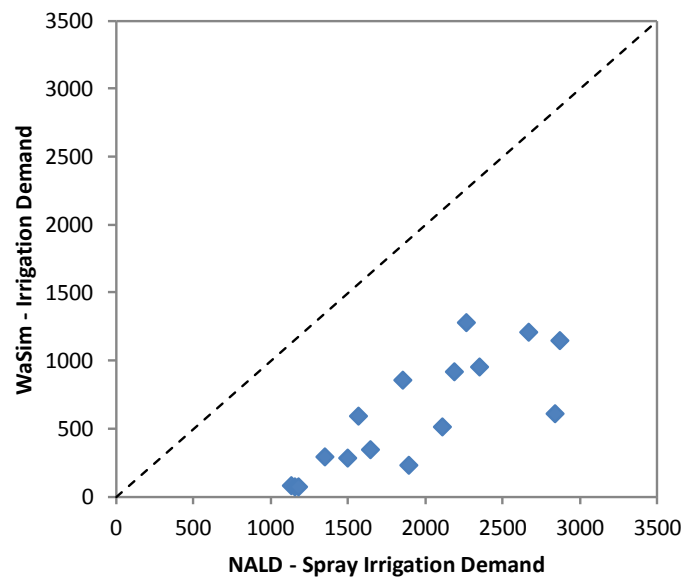
**Old Bedford inc. Middle Level**



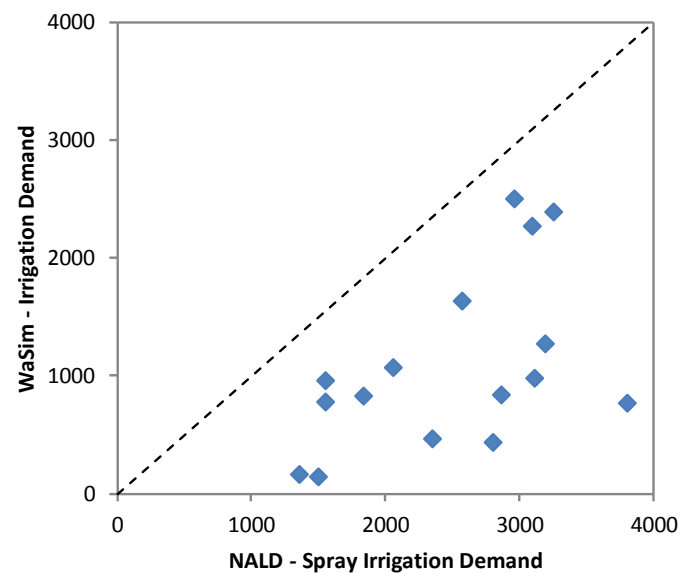


# Irrigation demand validation at catchment scale (comparing modelled v reported)

**North Norfolk**



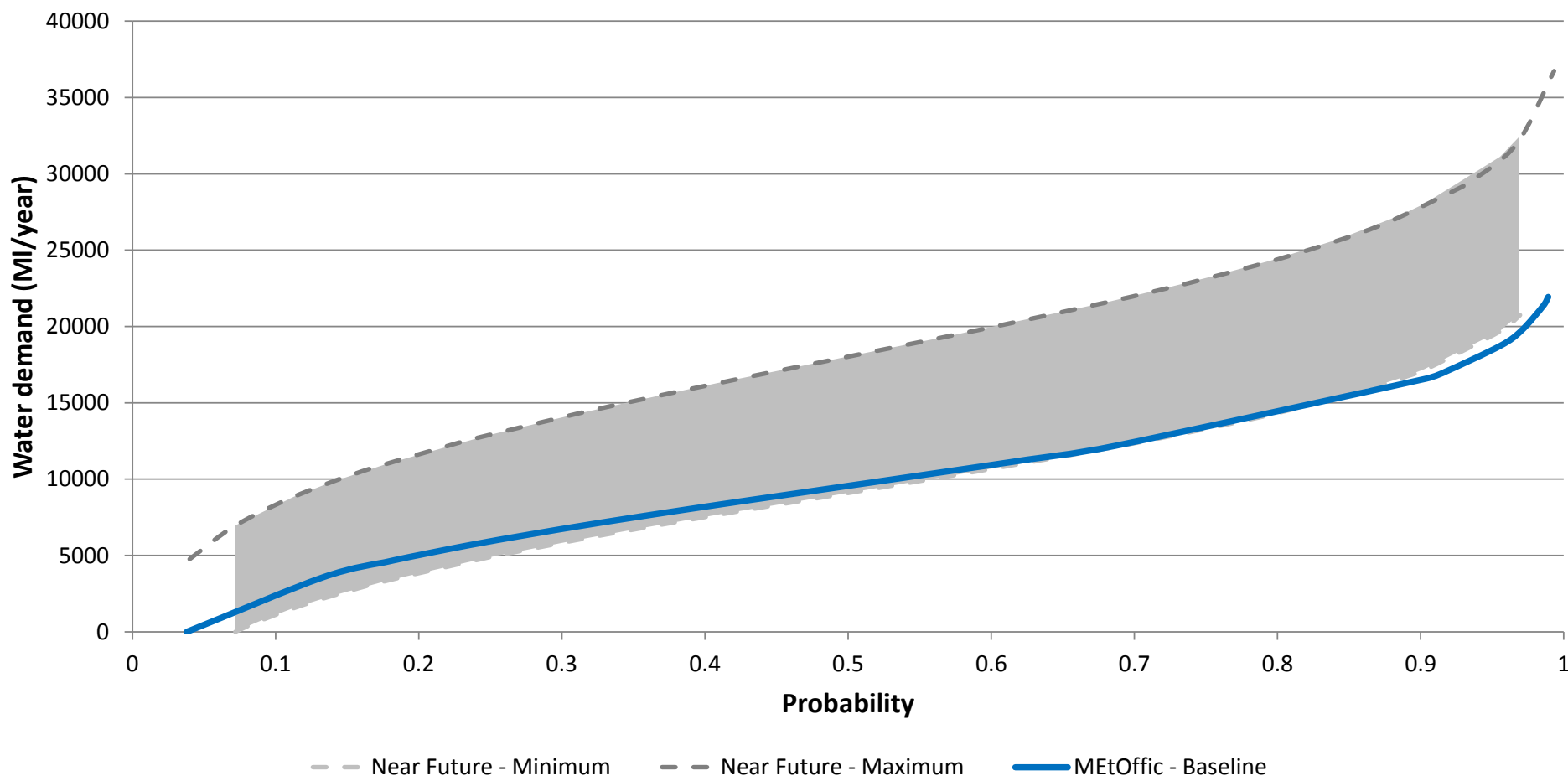
**North West Norfolk**





# WRE Baseline and future agricultural water demand – Cam and Ely Ouse catchment

Cam and Ely Ouse - Baseline (1975-2005) and Near Future (2020-2049)





# Estimating future changes in irrigation demand

## Irrigation demand a function of:

- Agroclimate (P and ET) + climate change impact
- Pattern of land use and irrigated crop mix
- Soil available water characteristics (NatMap)
- Proportion of cropped area irrigated (%)

## Underlying future agro-economic and socio economic scenario

Population growth

Self-sufficiency (proportion food grown in UK)

Changes in crop yield

Changes in management and technology (efficiency)

Changing farmer attitudes and motivation

Changing government/consumer attitudes to GM

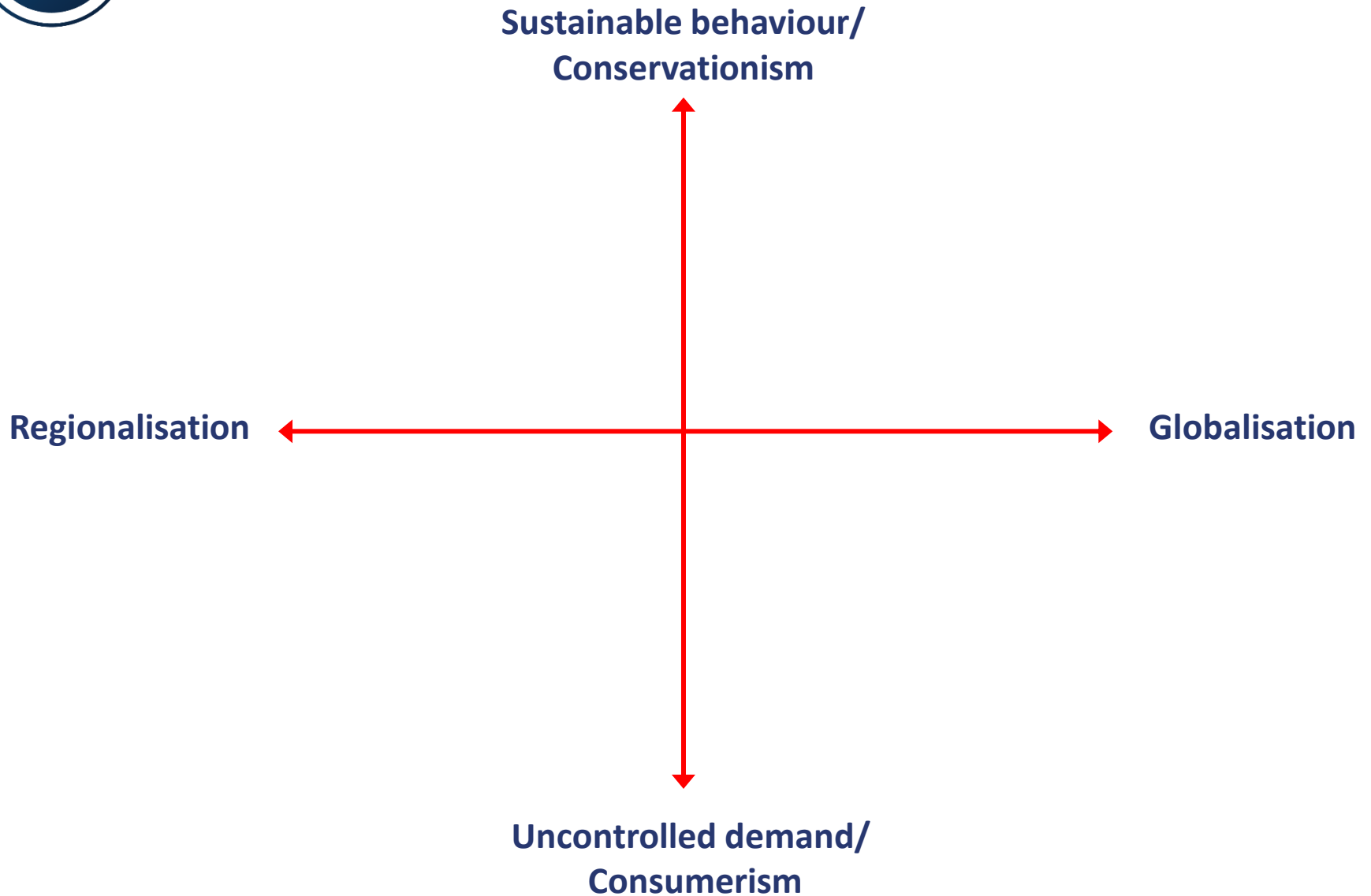
Changing exchange rates, tariffs and international trade agreements/Brexit

Changing water and environmental regulation/policy

Multiple  
feedbacks

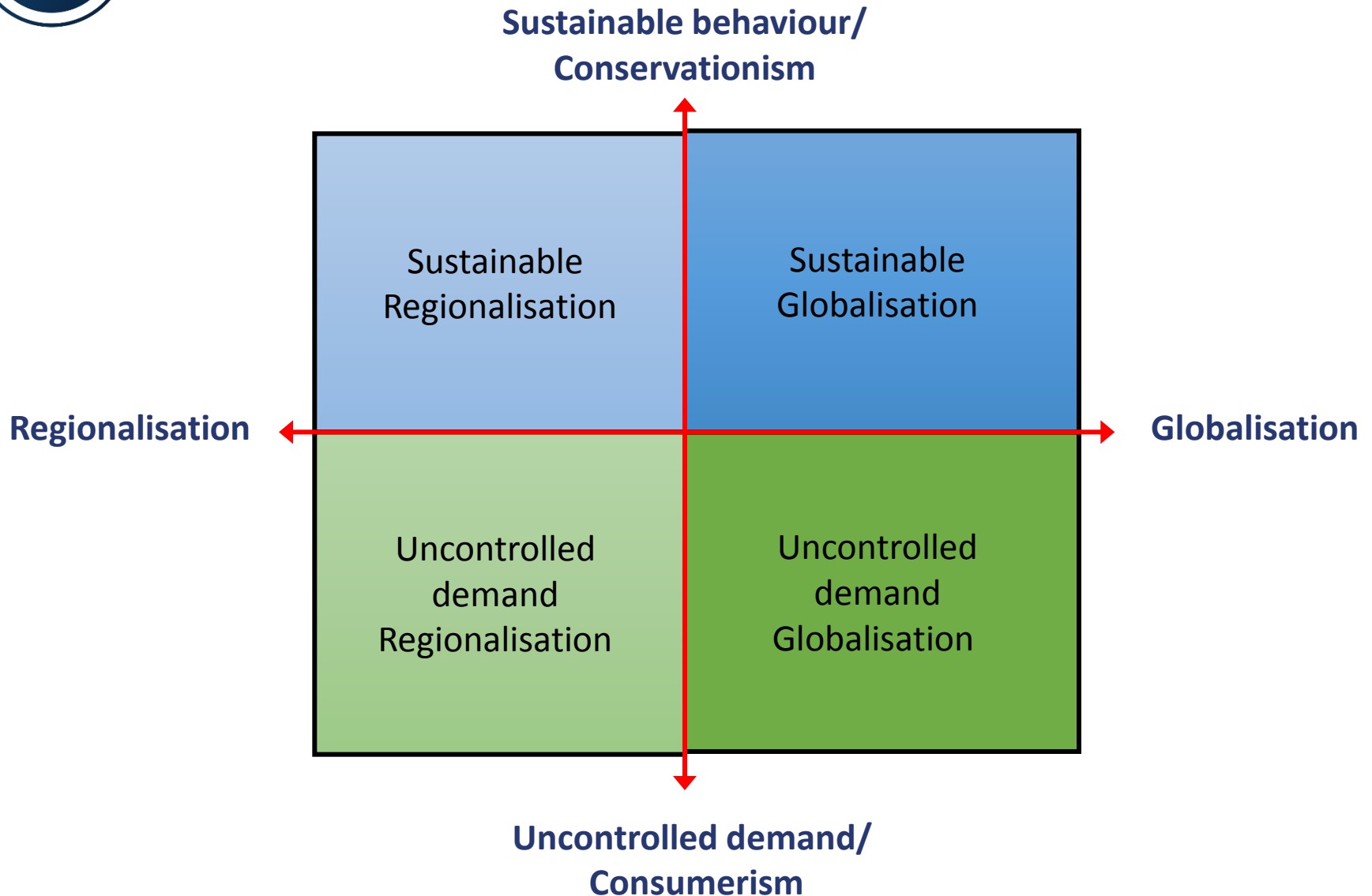


# Plausible futures



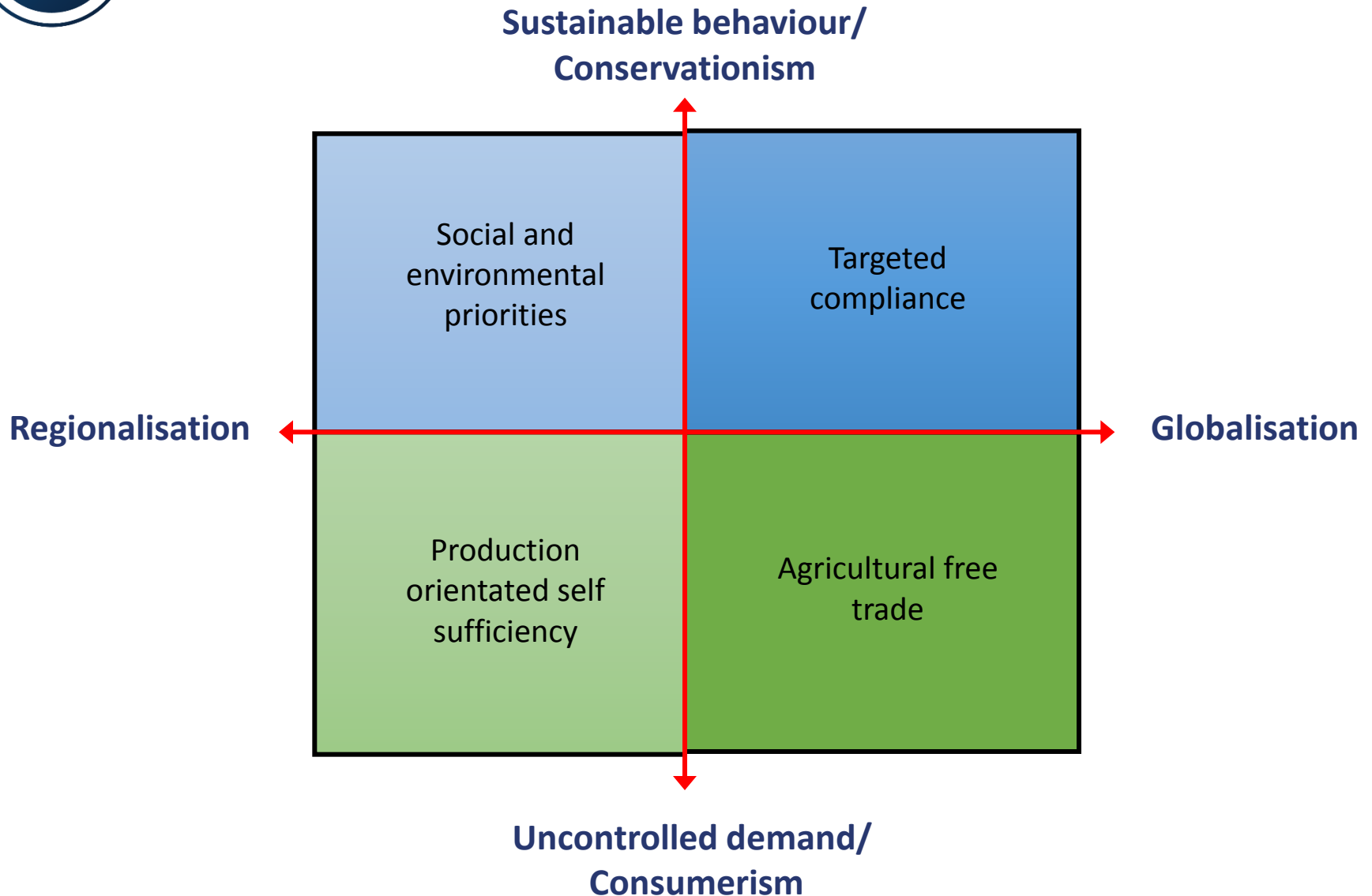


# Plausible socio-economic futures





# Plausible agricultural futures





## **Scenario narratives – framing future agricultural drivers of change**

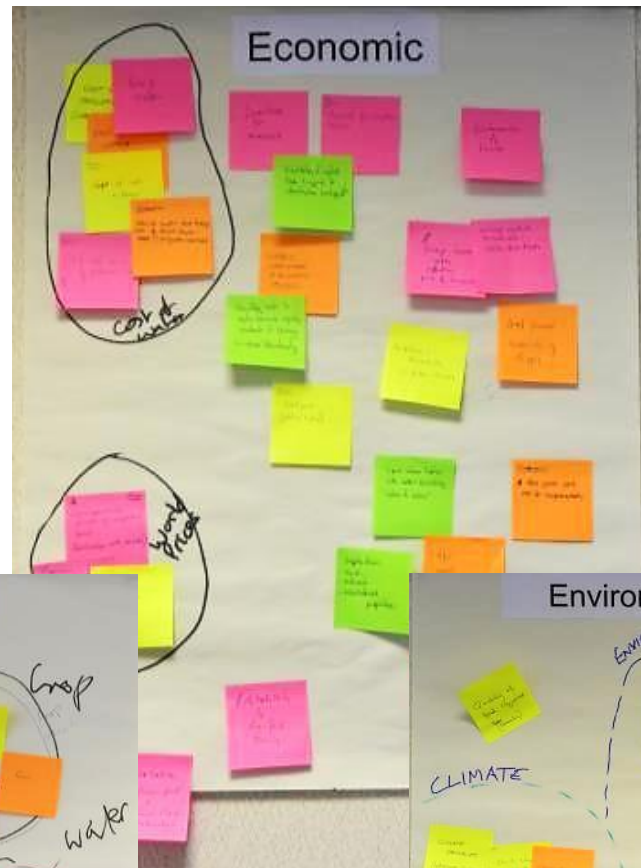
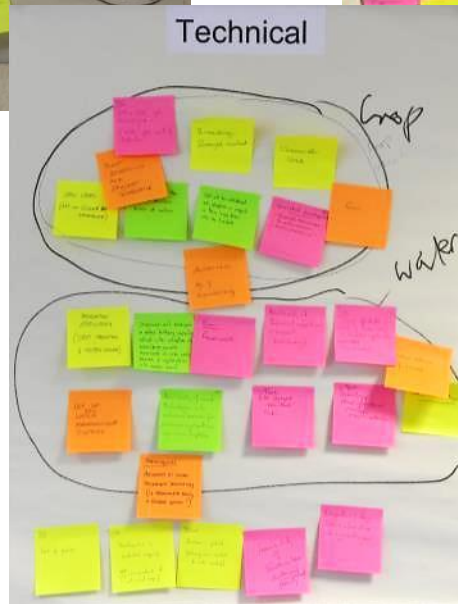
1. What are the key drivers affecting UK agriculture over the next 30 years, and is there an Anglian region dimension?
2. How do these drivers impact on the main irrigation sub-sectors in the UK and Anglian region?
3. What are the likely directions and magnitude of change in the components of irrigation demand?
4. What are the main gaps and uncertainties in our knowledge and understanding?



# Future agricultural water demand workshop



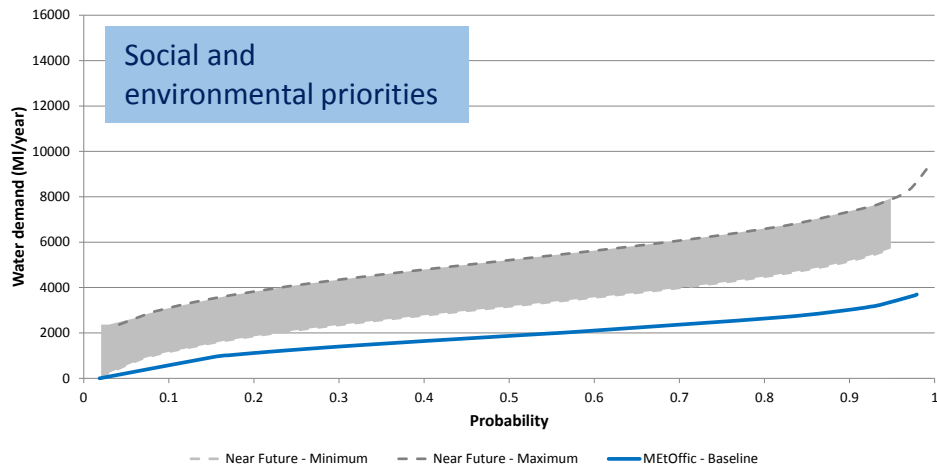
# PESTE analysis



Growth factor = 1.38

East Suffolk - Baseline (1975-2005) and Near Future (2020-2049)

Social and environmental priorities

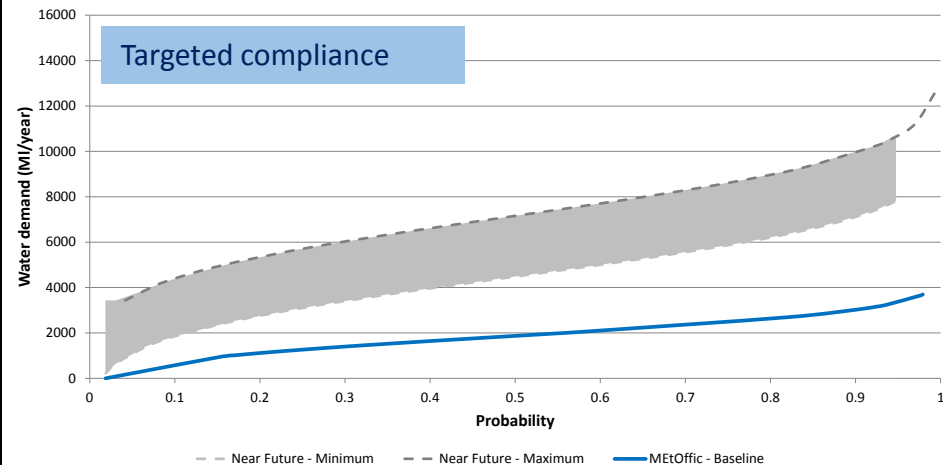


Sustainable

Growth factor = 1.81

East Suffolk - Baseline (1975-2005) and Near Future (2020-2049)

Targeted compliance

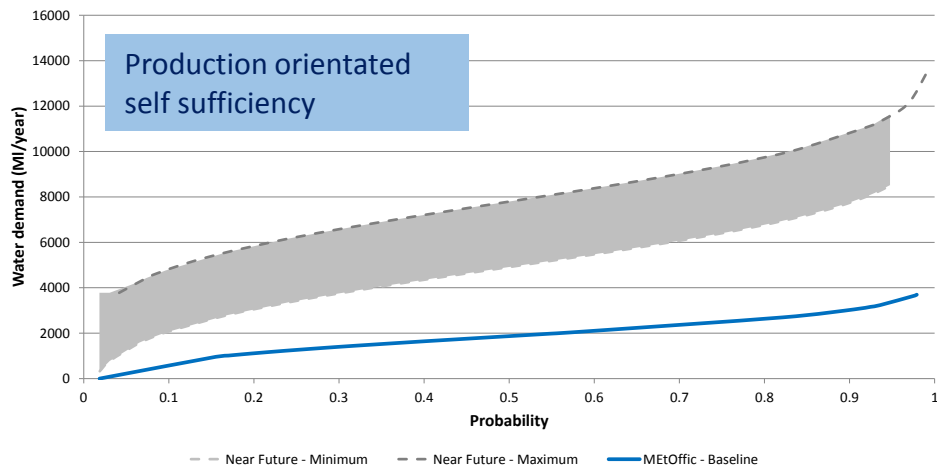


Regionalisation

Globalisation

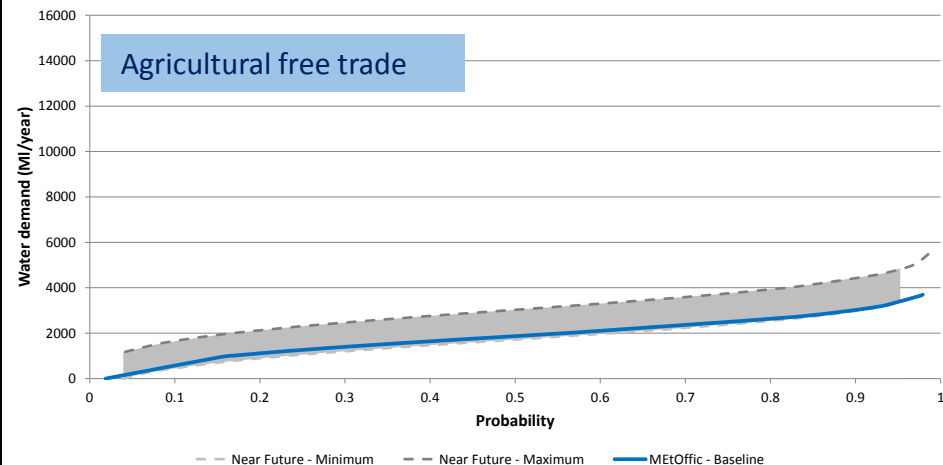
East Suffolk - Baseline (1975-2005) and Near Future (2020-2049)

Production orientated self sufficiency



East Suffolk - Baseline (1975-2005) and Near Future (2020-2049)

Agricultural free trade



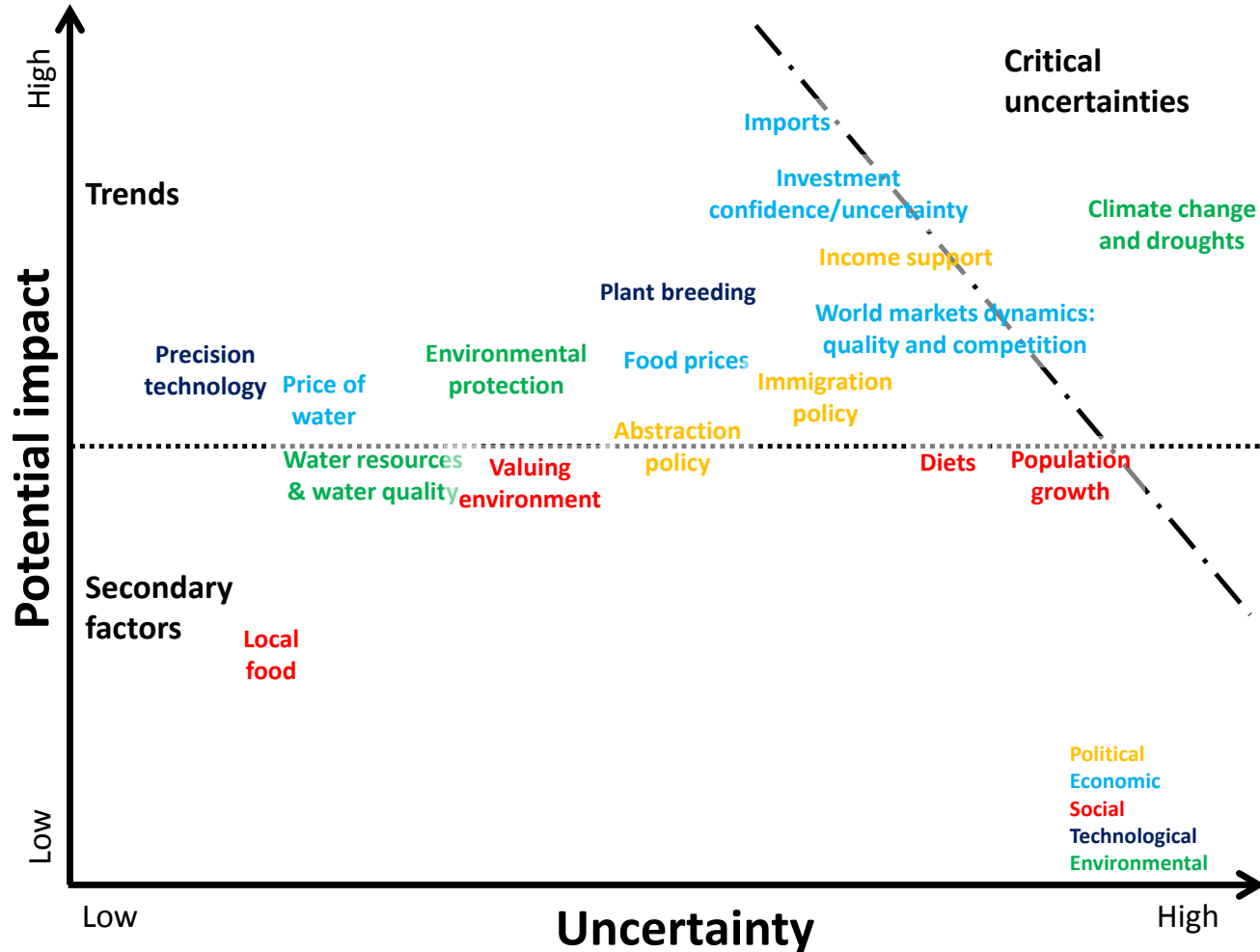
Growth factor = 1.95

Uncontrolled demand

Growth factor = 0.9

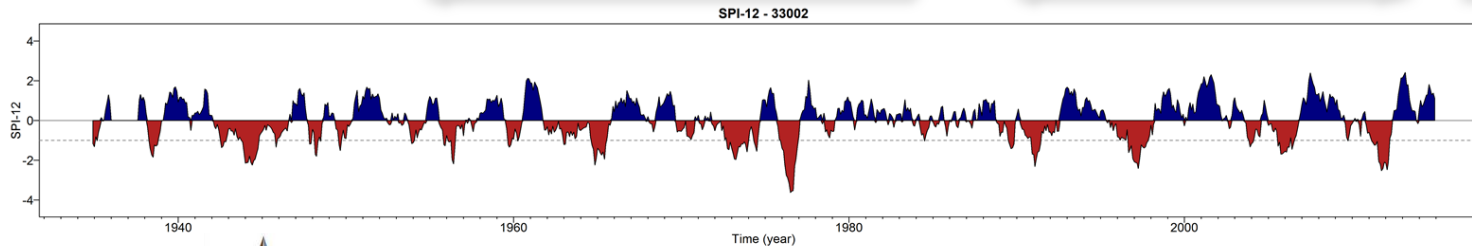


# Key uncertainties and potential impact





# WRE synergies with other research



Observed impacts on agriculture and food (and responses)

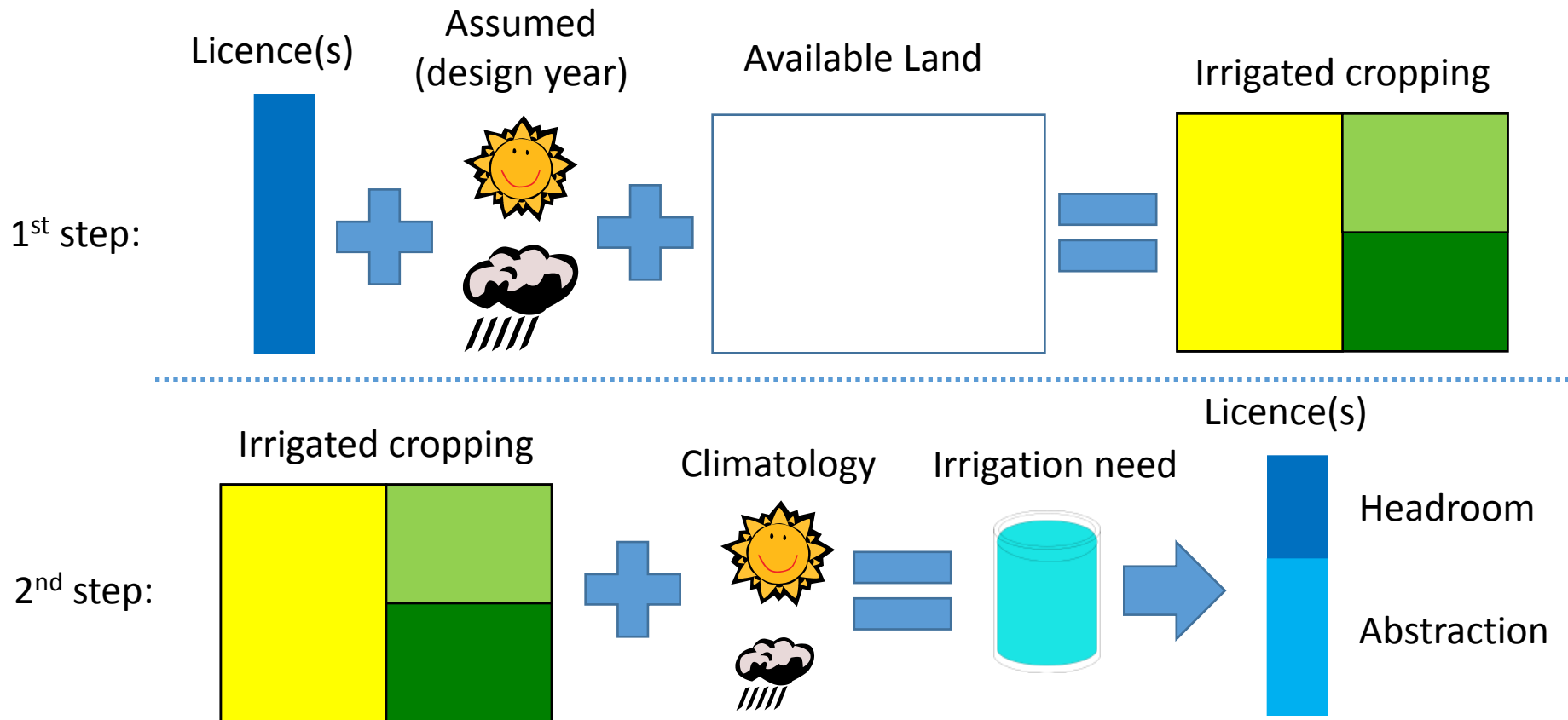


Risk-based approach to current and future impacts and responses

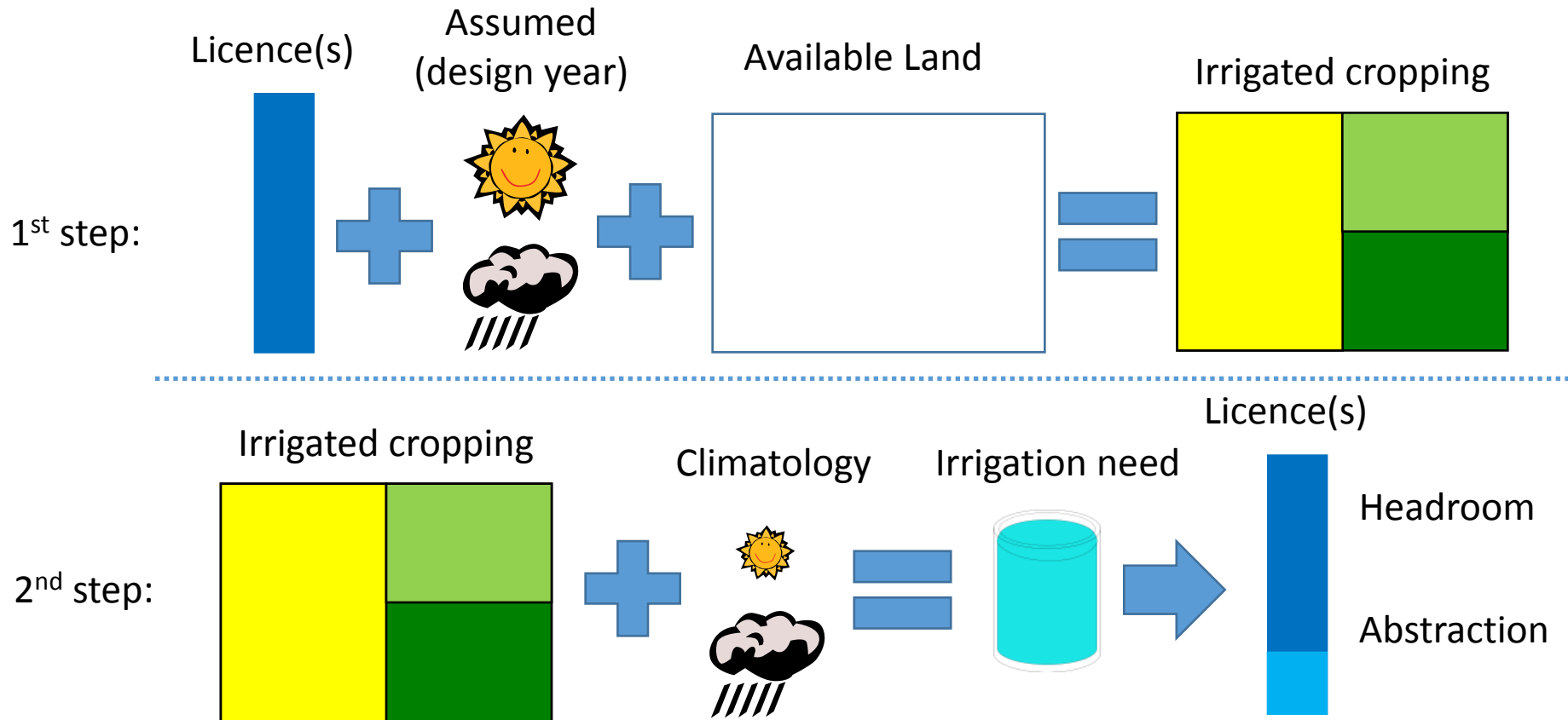


# D-Risk rationale – a webtool for individual growers/businesses

## Analysing current approaches to managing changing irrigation risks



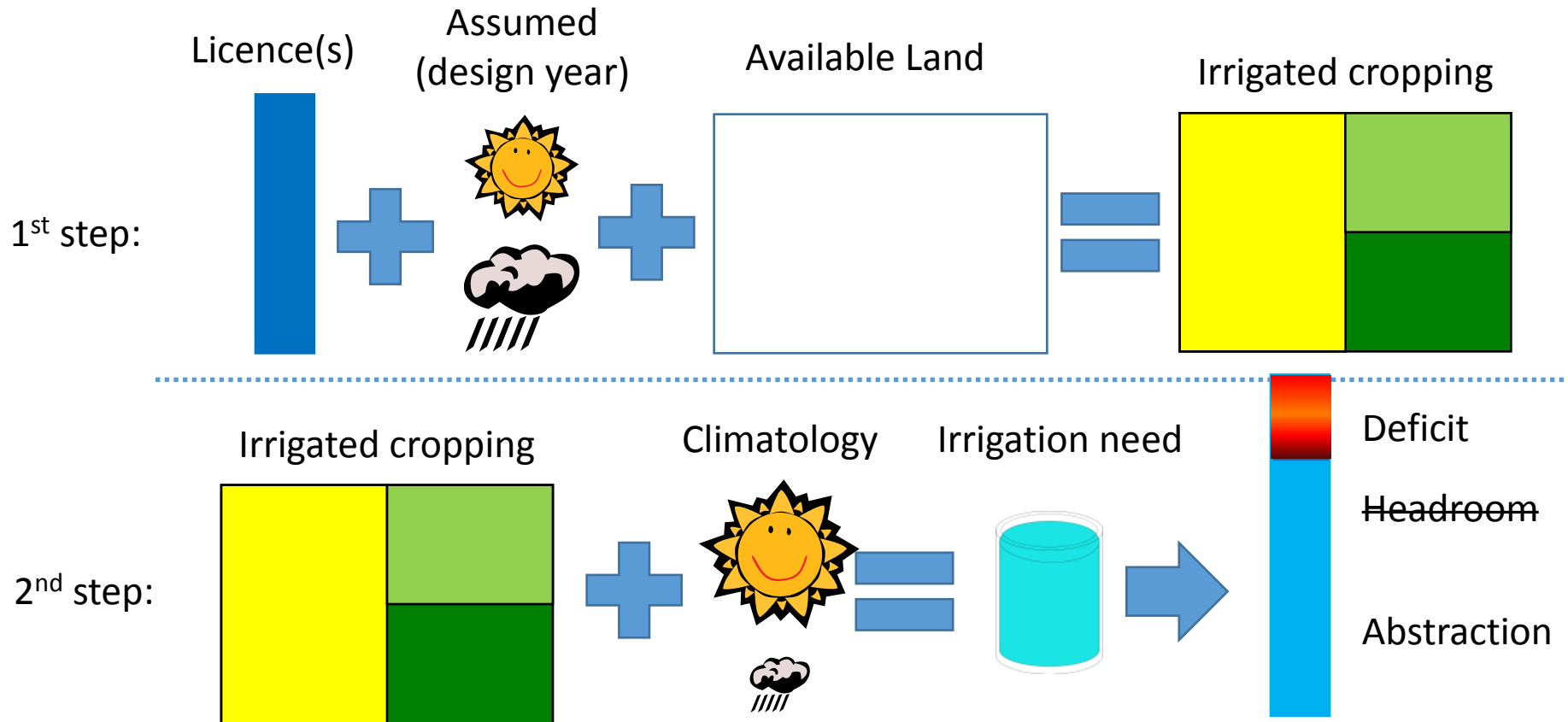
## Analysing current approaches to managing changing irrigation risks





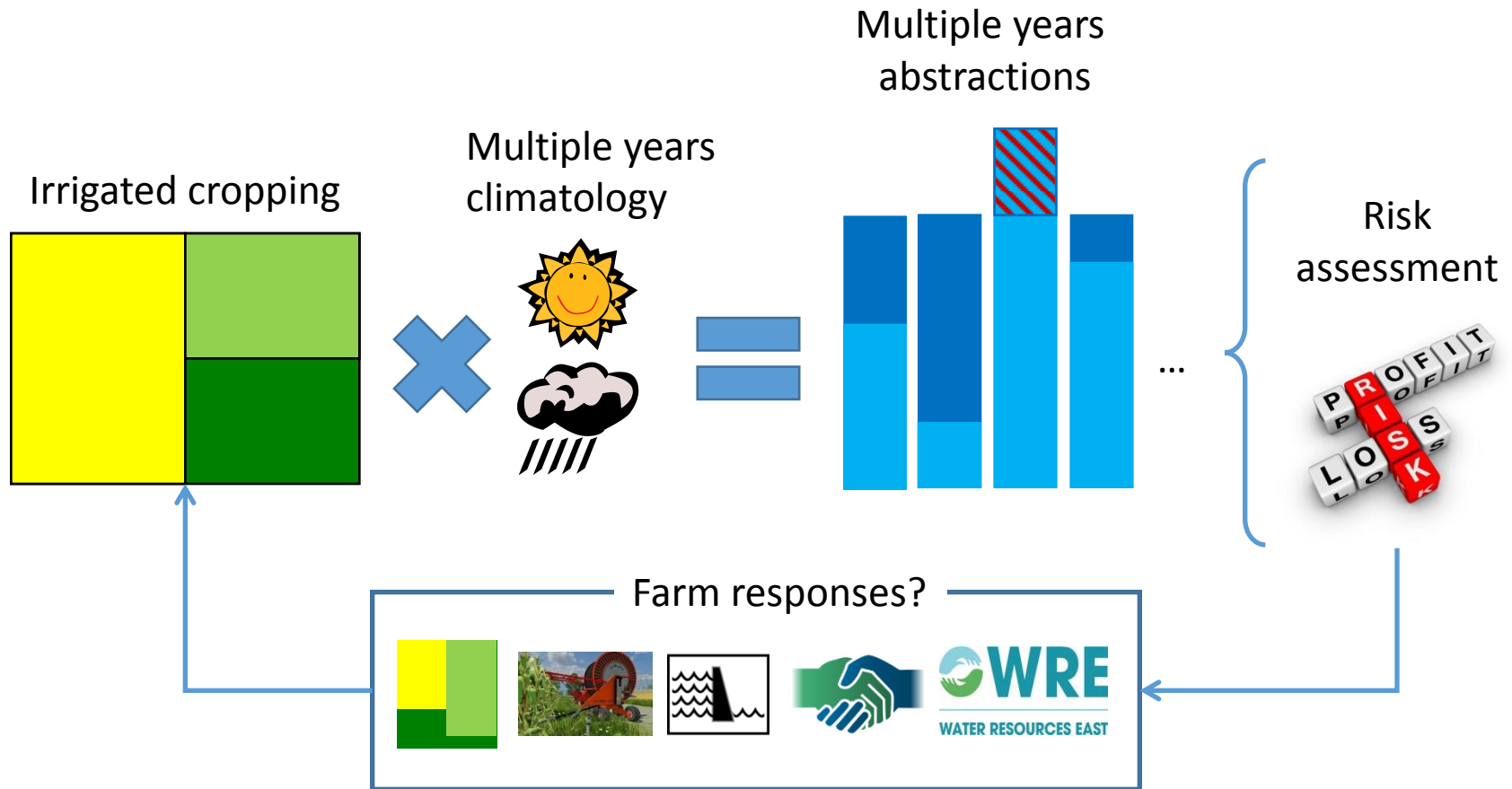
## D-Risk rationale

### Analysing current approaches to managing changing irrigation risks





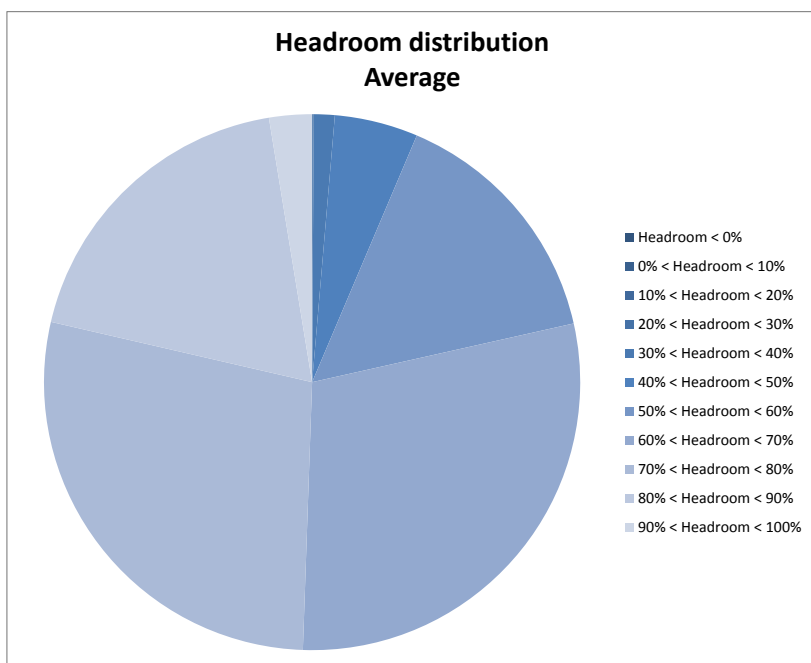
# Developing a webtool to help farmers understand their changing abstraction risk profile



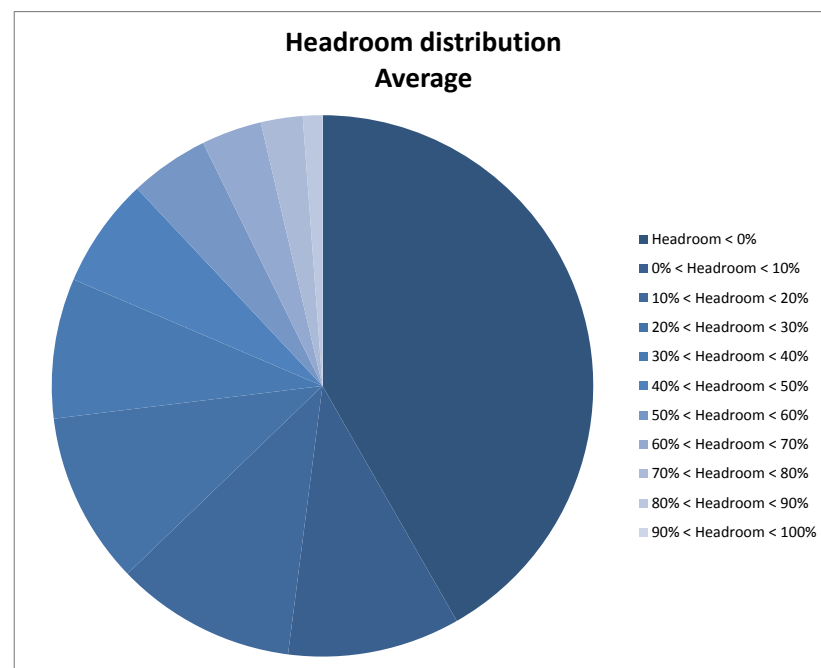


# D-Risk – projected average changes in abstraction licensing headroom (individual licence)

## Baseline



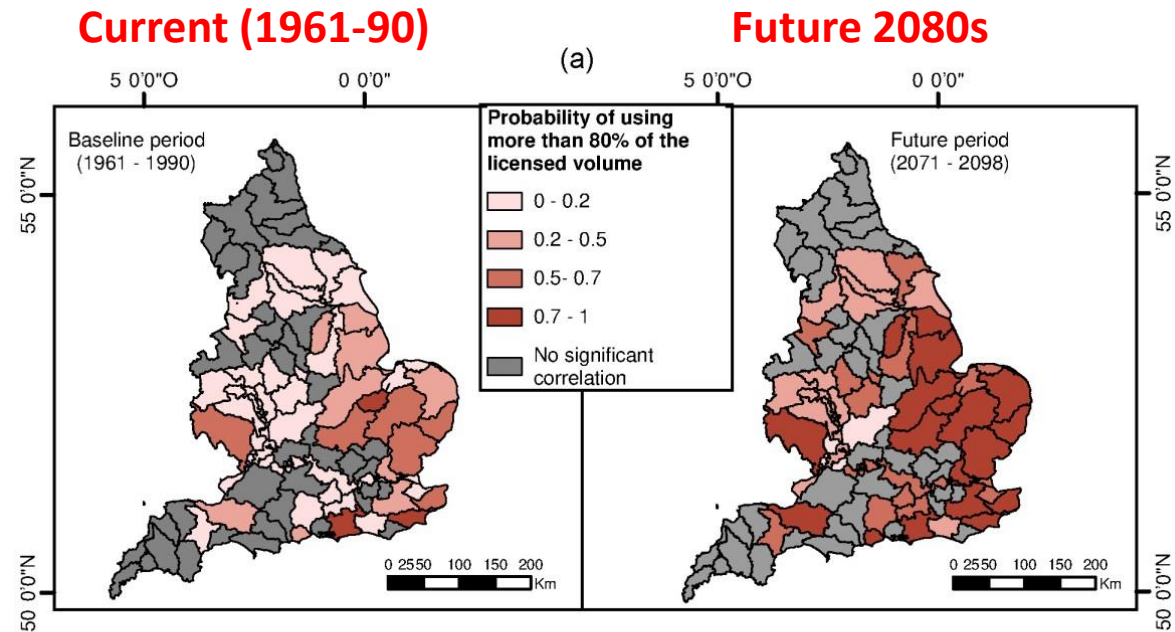
## Near future



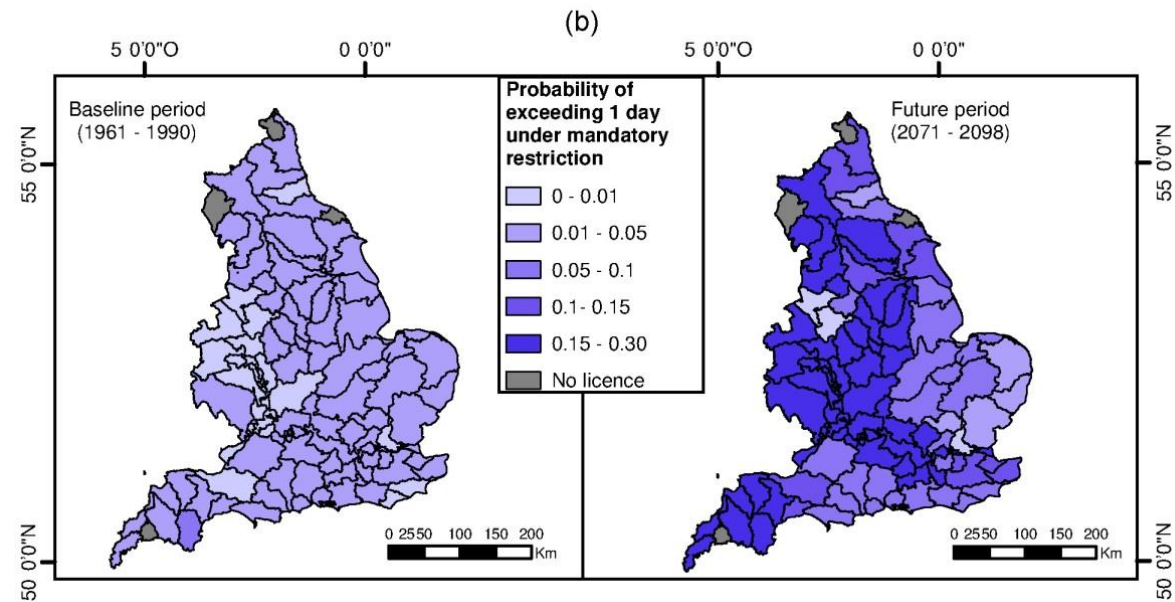


# Changing irrigation abstraction risks (all licences)

Probability of reductions in licensed headroom



Probability of abstraction licensing restrictions





## Concluding remarks

- WRE provides a unique opportunity to engage with PWS sector, to understand their drivers of demand and investigate opportunities for collaboration and mutual benefit;
- Projecting future changes in irrigation demand is complex and entrenched with multiple agro-economic and socio-economic policy uncertainties. Focus on the most sensitive variables;
- Ignored equivalent impacts and responses within livestock, and niche agric sectors (HNS, protected cropping);
- Common denominator whether driven by Brexit, climate variability, drought, abstraction reform, WFD or climate change is:

**Understanding and managing “risk and uncertainty”**



# Acknowledgements

