AquaPlan

A new tool to assess and mitigate water risks in agricultural supply chains

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The University of Manchester

SLR

UKRI Engineering and Physical Sciences Research Council

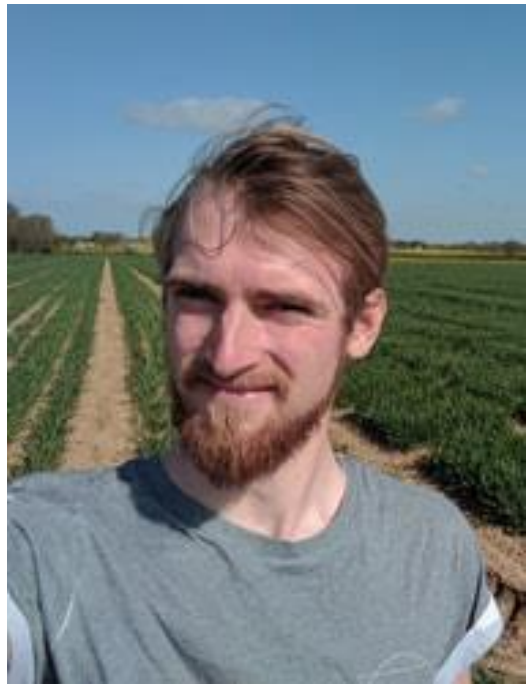
Introductions

Christopher Bowden

Background in breeding

PhD in climate-crop machine learning models

Lead developer of AquaCrop and AquaPlan



Introductions

Agriculture, Water and Climate Research Group

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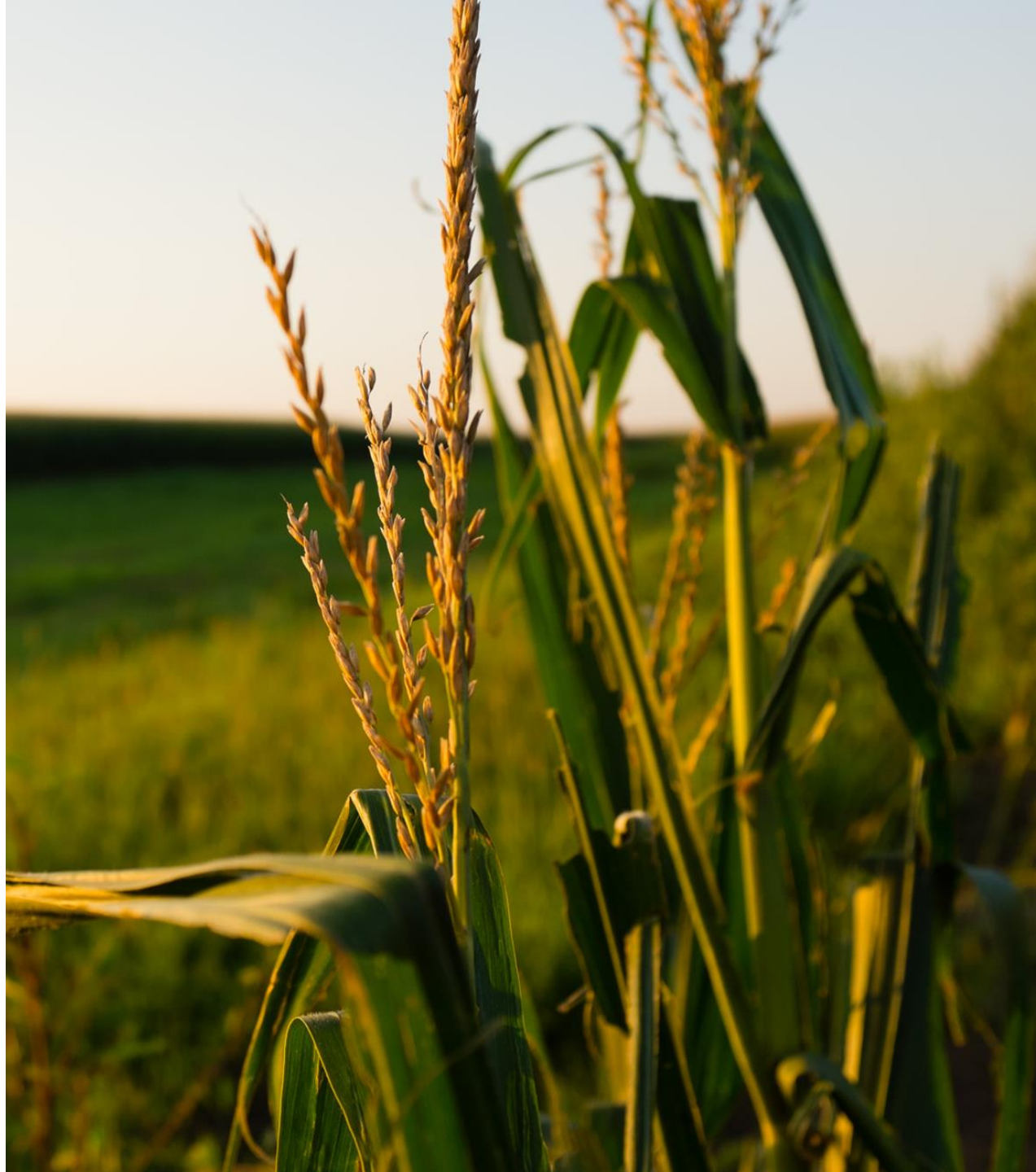
Links between agricultural production and environmental change

Focus on application of scientific research in agriculture

Active research projects around the world incl. UK, N America, Sub-Saharan Africa and South Asia



Introductions

Matthew Roberts

Academic Background in Applied Science

Flood Risk & Water Management

Water & Env Technical Consulting Firm

Climate Resilience & Net Zero

SLR

Making Sustainability Happen

Matthew Roberts

Introductions

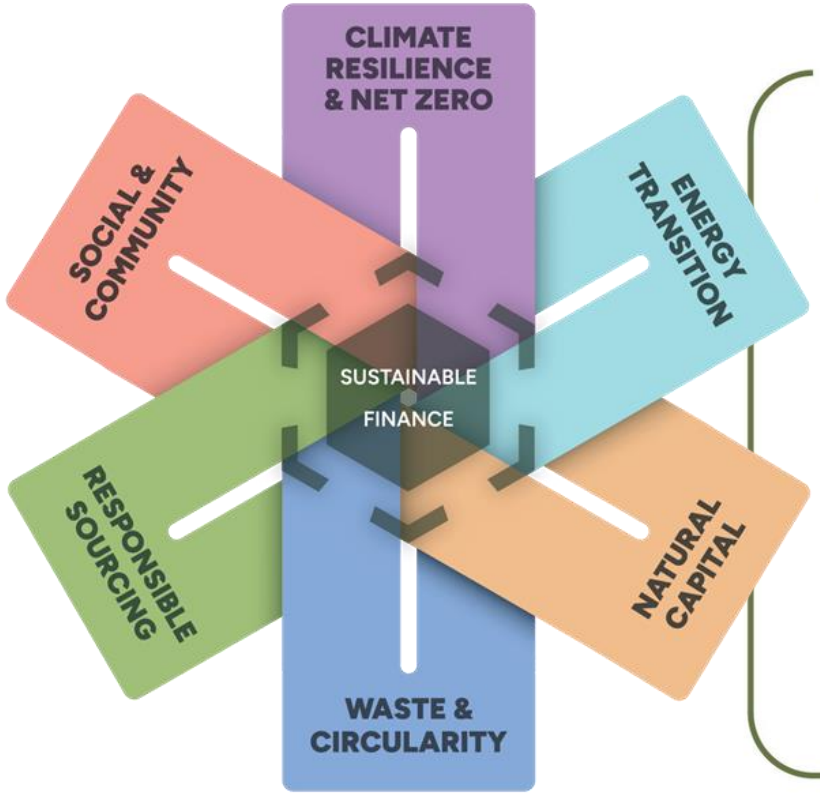
SLR Consulting

6 Regions with **over 8,000** live projects on every continent

125+ Offices in **13** countries

3,500+ Staff with a collaborative **'one team'** culture

35+ Technical Services Environmental, Engineering, Scientific, Advisory



Advisory Services

- Carbon & Energy Management
- ESG Strategic Advisory
- Mining Advisory
- Energy Advisory
- Safety Advisory
- Transactional Due Diligence
- Sustainable Waste Management

Engineering & Design

- CAD
- Civil & Structural Engineering
- Construction Services
- Geotechnical Engineering
- Land Surveying
- Mine Waste Engineering
- Process Engineering
- Transport Engineering
- Water Resource Engineering
- Water & Wastewater Engineering

Planning & Assessment

- Environmental & Social Impact Assessment
- Environmental Management Permitting & Compliance
- GIS & Information Services
- Transport Planning
- Landscape Architecture
- Planning
- Resiliency Planning

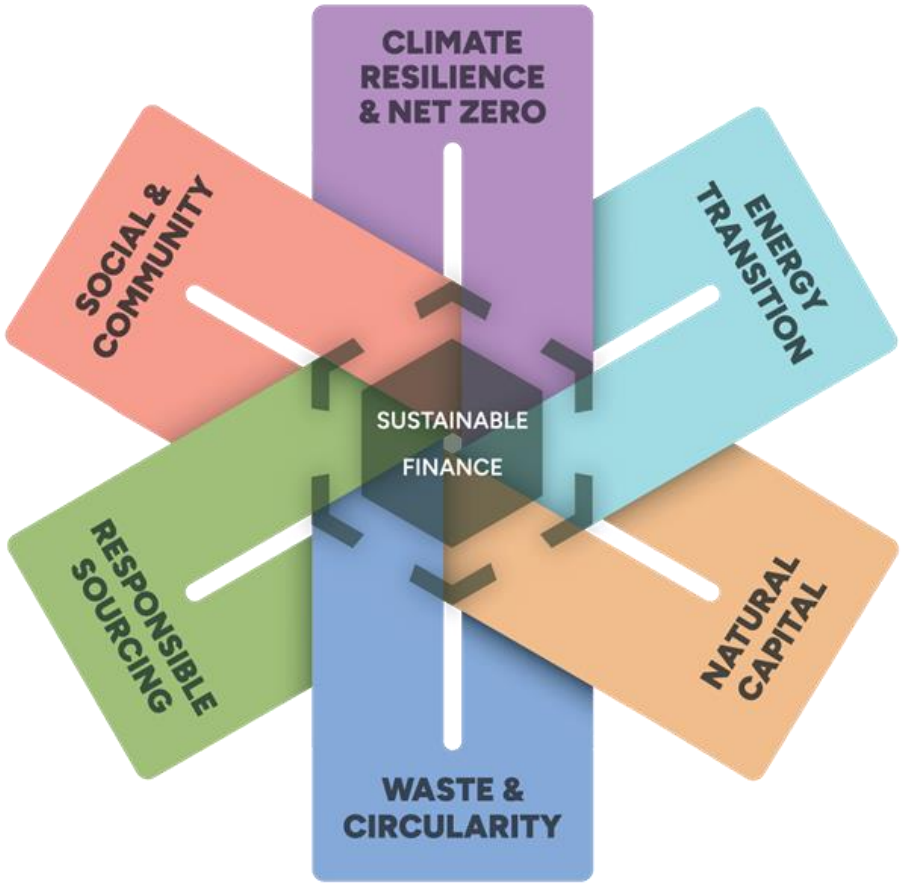
Environmental Sciences

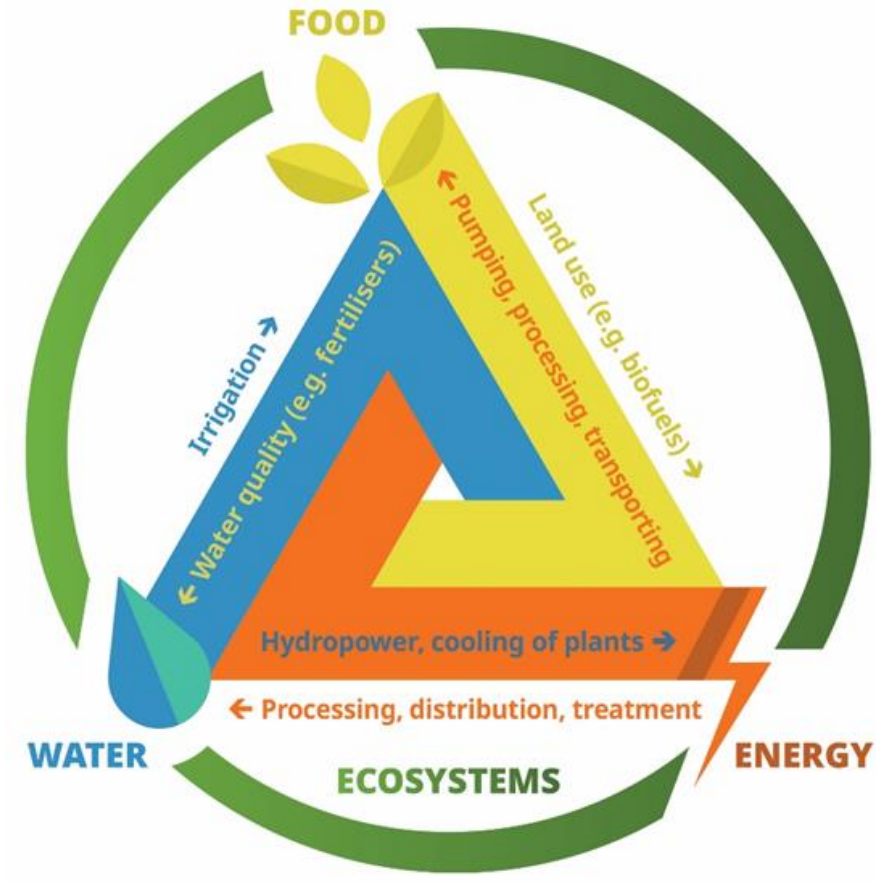
- Acoustics & Vibration
- Air Quality
- Archaeology
- CFD, Wind & Energy
- Ecology & Biodiversity
- Hazardous Material Management
- Marine Science
- Occupational Hygiene

Earth Sciences

- Geology
- Hydrogeology
- Hydrology
- Land Quality & Remediation
- Risk Assessment & Toxicology
- Soil Science

Introductions





Source: The Global Water Partnership (https://www.gwp.org/)

Introductions

Collaboration – UoM & SLR

Enhancing research and innovation

Leveraging resources and knowledge transfer

Comprehensive solutions with joint efforts

Water in Agriculture

Critical for crop growth and yield

Irrigation needs

Economic value

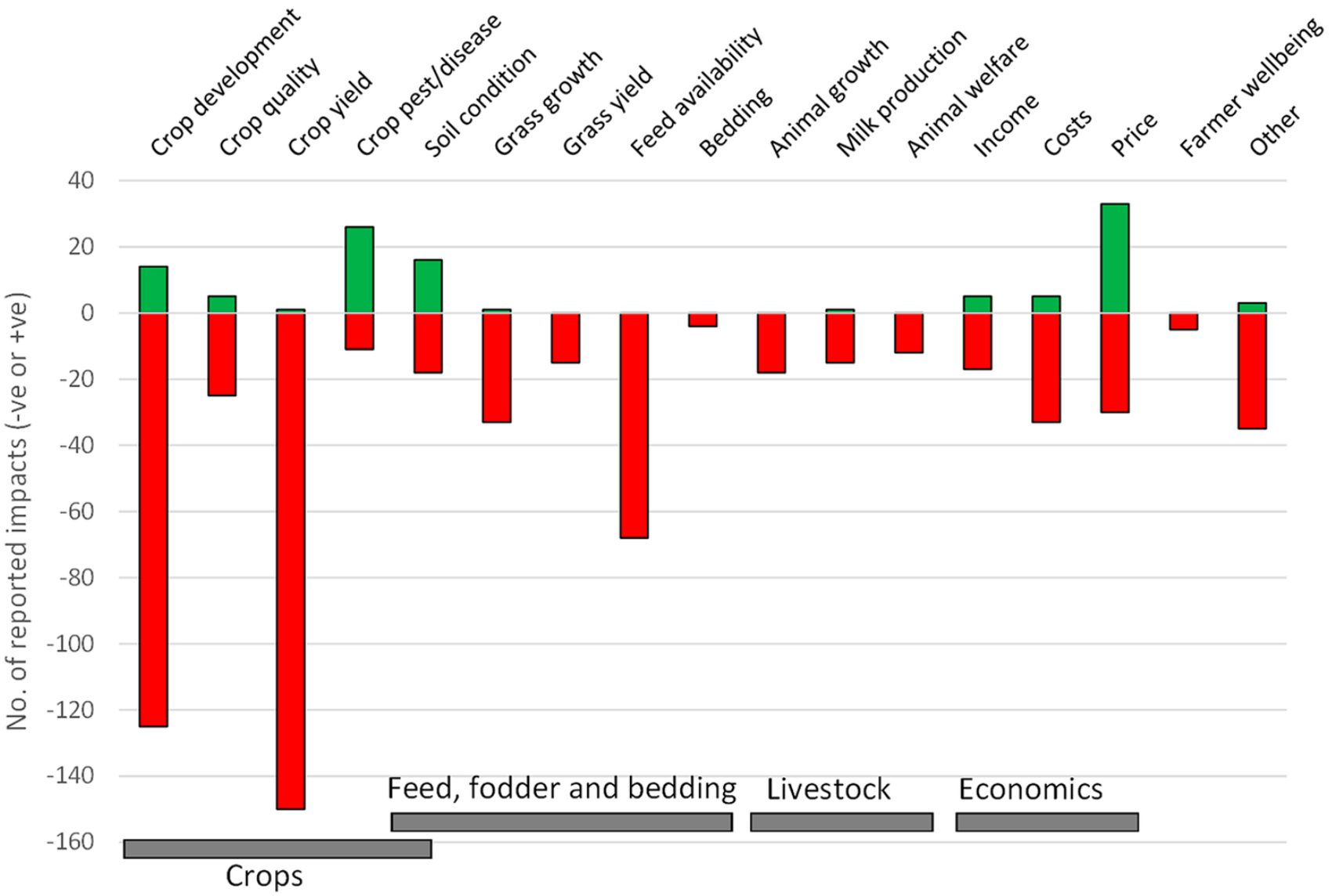
Water Scarcity

Current issues and impacts

Decreasing Water Availability

Increased Competition for Water Resources

Impact on crop yield

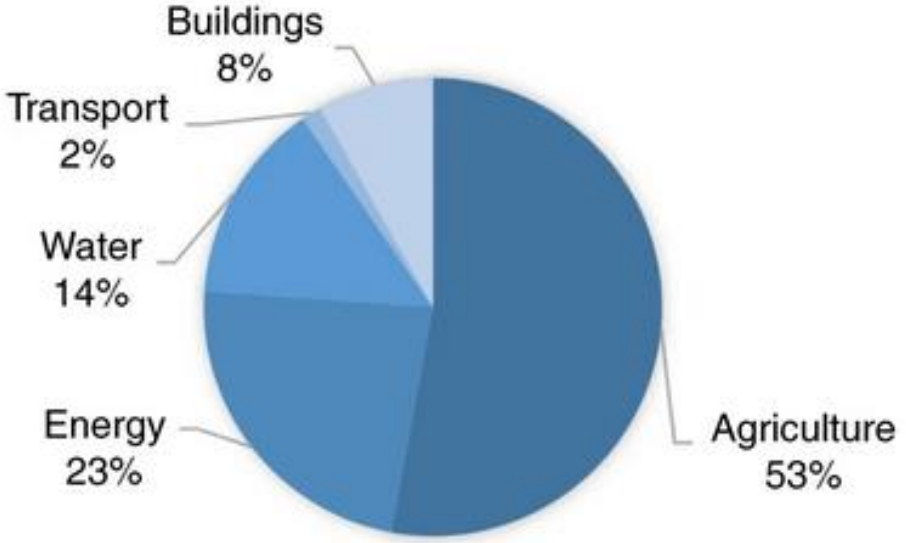


Negative (red) and positive (green) drought impacts reported in Farmers Weekly and Farmers Guardian trade magazines in 2018

Water Scarcity

Current issues and impacts

Agriculture is a contributor to water scarcity



Sector shares in total drought damages under base (2015) socioeconomic conditions for EU + UK

Example: Spanish olive oil production

- Head of Spanish small farmers' union: ‘In short, the worst campaign of the century’, ‘If we want to fight against the rise in the price of oil, we must fight against drought in the olive grove’

Water Scarcity

Current issues and impacts

Example: Global food and beverage company in India

- Produced more than permitted capacity
- Accused of over-abstraction from local aquifers
- Ultimately forced to close the plant due to government and activist action

Water Risk Management

The next carbon

Risks are already significant and rising

Increasing UK drought frequency

Future climate change

Financial risks

Costs of inaction

- Increased costs from higher irrigation expenses and decreased yields
- Competitors gaining market advantage through sustainable water practices
- Non-compliance with evolving water regulations leads to fines and legal implications
- Unsustainable practices harm brand image and consumer trust

Addressing water risks

Where to begin

Adopting the AWS Standard

Gather and Understand step is crucial

Primary risk is associated with the crop production step

Addressing water risks

Crop production

Supply

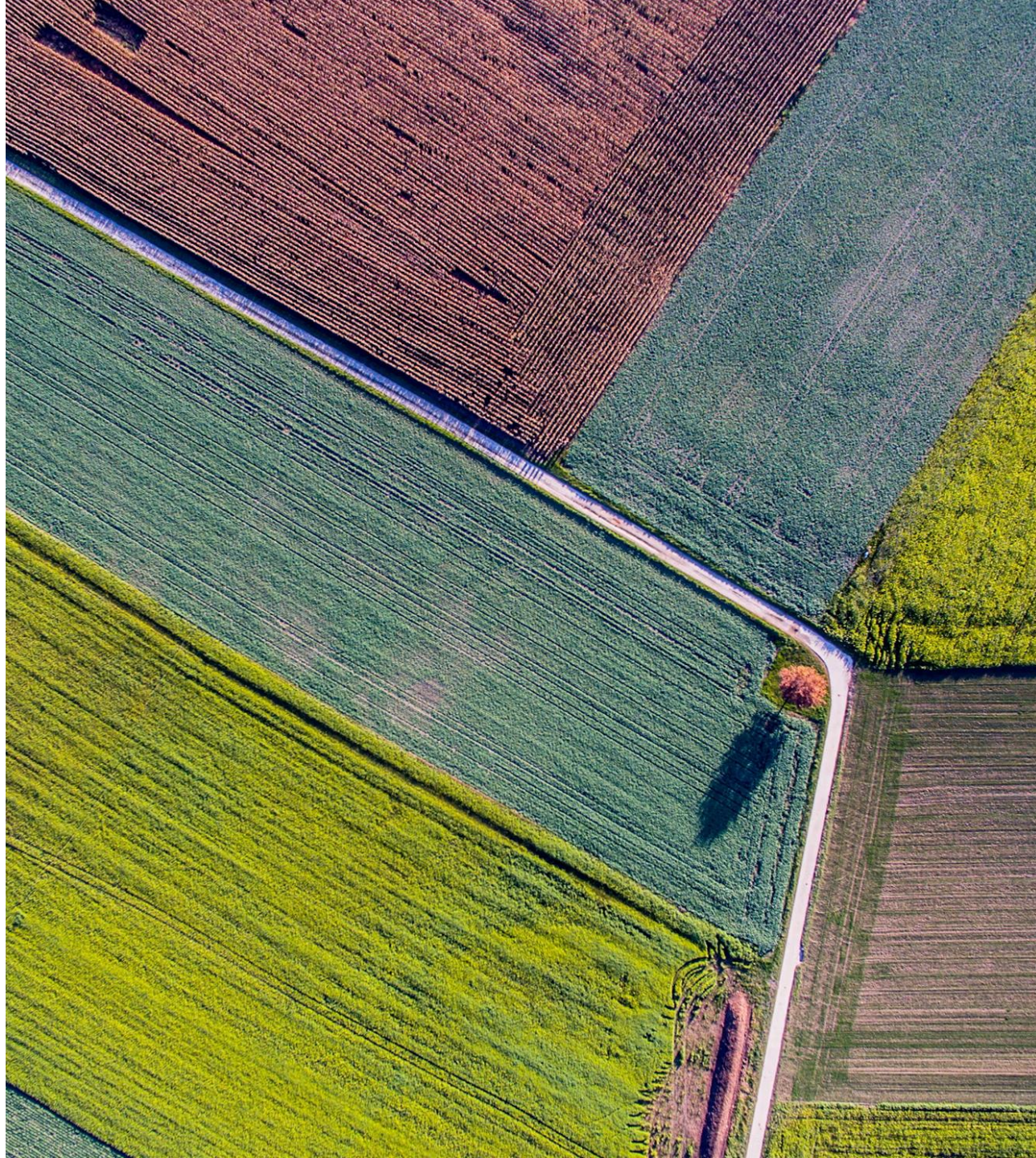
- Availability and continuity of water supply
- Physical, regulatory and reputational risks in locations you source primary commodities from

Demand

- Requirement of crops and commodities in your locations now and in future

Interaction

- How do demands impact supply?



Addressing water risks

Existing tools

WRI Aqueduct, Ecolab & Risk Atlas

- Used for assessing water risk exposure
- Great tools for broad-scale overviews
- Typically focus on assessments for manufacturing stages

High-level challenges for these tools

- Coarse scale
- Not tailored to agricultural sector specifically
- No practical info on reducing agricultural risk exposure

Crop models

What are they and how can they help?

Representation of physical plant growth processes

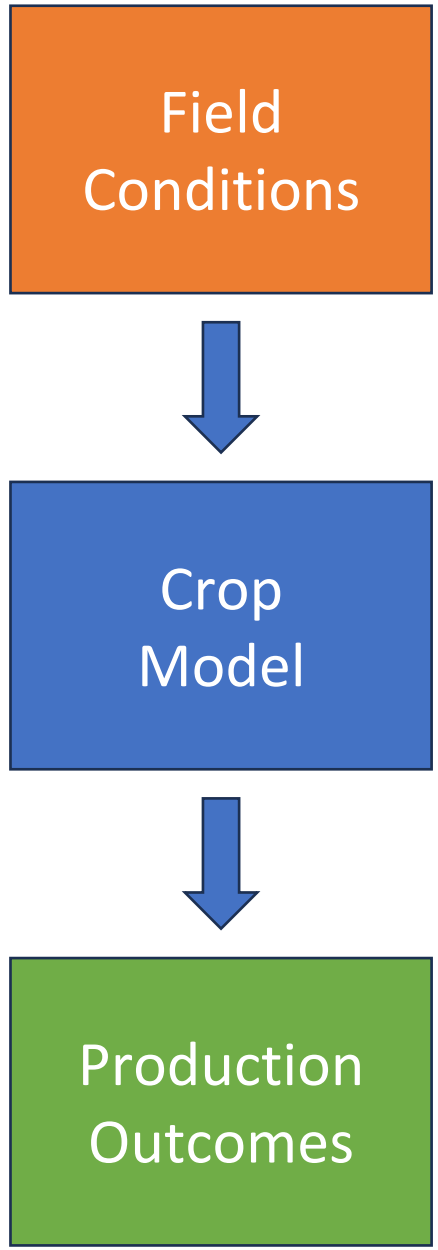
- Simulate daily growth of crop throughout season
- Based on our understanding of plant physiology

Tools to anticipate and design solutions to water risks

- Work on farm, regional and global scales
- Complementary to other water risk tools
- Can assess impact of mitigation strategies

Historically, use outside of academia has been limited by:

- Time and expertise to implement
- Closed-source codes and software



AquaPlan

An interface for AquaCropOS-Py

AquaCropOS-Py: water-focused crop model in academia

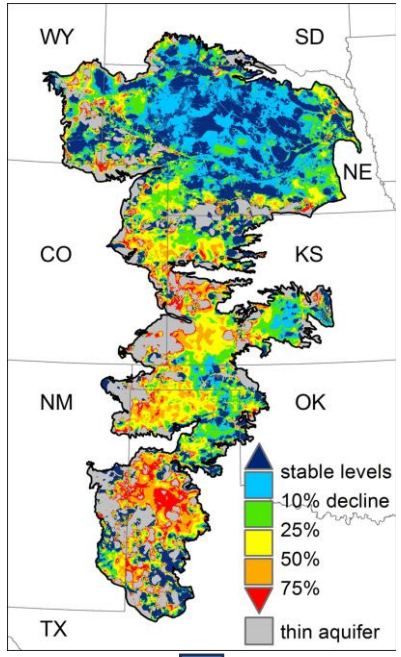
- Originally developed by UN FAO

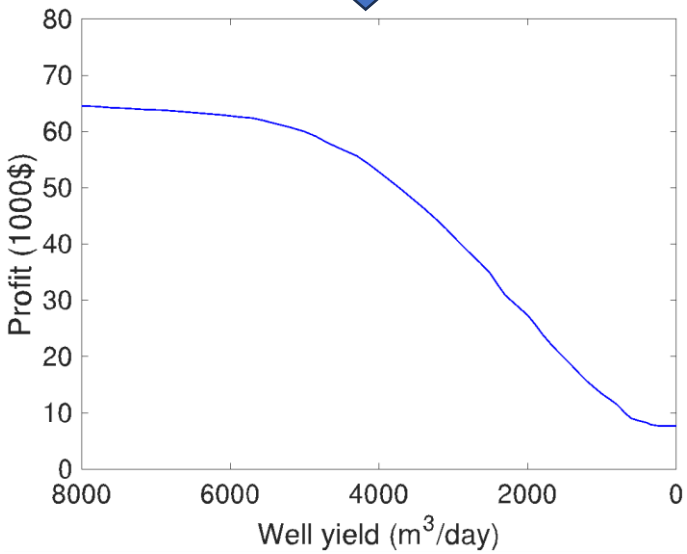
Over 140,000 downloads

AquaPlan: a no-code modelling solution for industry

- Automated model setup
- Cloud processing
- Interactive visualisations

Interactive tutorials and workflows for key use cases





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Quantify agricultural water demand

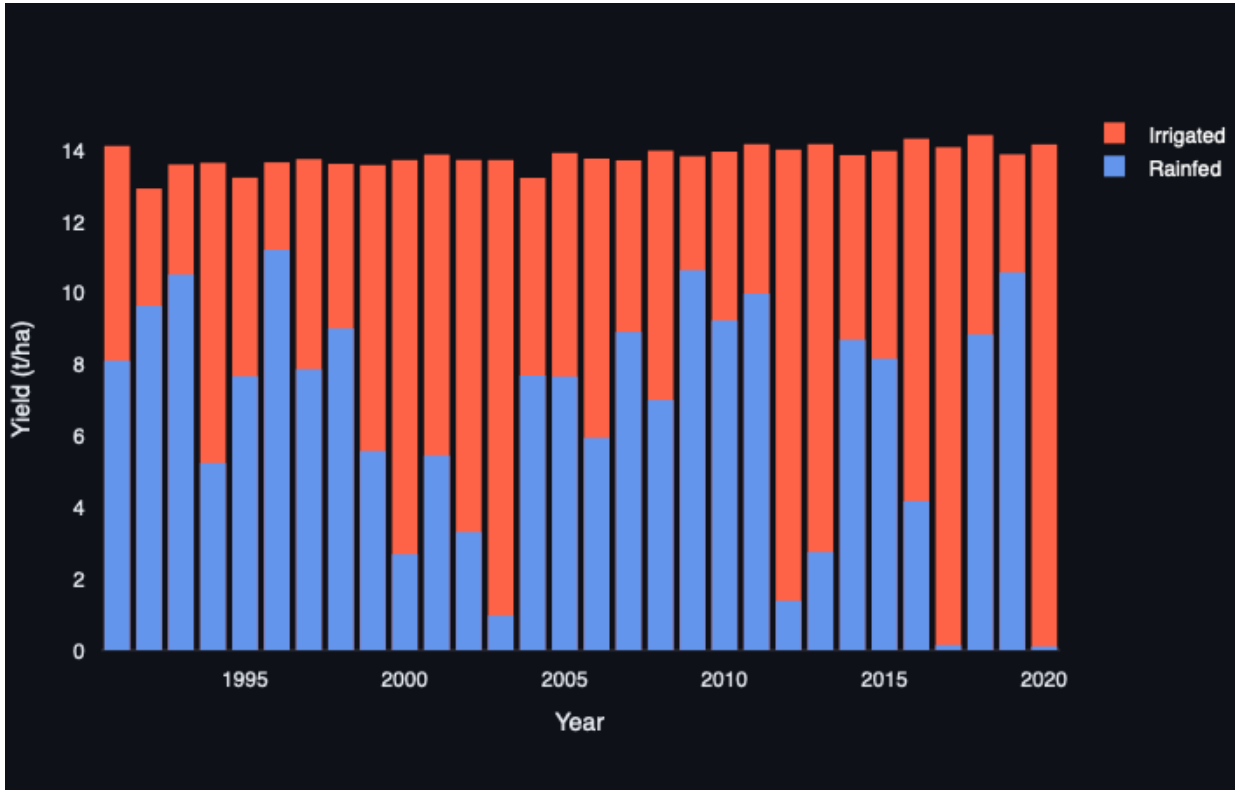
Interactively select and load input data

- Select from pre-loaded weather and soil data
- Or upload your own

Define custom crops and management practices

Quickly visualise outputs:

- Crop yields
- Production risks
- Water use over time



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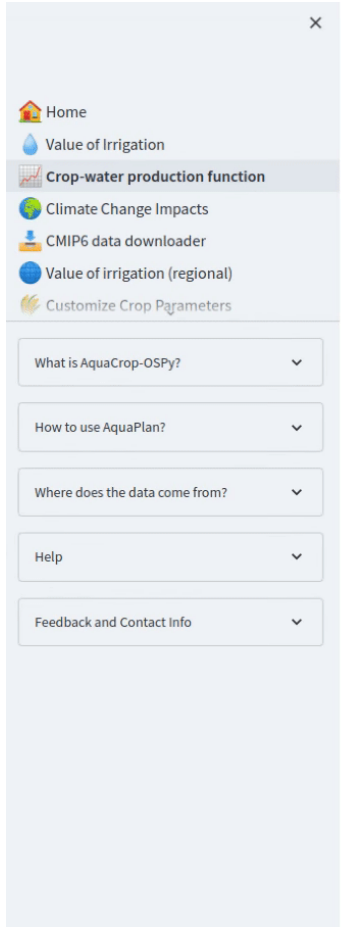
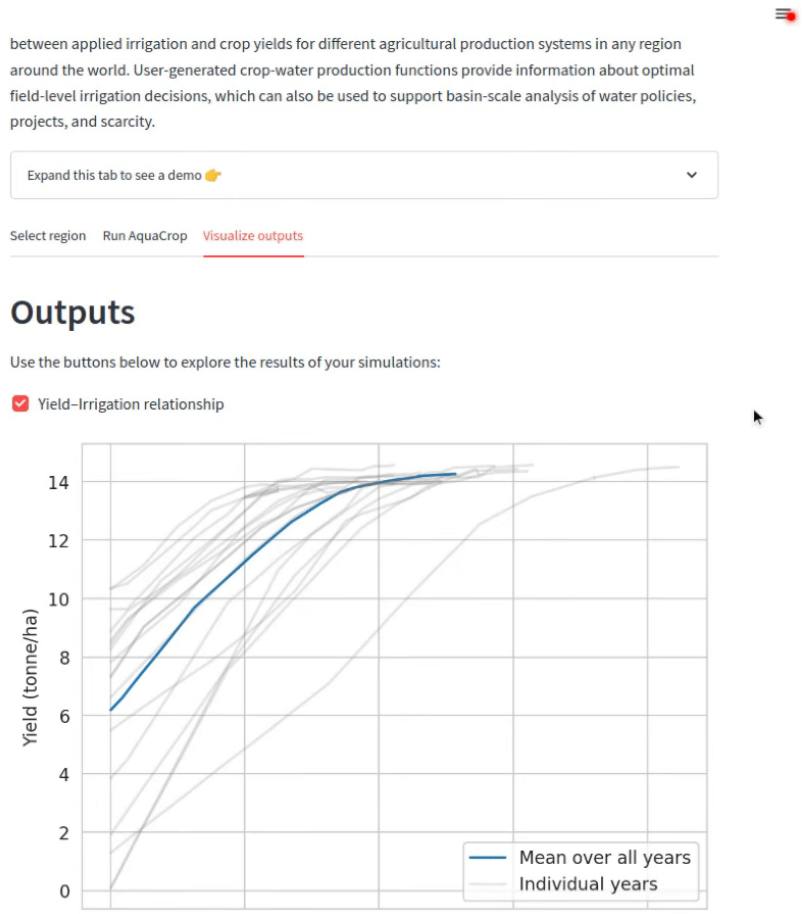
Optimise farm water management practices

Different irrigation rules, practices or technologies

- Optimise irrigation on a farm or regional level

Use as input to basin-level planning models and tools





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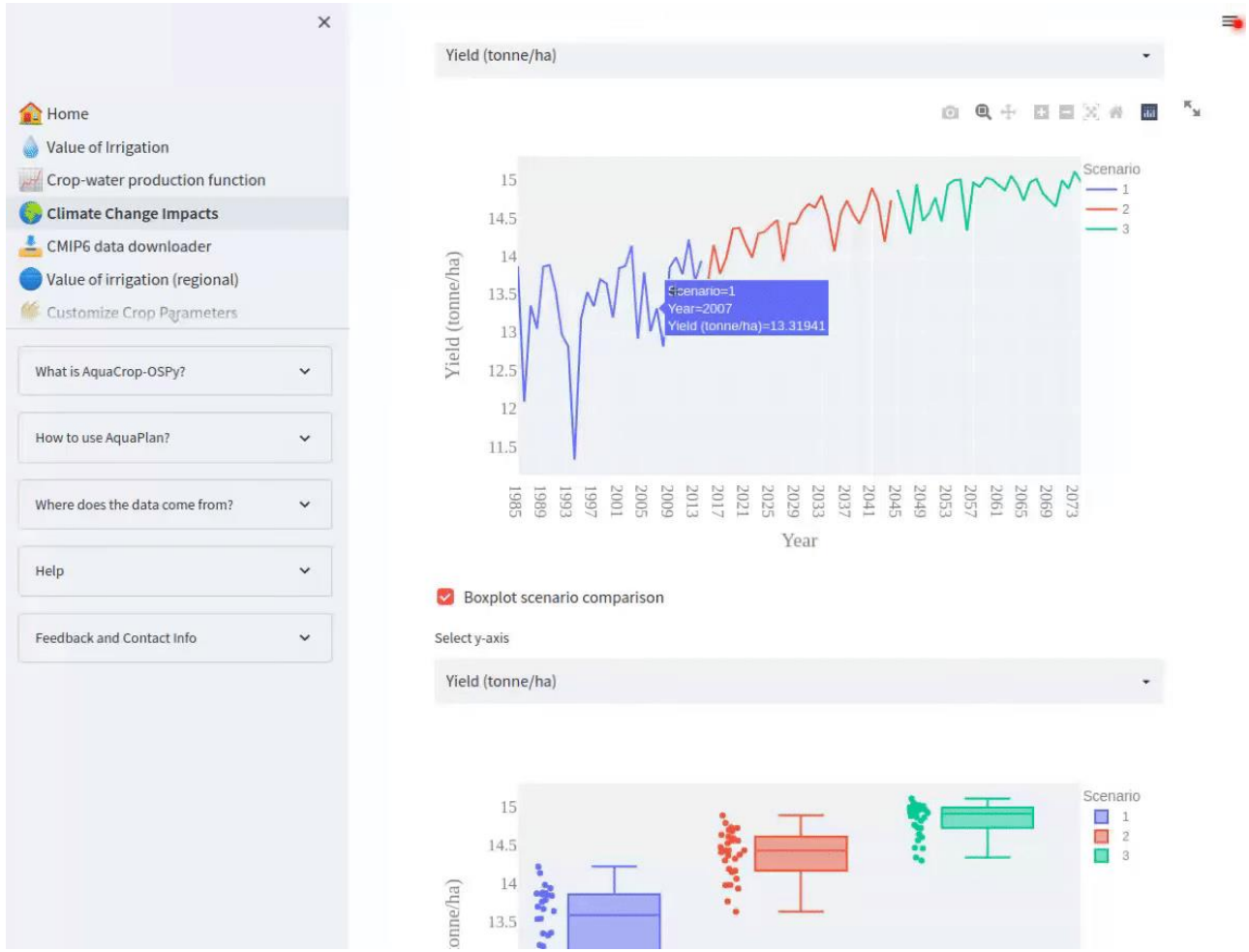
Assess impacts of climate change

Simulate multiple climate futures

Compare impacts across different regions



AquaPlan

UoM & SLR Collaboration

Developing new features and functionality

- New spatial functionality to run the model over large regions
- Integrating SLR's specialist future climate model data

Pilot study to develop bespoke application with British Sugar

AquaPlan

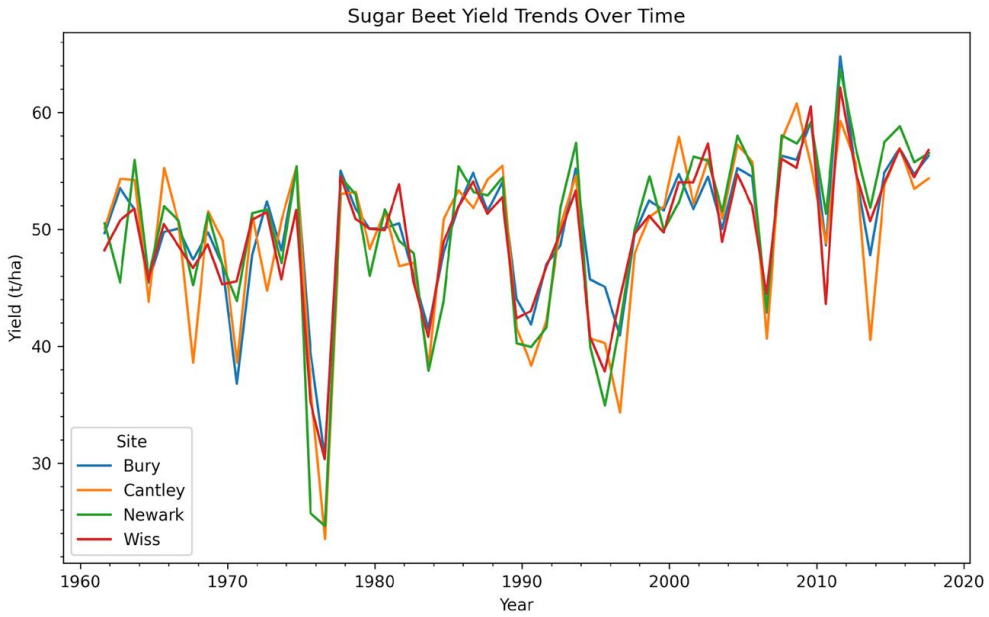
UoM & SLR with British Sugar

Assess water risks to rainfed sugar beet production

- Clear picture of current production and water needs
- How these vary across production regions

Project future yield changes

- Assess viability of future production regions
- Aid strategic decision-making



AquaPlan

Advantages

Regional agricultural water demands and supply chain impact

Long-term strategic decision making under climate change

Globally applicable

Limitations

Not designed for short-term forecasting

Cannot account for entire supply chain

Summary

Water risk to agricultural production is significant and rising

Opportunity to get ahead of the curve and avoid future costs

Crop models are useful and complementary to other water risk tools

AquaPlan is a powerful, flexible and easy to use crop modelling tool

Let us know what water risk challenges your company is facing

Further info

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