

Developing drought resilience in irrigated agriculture in the face of increasing water scarcity

Cranfield
UNIVERSITY



Dolores Rey, Ian Holman, Jerry Knox
May 2016



www.cranfield.ac.uk

Outline

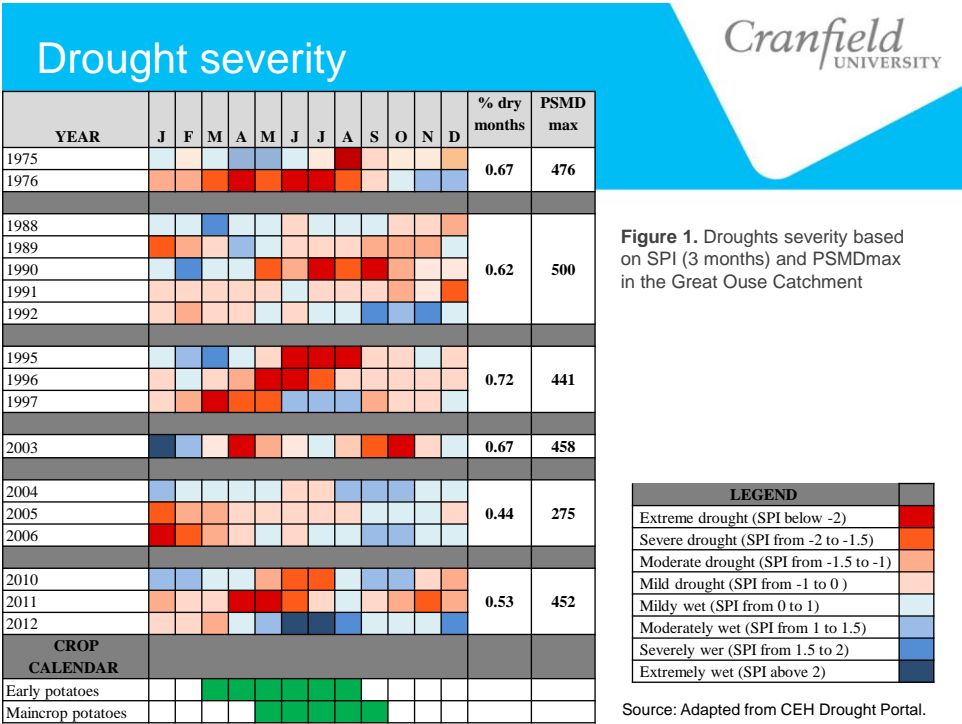
Cranfield
UNIVERSITY

1. Introduction
2. Case study
3. Data collection and methods
4. Results
5. Conclusions

Introduction



- Droughts are responsible for the greatest loss of agricultural production in many countries
- Despite the apparent lesser importance of irrigation in humid climate, it is a highly productive use of water (≈ £665 million in a dry year in England and Wales)



Research question

Cranfield
UNIVERSITY

Are farmers in the UK becoming more resilient to droughts?

Case study

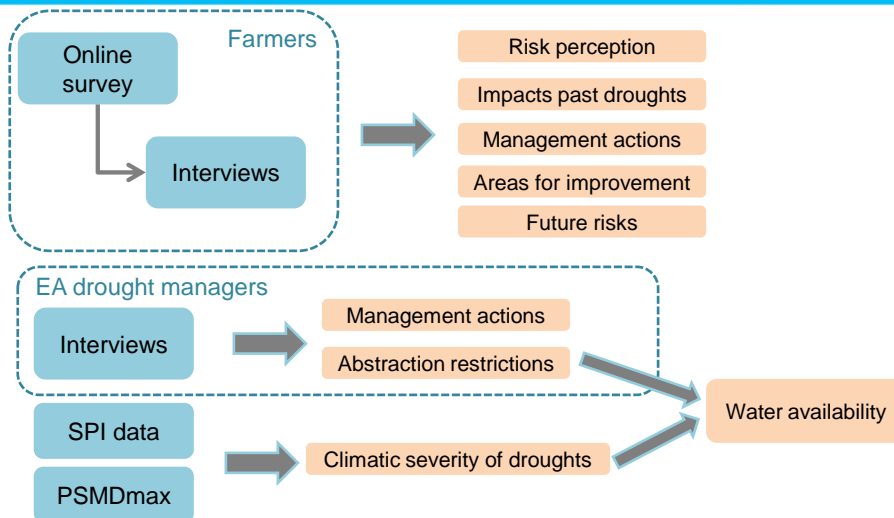
Cranfield
UNIVERSITY

- Intensive lowland arable and horticultural region
- Driest part of the country. Average annual rainfall 600mm (less than 70% national average)
- 60% of the irrigated area and 57% of the volume of water used for irrigation is located in Eastern England (160 Mm³)
- Environment Agency (EA) manages the water abstraction through a statutory licensing system
- Section 57 of the Water Act: abstraction restrictions on spray irrigation during drought periods



Figure 2. Anglian Region

Data collection and methods



Farmer's drought perception

DROUGHT DEFINITION

- *"So, this whole thing is about distribution of rainfall patterns, isn't it?"*
- *"looking back I have found 40 years weather data here, and it appears that 1 year in 5 rainfall drops to 175 mm or below"*
- *"water scarcity is wherever there is drought, and the other way around. One becomes the other. It is a risk to your business"*
- *"On this sort of soils the word drought is not always used that much because we have to manage water so actively anyway"*

WHEN THEY ARE STARTING HAVING PROBLEMS

- A period of 3 weeks without rain
- problems of water availability after 6 weeks with very low rainfall in May and June.
- the worst scenario is a dry summer after a dry winter.

Farmer's drought risks perception

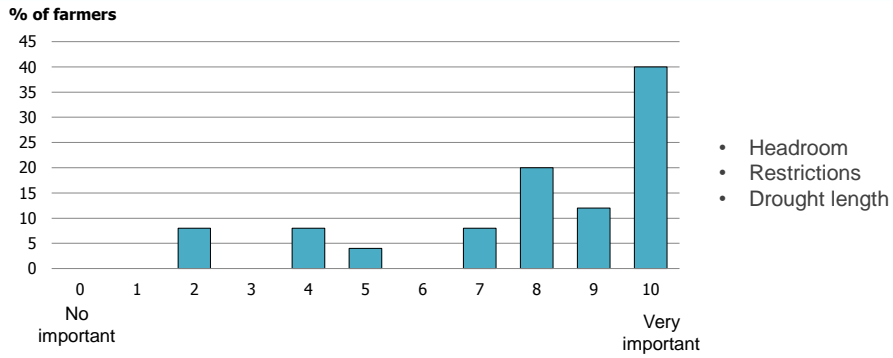


Figure 3. On a scale from 0 to 10, how do you rate drought risk to your farm business?

Abstraction restrictions

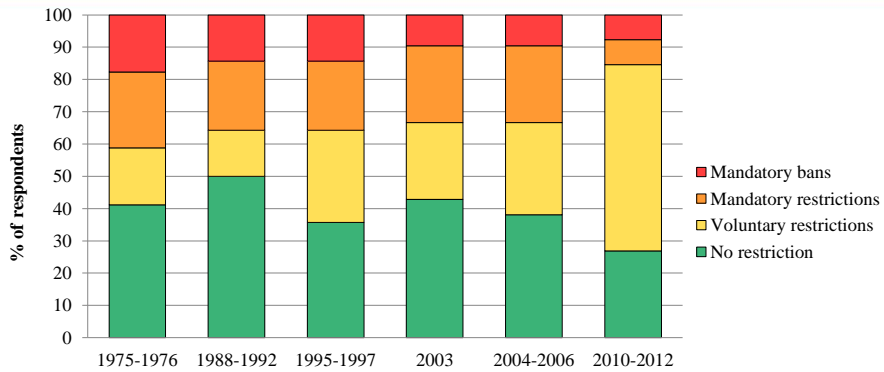
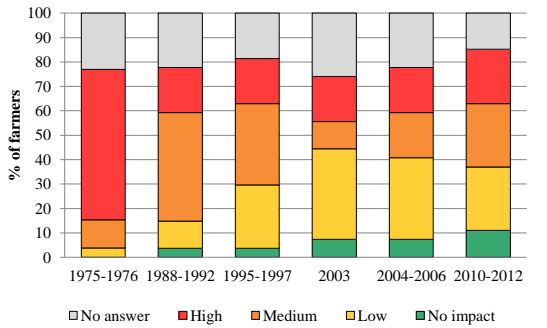


Figure 3. Abstraction restrictions imposed by EA during past drought events (n=26)

- From mandatory to voluntary approach
- Mainly surface water

Impacts of past droughts



- | | |
|------------------|--|
| 1976 | <ul style="list-style-type: none"> Irrigation was not such a big thing The limiting thing was the machines we had to apply water We were not organized Market has changed a lot since then |
| 2010-2012 | <ul style="list-style-type: none"> We were able to manage the situation Sufficient warning, more information from EA |

Figure 4. Impact level of past drought events on production (yield and quality) (n=26)

Source: CEH Drought Portal

YEAR	J	F	M	A	M	J	J	A	S	O	N	D	% dry months
1976													0.75
2010													
2011													0.53
2012													

LEGEND	
Extreme drought (SPI below -2)	
Severe drought (SPI from -2 to -1.5)	
Moderate drought (SPI from -1.5 to -1)	
Mild drought (SPI from -1 to 0)	
Mildly wet (SPI from 0 to 1)	
Moderately wet (SPI from 1 to 1.5)	
Severely wet (SPI from 1.5 to 2)	
Extremely wet (SPI above 2)	

Drought management actions at the farm level: short-term

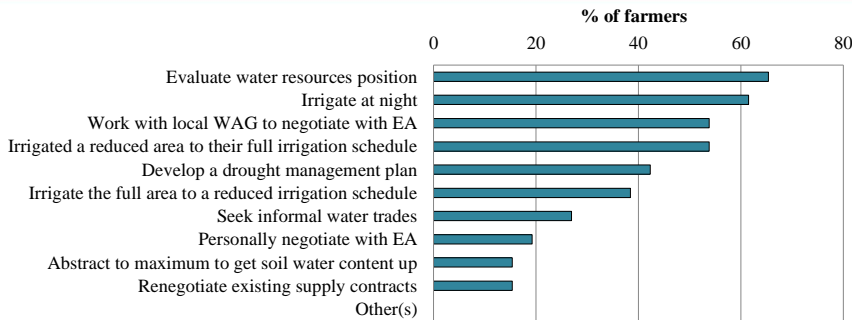


Figure 5. Management actions when a drought has been declared and restrictions are likely (n=26)

- Crop prioritization
- Forward contracts

Drought management strategies at the farm level: long-term

Cranfield
UNIVERSITY

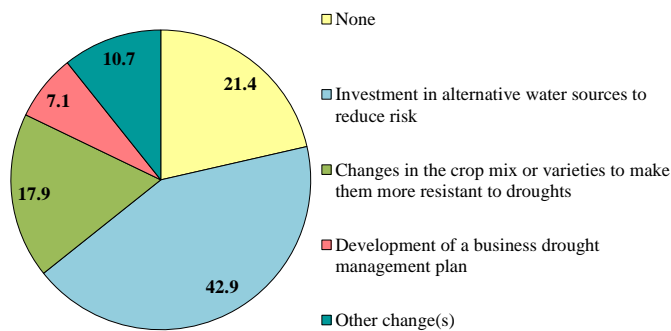


Figure 6. Recent changes in farm management to cope with future drought (% of farmers)(n=26)

EA drought management

Cranfield
UNIVERSITY

- It has changed to a more proactive way of communicating with farmers
- More information, more engagement
- Drought management plans
- National Drought Group
- Abstraction restrictions (Section 57)

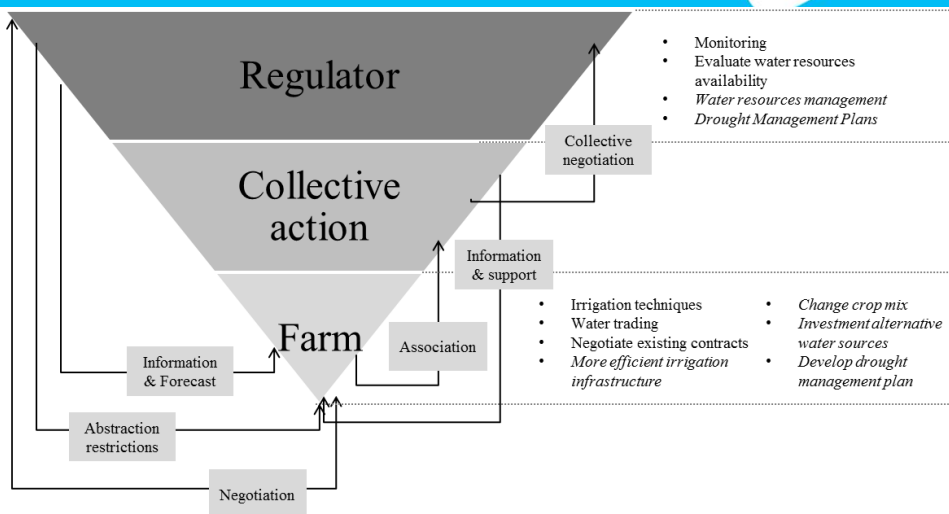
"Relations with the Agency have improved immeasurably over the last 15-20 years"

"in 2012 compare to other periods is the frequency of meetings went up. We were actually watching us week by week, both sides."

"The EA in the last period of drought they were extremely helpful sending us information, having regular meetings..."

Drought management at different levels

Cranfield
UNIVERSITY



Conclusions

Cranfield
UNIVERSITY

- Droughts have severely impacted irrigated agriculture in the UK, although the impact level seems to have decreased over time
- Irrigated agriculture has made many changes to become more efficient, coordinated and resilient. However, farmers want:
 - 1) Collaborative management of water resources
 - 2) Better forecasting of water availability and restrictions
 - 3) More flexibility in water reallocation
 - 4) Impacts to be shared across sectors
 - 5) Evidence of the actual environmental impacts of abstraction

Thank you!

d.reyvicario@cranfield.ac.uk

