Climate change – risks to Australian agriculture

CRSPI Workshop

Dr Nick Wood, Energetics | 3 & 4 September 2019

De-risking - using climate science

CBA – climate risk in agriculture - analysis project

Jan to Aug 2019

Bespoke climate change data

Detailed farm system response data

Adaptation options

Geospatial analysis workflow

Directly informed risk and opportunities

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Commodity and region combinations

Commodity region	Analytical challenge	Risk drivers	Climate data	Adaptative responses
Wheat – WA	Basic	Crop physiology	Winter rain and daily maximum temperatures Single climate model	
Beef – NC QLD	Basic	Pasture physiology	Summer and winter rains Multi-model analysis	
Dairy – Gippsland VIC	Intermediate	Pasture and animal physiology	Monthly rainfall and short duration extreme heat events – thresholds. Best case - worst case	Detailed research
Wheat – Mallee	Advanced	Crop physiology	Winter rain and short duration extreme heat events – thresholds using downscaled 5km grid data	

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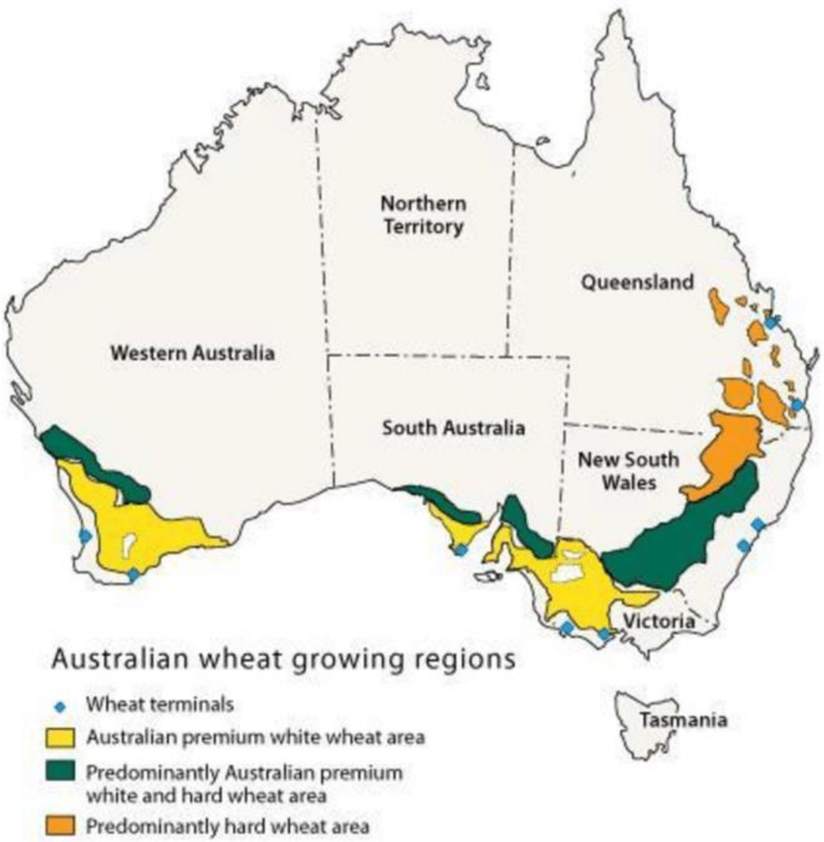
Commodities: Grains – Wheat

Wheat production

Nationally



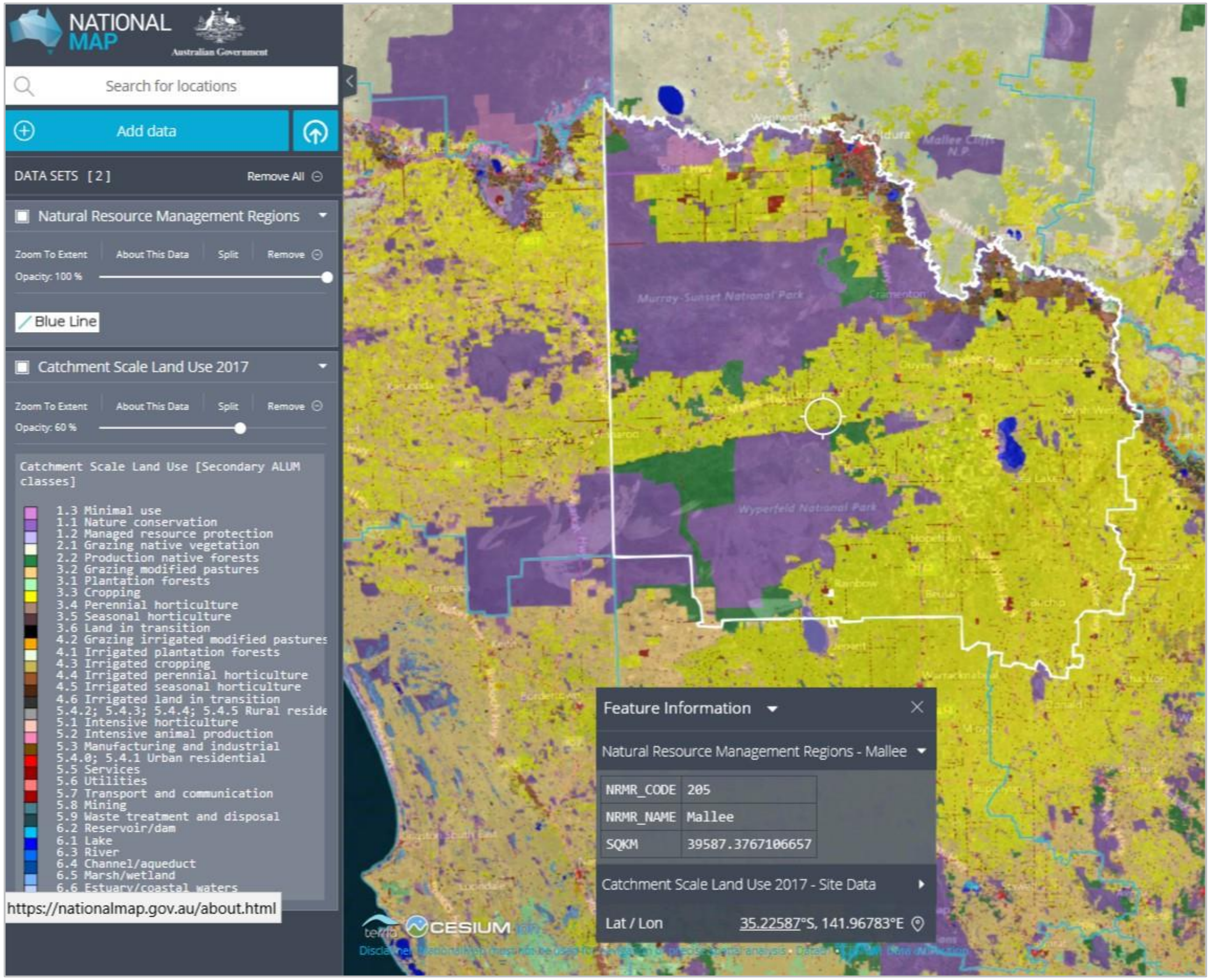
Production by state and type (kt/year)						
	NSW	VIC	QLD	SA	WA	TAS
Wheat						
2018–19 (*)	1,800	1,950	400	2,950	10,150	48
2017–18 (*)	4,495	4,000	683	4,090	7,945	30
2016–17	9,819	4,665	1,502	6,133	9,645	56
Five-year average to 2017–18	6,892	3,301	1,105	4,552	8,980	45
Barley						
Five-year average to 2017–18	1,980	1,940	272	2,071	3,564	22
Canola						
Five-year average to 2017–18	948	588	1	333	1,754	2
Oats						
Five-year average to 2017–18	353	268	21	112	667	7

ABARES Australian crop report February 2019

Note: * Indicates ABARES estimates

Wheat

Mallee



https://nationalmap.gov.au/

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Risk drivers

Temperature

- Threshold measures >32C
- Average monthly – maximum and minimum
- Growing degree days

Rainfall

- Soil moisture
- Growing season rainfall
  - April – October
  - November – March
- Lagged summer rainfall

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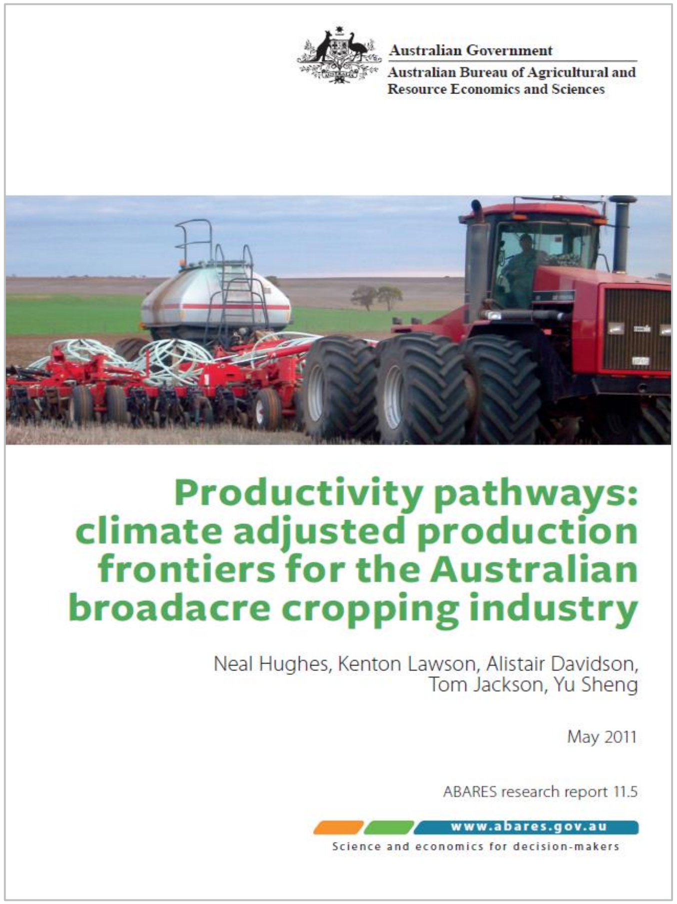
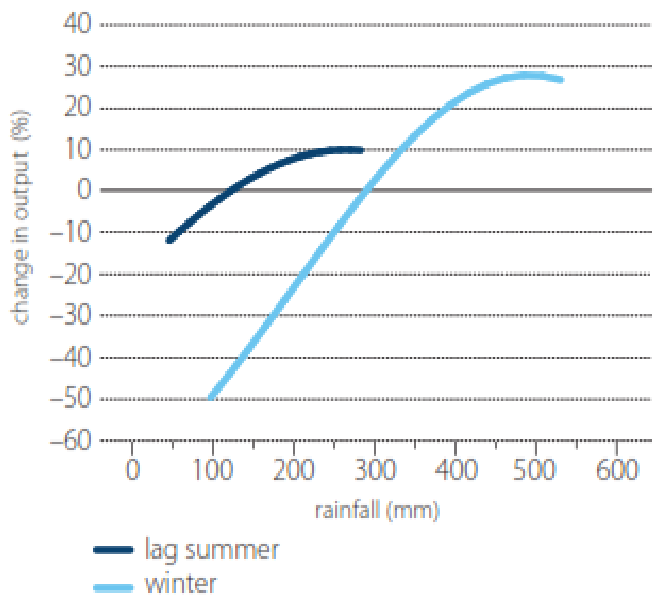
Impact on yield

No mitigation



8 Effect of winter and lagged summer rainfall on output in the southern region (model 1)



Note: Range is the 2.5 percentile to the 97.5 percentile of farm winter and lagged summer rainfall; the average winter rainfall was 291 mm and the average summer rainfall was 132 mm

[Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)](#)

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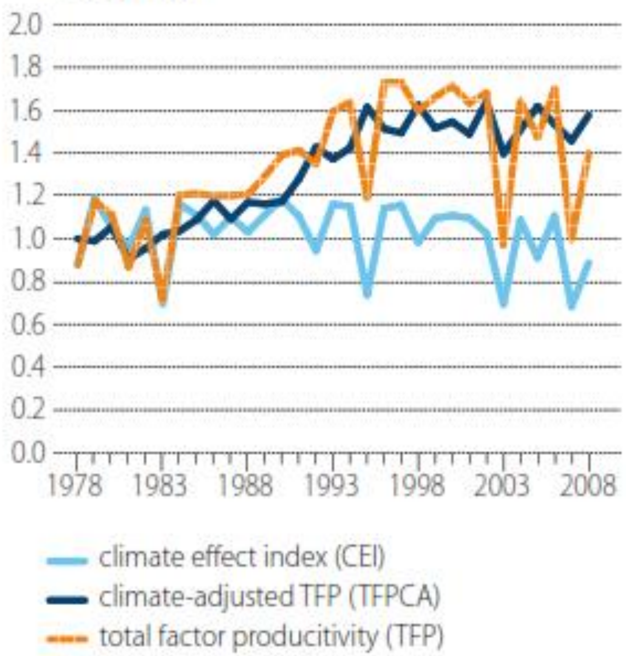
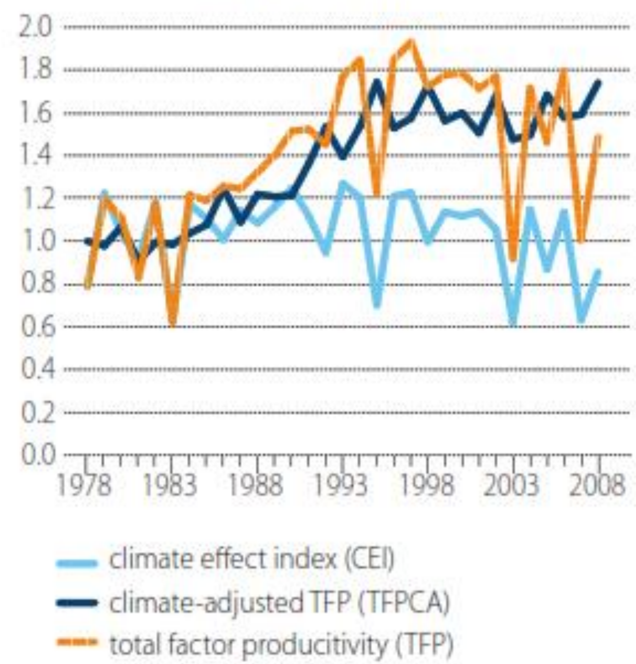
Impact on yield

In context

16 Average climate adjusted TFP for all cropping farms, 1977–78 to 2007–08



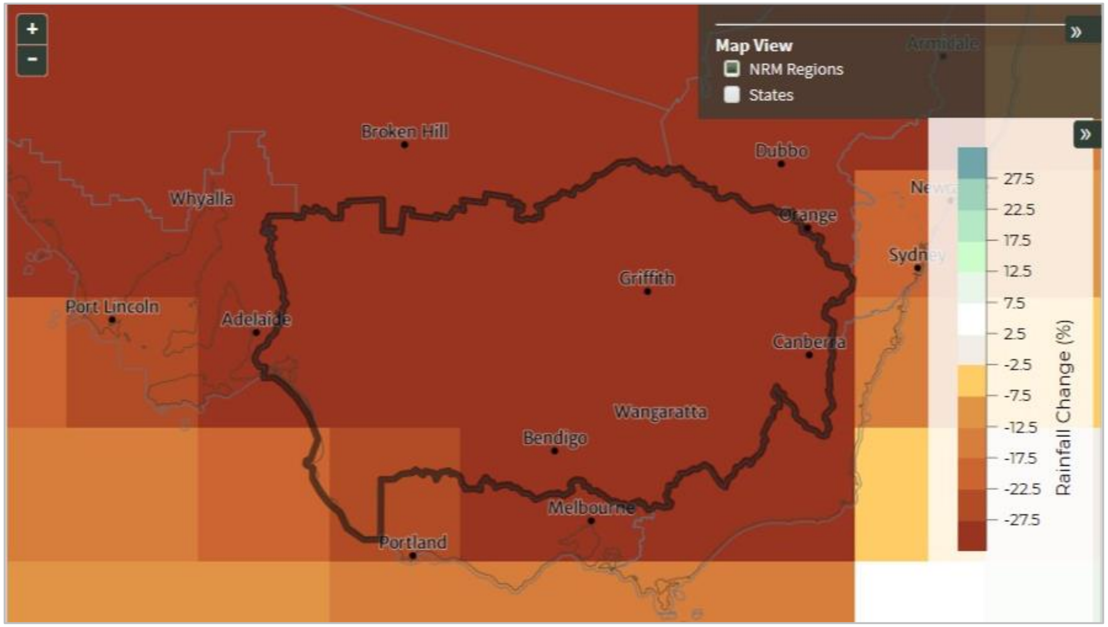
17 Average climate adjusted TFP for cropping specialist farms only, 1977–78 to 2007–08



Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)

Climate data

Rainfall – low resolution

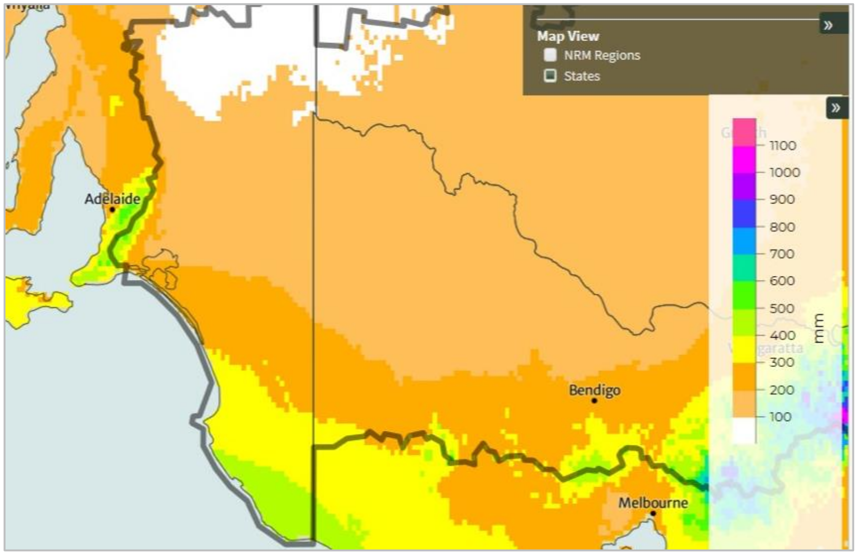


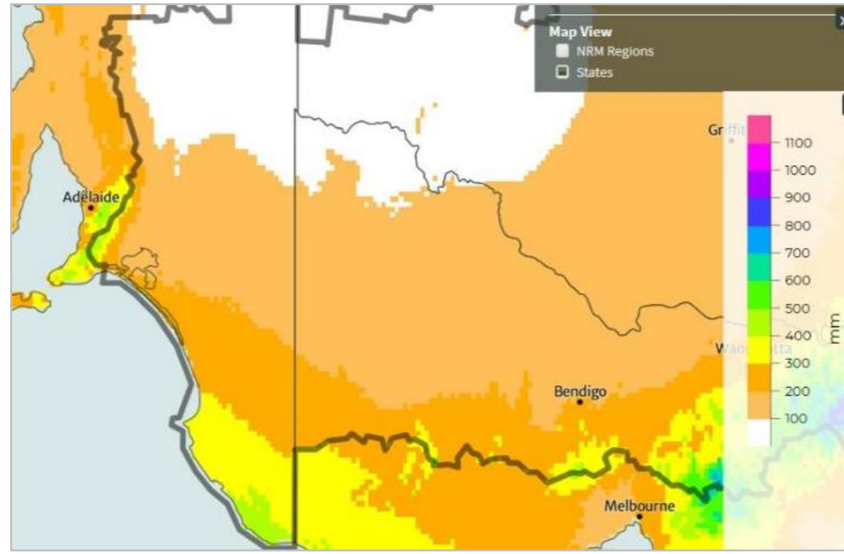
Configuration data	
Model	GFDL-ESM2M
Time period	2070
Emissions scenario	RCP 4.5 (medium)
Season	May - October
Changes relative to	1996 - 2005

https://www.climatechangeinaustralia.gov.au/en/

Climate data

Rainfall – high resolution





Configuration data	
Model	GFDL-ESM2M
Time period	**2030**
Emissions scenario	RCP 8.5 (high)
Season	May - October

Configuration data	
Model	GFDL-ESM2M
Time period	**2070**
Emissions scenario	RCP 8.5 (high)
Season	May - October

https://www.climatechangeinaustralia.gov.au/en/

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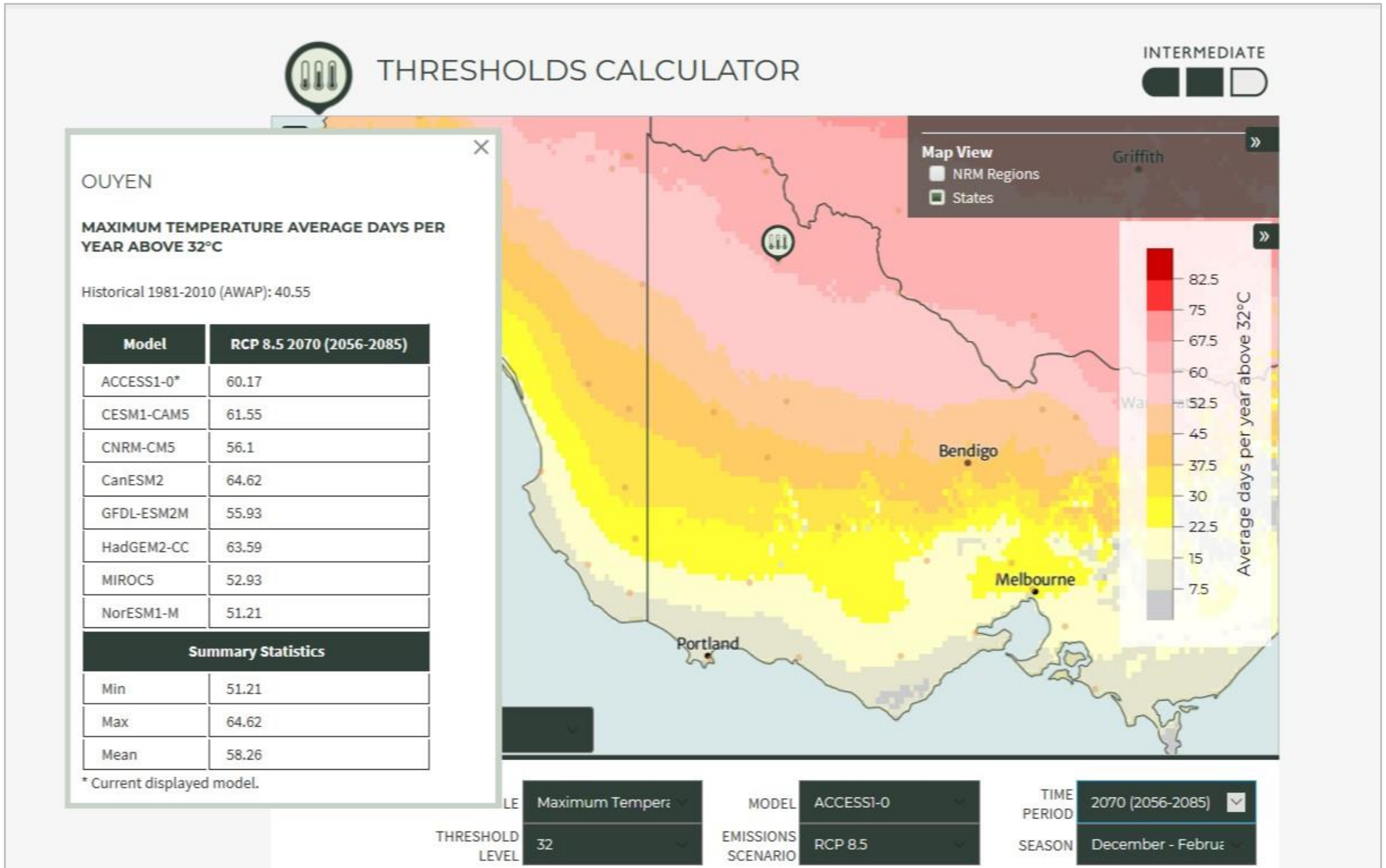
Climate data

Extreme heat days – Summer

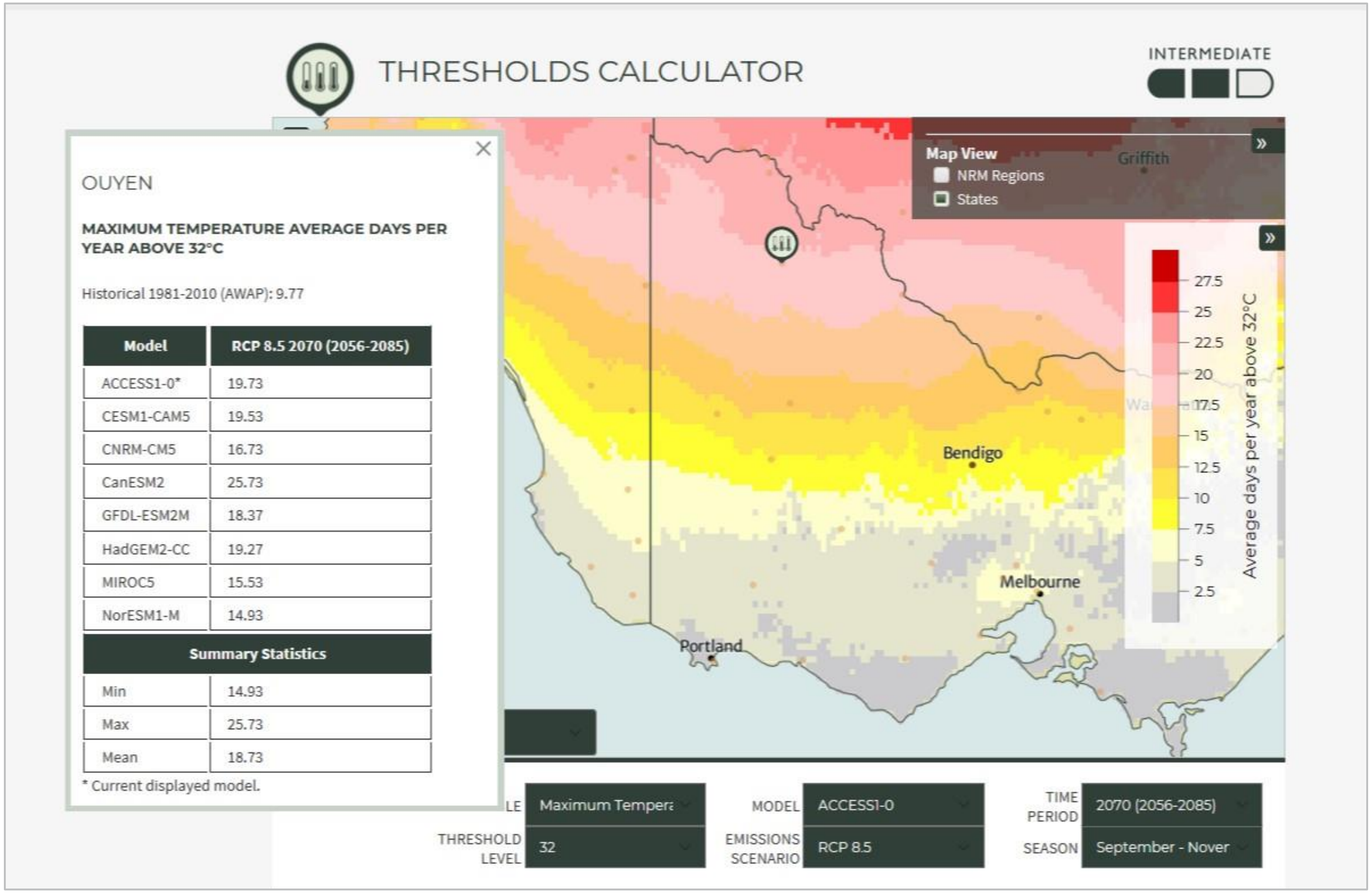


Model	RCP 8.5 2070 (2056-2085)
ACCESS1-0*	60.17
CESM1-CAM5	61.55
CNRM-CM5	56.1
CanESM2	64.62
GFDL-ESM2M	55.93
HadGEM2-CC	63.59
MIROC5	52.93
NorESM1-M	51.21
Summary Statistics	
Min	51.21
Max	64.62
Mean	58.26

https://www.climatechangeinaustralia.gov.au/en/

Climate data

Extreme heat days – Spring



Model	RCP 8.5 2070 (2056-2085)
ACCESS1-0*	19.73
CESM1-CAM5	19.53
CNRM-CM5	16.73
CanESM2	25.73
GFDL-ESM2M	18.37
HadGEM2-CC	19.27
MIROC5	15.53
NorESM1-M	14.93
Summary Statistics	
Min	14.93
Max	25.73
Mean	18.73

https://www.climatechangeinaustralia.gov.au/en/

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Agricultural response

Adaptive response options

APPROACH 1

Stop

APPROACH 2

Alter current practices

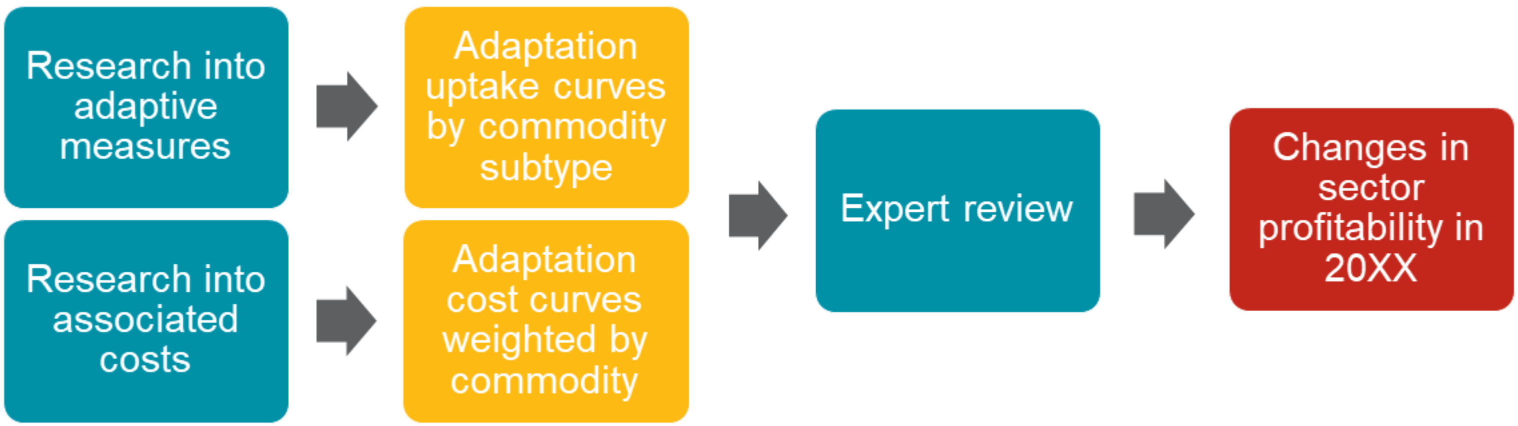
Incremental adaptation
Small adjustments to farming operations keeping the essence of the current management system in place

APPROACH 3

Do something different

Transformational adaptation
Major and non-marginal changes to farming management systems to address climate change risks

Adaptation method



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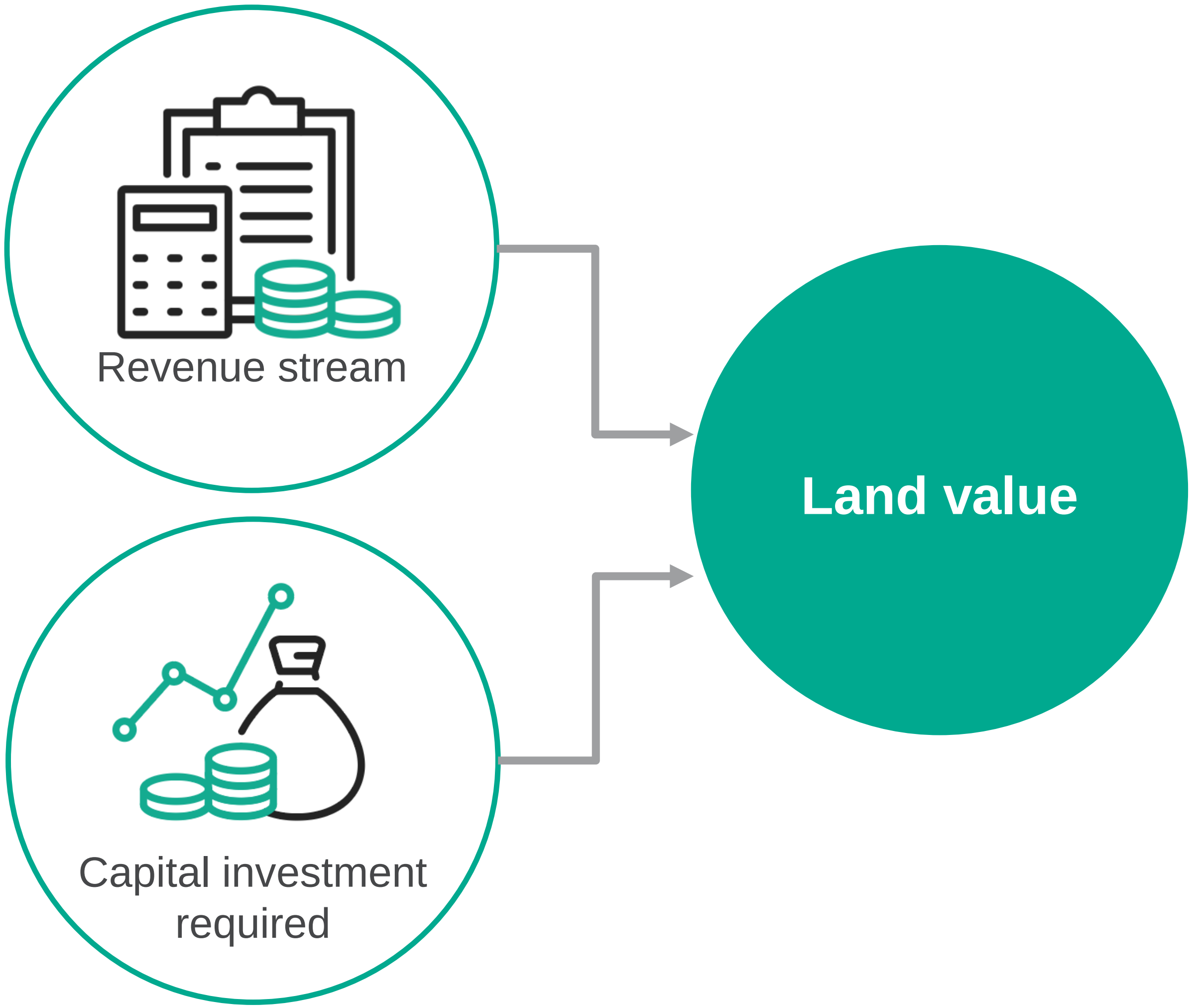
Results

Impact on yield

With mitigation



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Investors armed with climate change science

Emerging economic reality

The Economist

Costing the earth

Countries most exposed to climate change face higher costs of capital

Poor countries find themselves trapped in a vicious cycle

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Climate science armed with finance skills?

nature climate change

PERSPECTIVE

Future climate risk fro

Jakob Zscheischler[1*], Seth Westra[2], Bart J

feature

Rating climate risks to credit worthiness

Credit ratings agencies are now accounting for climate change risks in their ratings of credit worthiness. This could incentivize climate risk reduction efforts if it allows organizations access to cheaper credit. Karl Mathiesen

PERSPECTIVE

https://doi.org/10.1038/s41558-018-0175-0

nature climate change

Climate change challenges for central banks and financial regulators

Emanuele Campiglio[1,2*], Yannis Dafermos[3], Pierre Monnin[4], Josh Ryan-Collins[5], Guido Schotten[6] and Misa Tanaka[7]

The academic and policy debate regarding the role of central banks and financial regulators in addressing climate-related financial risks has rapidly expanded in recent years. This Perspective presents the key controversies and discusses potential research and policy avenues for the future. Developing a comprehensive analytical framework to assess the potential impact of climate change and the low-carbon transition on financial stability seems to be the first crucial challenge. These enhanced risk measures could then be incorporated in setting financial regulations and implementing the policies of central banks.

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Context

BANK OF ENGLAND
PRUDENTIAL REGULATION AUTHORITY

Table 1: Impacts to liabilities from physical risk for General Insurers (refer to text above for a description of each Scenario)

		Transition Risks			Physical Risks		
Sector	Assumptions	Scenario A	Scenario B	Scenario C	Scenario A	Scenario B	Scenario C
US Hurricane exposed LoBs - Hurricanes[1]	% increase in frequency of major hurricanes				5%	20%	60%
	Uniform increase in wind speed of major hurricanes				3%	7%	15%
	% increase in surface run-off resulting from increased tropical cyclone-induced precipitation (cumecs)				5%	10%	40%
	Increase in cm in average storm tide sea-levels for US mainland coastline between Texas and North Carolina. Figures exclude wave set-up and run-up.				10cm	40cm	80cm

		Transition Risks			Physical Risks		
Sector	Assumptions	Scenario A	Scenario B	Scenario C	Scenario A	Scenario B	Scenario C
UK weather exposed LoBs - flood , freeze and subsidence[1]	% increase in surface run-off resulting from increased precipitation (cumecs)				5%	10%	40%
	Uniform increase in cm in average storm tide sea-levels for UK mainland coastline.				2cm	10cm	50cm
	Increase in frequency of subsidence-related property claims using as a benchmark the worst year on record				3%	7%	15%
	Increase in frequency of freeze-related property claims using as a benchmark the worst year on record				5%	20%	40%

Key insights

The climate science shows a clear trend to an impacted agricultural industry

There is an inherent risk across the sector

How this risk manifests will depend on individual and group responses and adaptation

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