NEXUS project: exploring profitable, sustainable livestock businesses in an increasingly variable climate

National webinar

15 June 2023

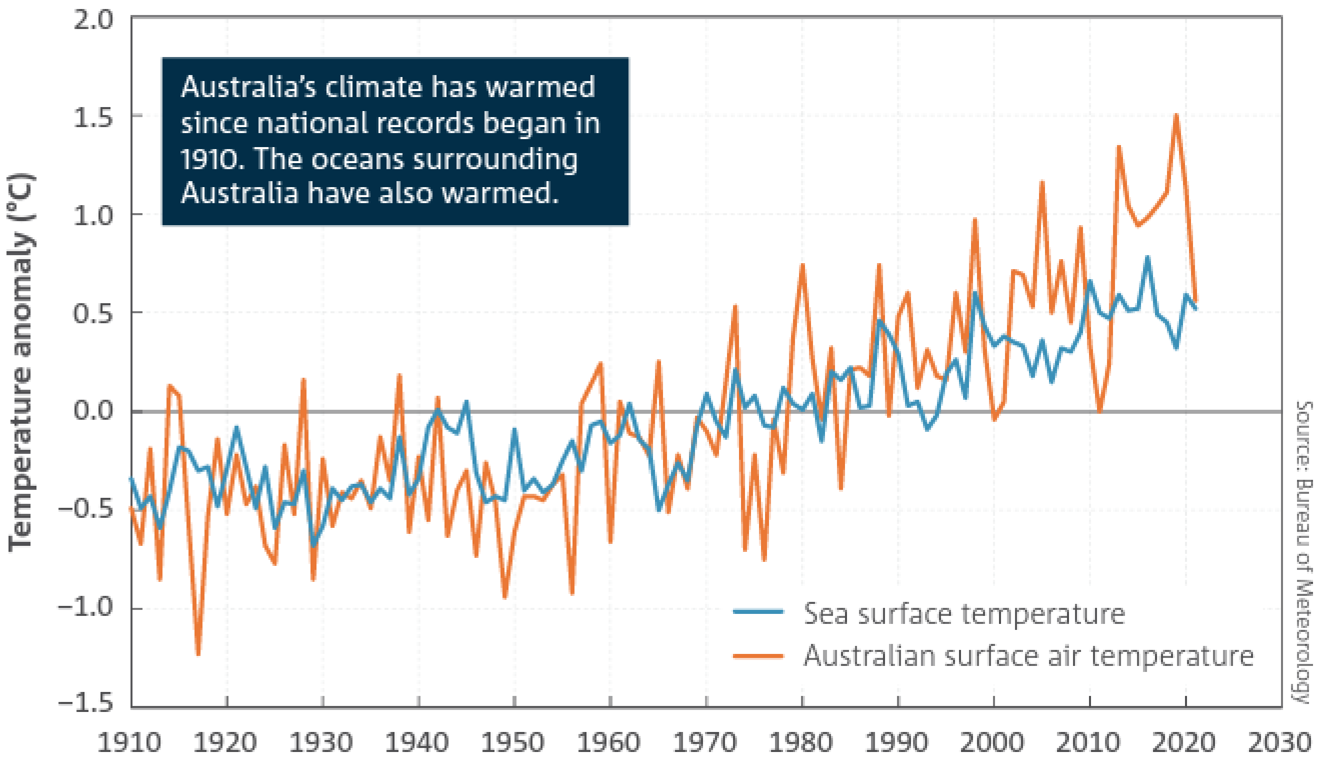
Overview

- Exploring the nexus between profitability, productivity, greenhouse gas (GHG) mitigation and carbon sequestration in an increasingly variable climate.

- Case studies from:

– Victoria and New South Wales	Brendan Cullen and Nicole Reichelt
– Tasmania	Matthew Harrison
– Central Queensland	Duc-Anh An-Vo
– Western Australia (Future Sheep)	Paul Sanford and Kevin Foster

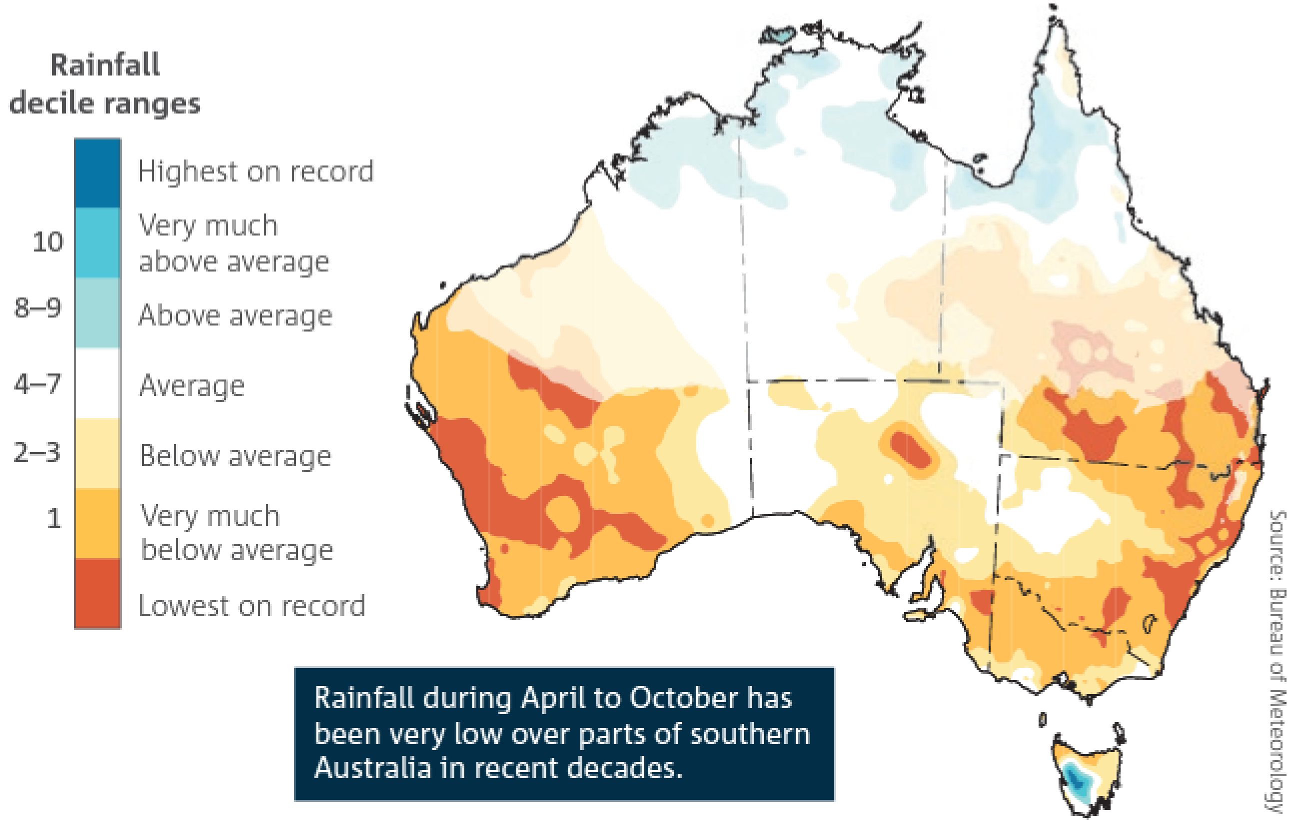
Increasing temperatures



- Temperatures have increased 1.5° C since 1910.
- Future projections:
  - Increased temperature with more hot extremes
  - Increased number of dangerous fire days, and longer fire season.

State of the Climate report 2022

Changing rainfall patterns



- April-October rainfall has declined in southern and eastern Australia.
- Future projections:
  - Continued decrease in cool season rainfall, more time in drought, but with short-duration heavy rainfall events.

State of the Climate report 2022

Reducing GHG emissions

- Industry and supply chain pressures to reduce GHG emissions

JBS:

“We care about our role in the world and our responsibility as a global food company. That’s why we're the first global meat and poultry company to commit to achieve net-zero greenhouse gas emissions by 2040.”

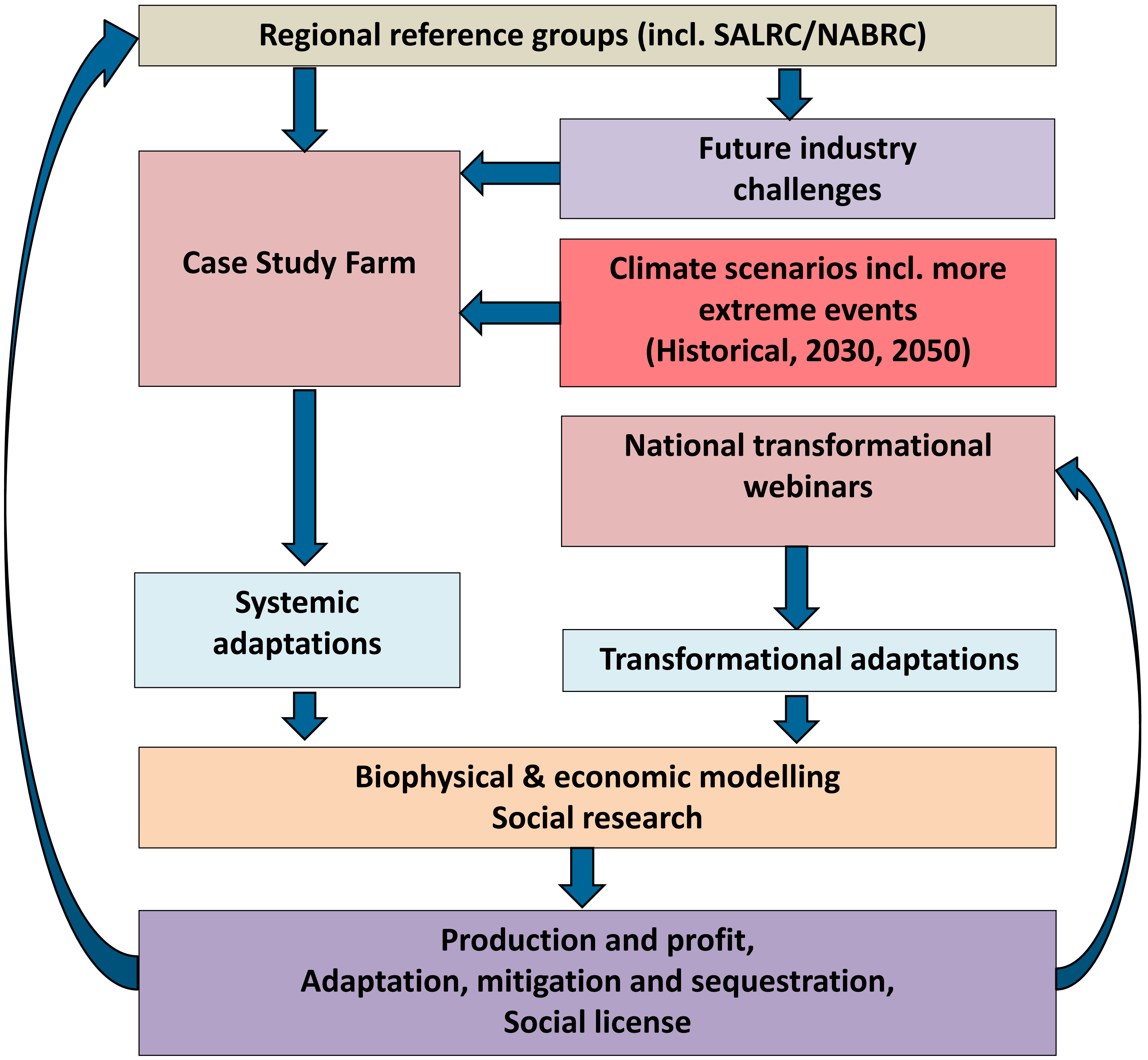
https://jbsfoodsgroup.com/our-purpose/sustainability

Meat & Livestock Australia:

“The Australian red meat industry has set a target to be carbon neutral by 2030 (CN30). This means that by 2030, Australian beef, lamb and goat production, including lot feeding and meat processing, aim to make no net release of greenhouse gas (GHG) emissions into the atmosphere.”

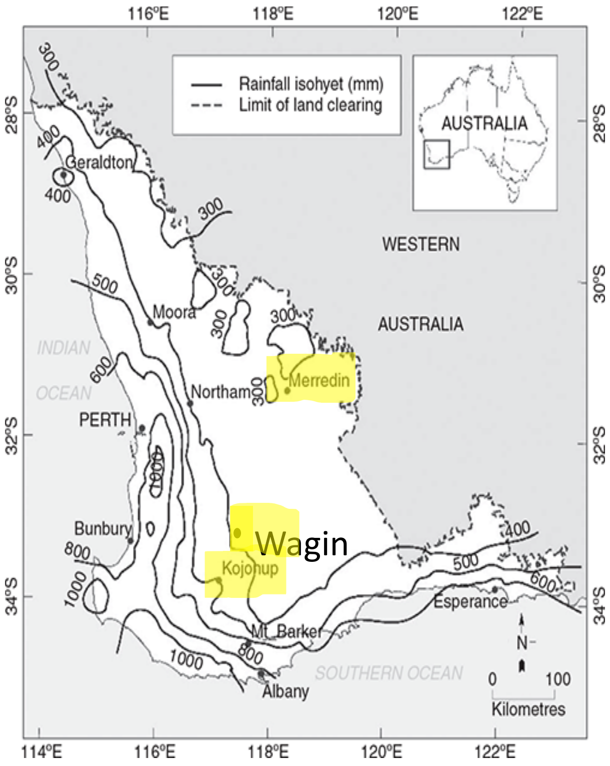
https://www.mla.com.au/research-and-development/Environment-sustainability/carbon-neutral-2030-rd/

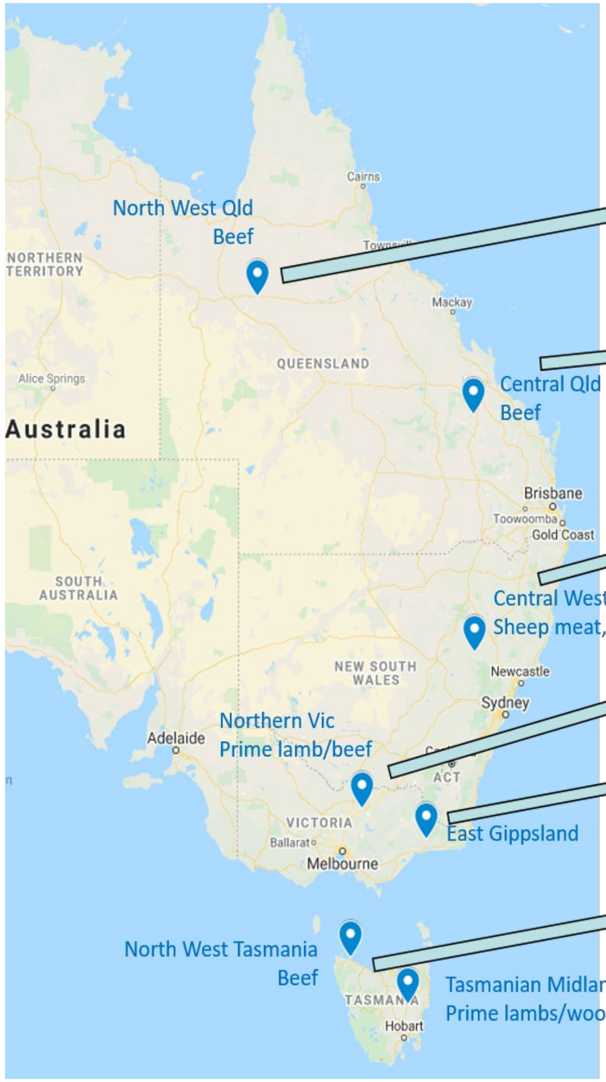
Nexus project approach



Nexus Case studies

Future Sheep project in WA





Self-replacing Bos indicus cross herd, 2,000 adult eq.

Self-replacing beef herd, 3,300 adult eq.

350 cow self-replacing Angus herd, 3000 Merino ewes

300 cow self-replacing Angus herd, 3,700 composite ewes

300 cow self-replacing Angus herd, 1,200 composite ewes

350 cow self-replacing Angus herd, weaners purchased

27,500 sheep with self-replacing prime lamb, Merino and super-fine Merino ram flocks.


Northern Queensland


East Gippsland, Victoria


North-western Tasmania


South-eastern WA

Regional reference groups

Future farm options explored

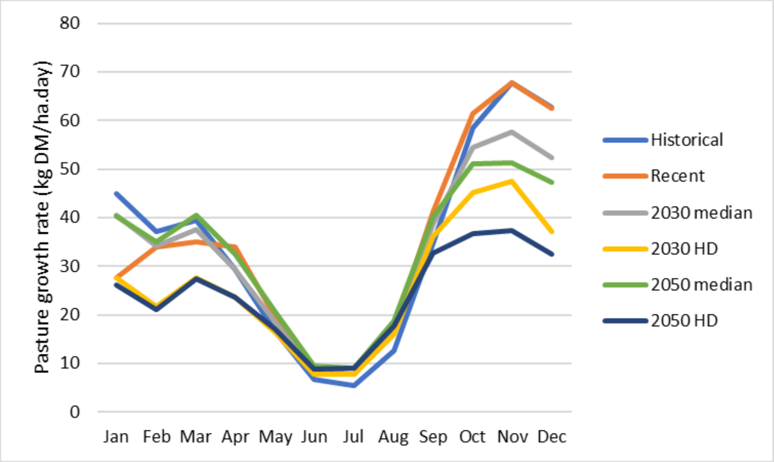
- Alternate farm scenarios:
  - Continue as is (baseline)
  - Adapt / low hanging fruit
    - a series of improvements to adapt to the changing climate.
  - Towards Carbon Neutral (TCN)
    - reducing GHG emissions through mitigation and/or sequestration.
  - Diversify and Grow
    - mange climate risk through increased scale, spatial diversification, changes to enterprise mix, accessing alternate markets.
  - Transformational
    - potential role of new research in farm systems.

Case study results:

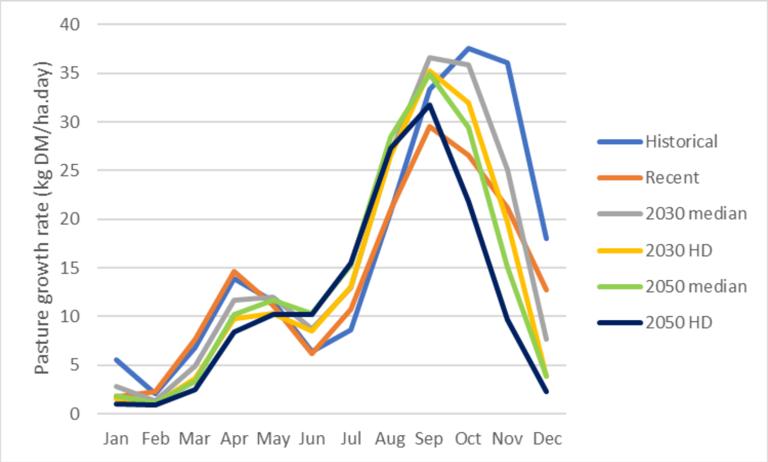
- East Gippsland
- Northern Victoria
- Upper Hunter region of New South Wales

- Project team: Brendan Cullen, Alexandria Sinnett, Nicole Reichelt, Richard Eckard, Margaret Ayre, Ruth Nettle, Paul Cheng, Saranika Talukder, Bill Malcolm.

Impact of climate on pasture growth rate



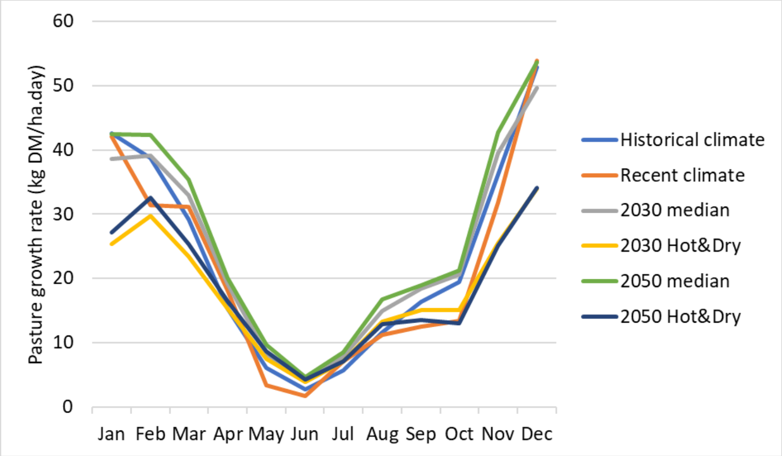
East Gippsland – phalaris, sub clover, lucerne



N Vic. – phalaris, sub clover

Climate scenarios:

- Historical 1986-2005
- Recent 2000-2019
- 2030 median change
- 2030 hot and dry (HD)
- 2050 median change
- 2050 hot and dry (HD)



NSW – tropical grass, sub clover

Adapt option

- Key components:
  - Pasture improvement:
    - Gippsland: sowing summer-active species mixtures
    - N Vic.: maximising production in reliable part of growing season
    - NSW: tropical species
  - Improved livestock reproduction (eg 15% increase in lambing)
  - Improved livestock growth rates
  - Earlier lambing and selling times
  - Plant trees in unproductive areas of farm

Towards Carbon Neutral & Diversify + Grow

- Towards Carbon Neutral components:
  - Reduce methane emissions through supplementation for earlier finishing and feed additive (3-NOP)
  - Forestry (Vic) or environmental plantings (NSW) on ≈20% farm area.

- Diversify and Grow
  - Increase scale of livestock production by purchasing new land (sometimes in different area).

Net Farm GHG emissions

Northern Vic example

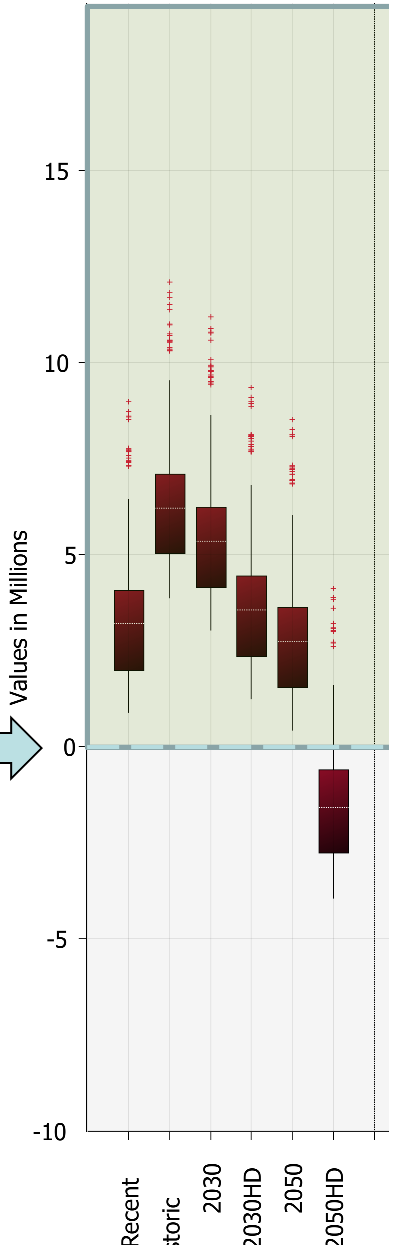
Option	Net farm GHG emissions (t CO_2e/farm)	Emissions intensity (kg CO_2e /kg liveweight sold, or wool sold (greasy))		
		Sheep meat	Wool	Beef
Base farm	3,510	7.6	27.4	9.9
Adapt	3,551	7.2	26.1	9.3
Grow and diversify	5,139	Not calculated		
Towards Carbon Neutral	-291	0	0	0

Economic analysis

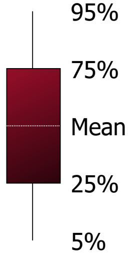
Northern Victoria example

7% per annum return on capital

Base Farm
$12.5m



Future climates add additional costs to business.

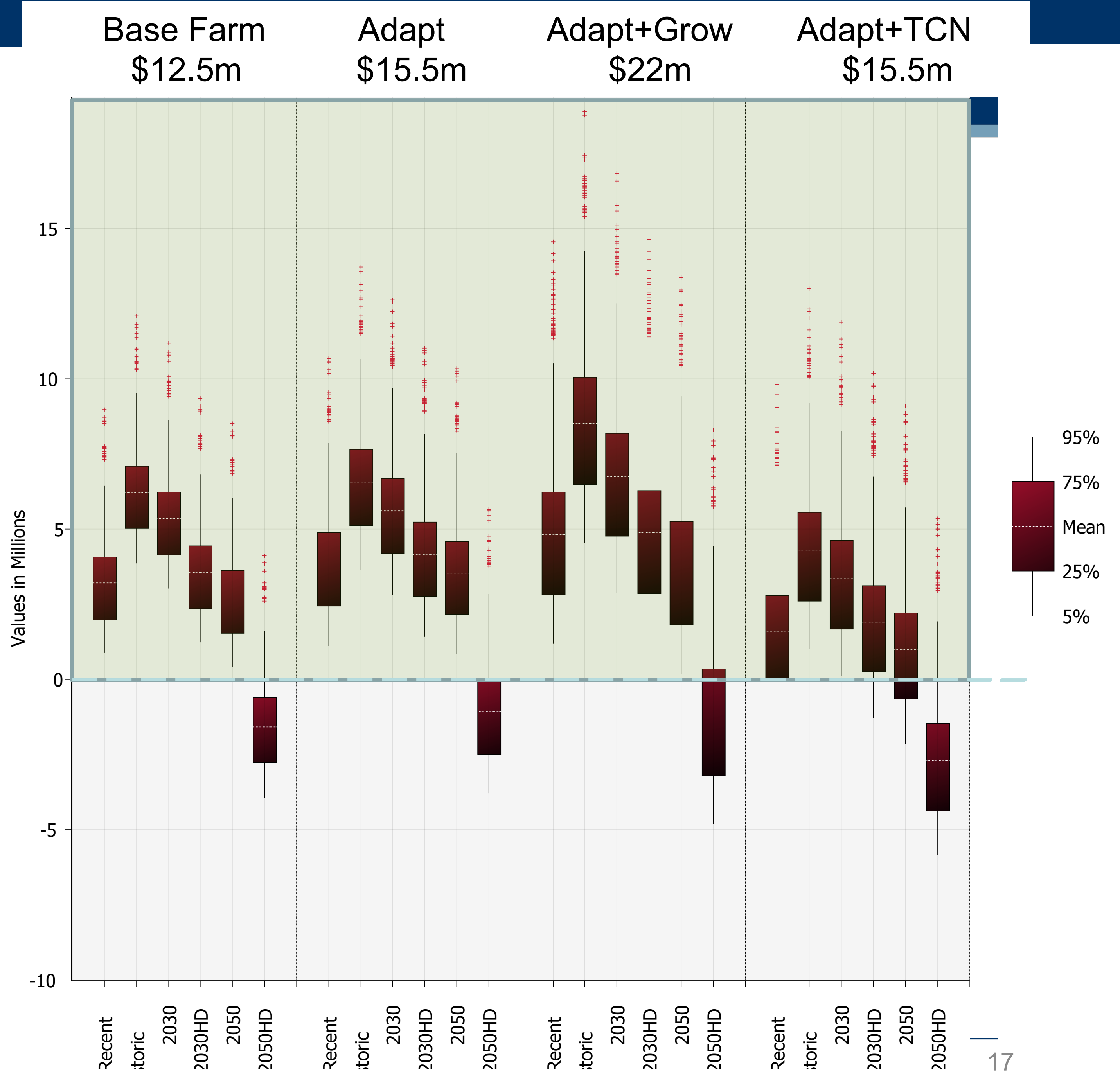


Northern Victoria example

All the options are better than an alternative use of capital earning 7% p.a. nominal (except if 2050HD climate)

If capital is unconstrained, then improving the existing farm business, buying land next door, buying land in a different climate area and buying livestock is likely to add the most to wealth but greater risk

Reducing GHG emissions will cost the farm business. The TCN future scenario is likely to be less profitable than the alternative scenarios



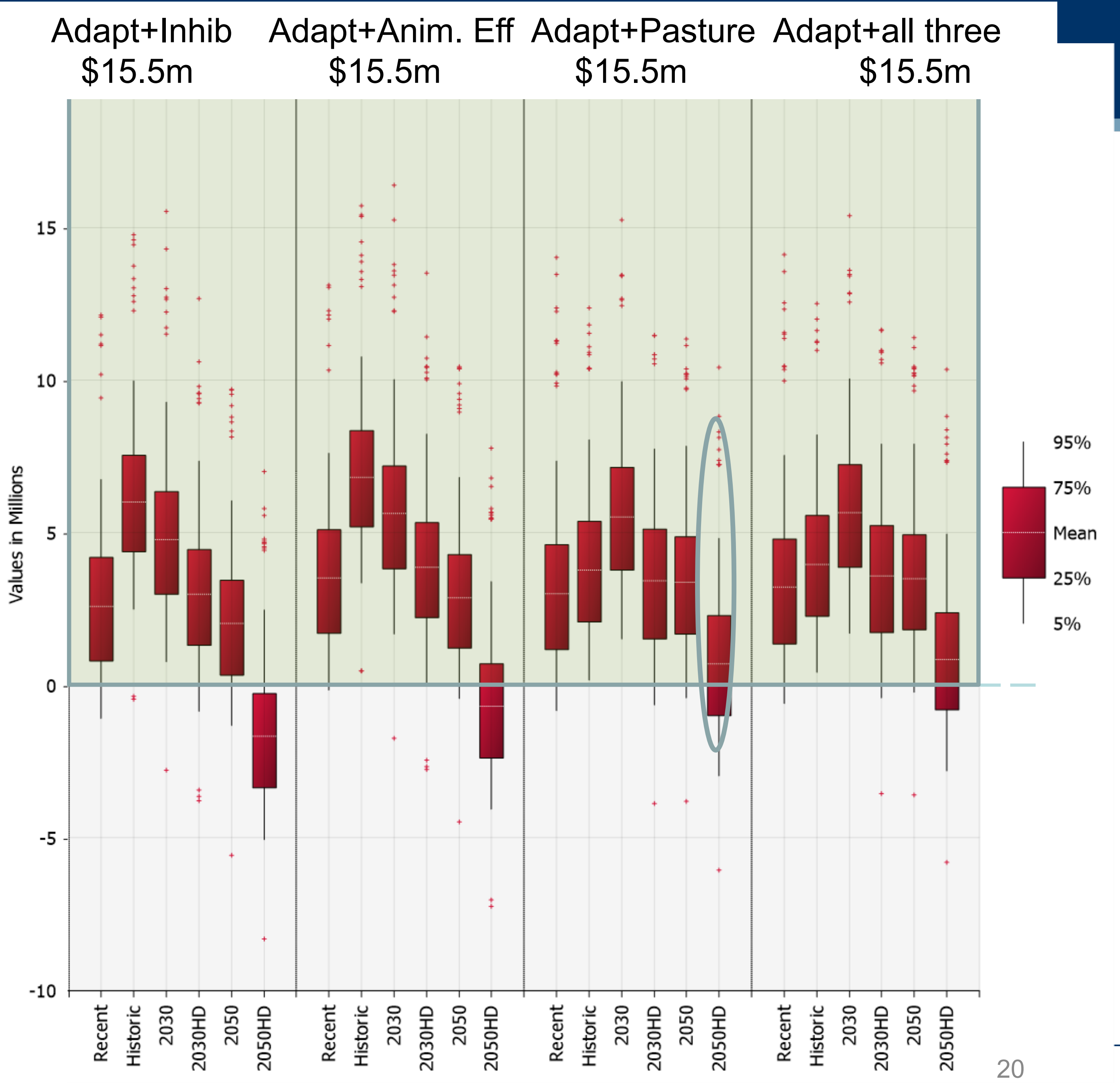
New technologies (N Vic example)

- Methane inhibitor slow-release bolus – 80% methane reduction.
- Animal efficiency – 10% reduced mature size.
- Pasture – summer active species suited to climate and soil type.
- All three combined.

Summary of GHG emissions

Option	Net farm GHG emissions ($t\ CO_2e$/farm)	Emissions intensity ($kg\ CO_2e$ /kg liveweight sold, or wool sold (greasy))		
		Sheep meat	Wool	Beef
Adapt	3,551	7.2	26.1	9.3
Adapt plus methane inhibitor	1090	2.1	7.6	2.7
Adapt with Animal genetics	3347	6.6	23.9	9.0
Adapt plus New pasture	3818	7.2	26.9	9.2
Adapt plus Pasture, Animal and Inhibitor	1305	1.9	7.0	2.6

A new pasture variety increases the likelihood that this farm will earn 7% p.a. return in a 2050HD climate



Conclusions

- Some regional differences:
  - Northern NSW may be less impacted than Victoria due to less rainfall reduction, and feedbase options.
- Adapt option – can overcome some of negative climate impacts but not the more extreme ‘hot and dry’.
- Grow option looks profitable but with added risk.
- TCN adds additional cost to business.
- New technologies will have a key role in adaptation and reducing GHG emissions.

Social research - introduction

Key research questions

- RQ1) What are the human and social capacities and capabilities required to put the adaptive pathways into practice at the farm and regional scale?

- RQ2) What are the opportunities and challenges with implementing the adaptation pathways by the red meat industry?

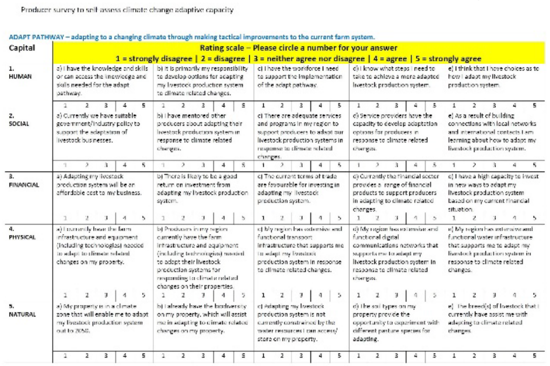
- RQ 3) What are the key elements of an enabling environment to support climate related adaptive and transformative decision making in red meat production?

Social research methods

> Focus group discussions during the reference group meetings (15+ meetings)

> Questionnaire to self-assess adaptive capacity for implementing the Nexus adaptation pathways

(n= 14 responses)



Producer survey to self assess climate change adaptive capacity

ADAPT PATHWAY – adapting to a changing climate through making tactical improvements to the current farm system.

Capital	Rating scale – Please circle a number for your answer 1 = strongly disagree | 2 = disagree | 3 = neither agree nor disagree | 4 = agree | 5 = strongly agree				
1. HUMAN	a) I have the knowledge and skills or can access the knowledge and skills needed for the adapt pathway. 1 2 3 4 5	b) It is primarily my responsibility to develop options for adapting my livestock production system to climate related changes. 1 2 3 4 5	c) I have the workforce I need to support the implementation of the adapt pathway. 1 2 3 4 5	d) I know what steps I need to take to achieve a more adapted livestock production system. 1 2 3 4 5	e) I think that I have choices as to how I adapt my livestock production system. 1 2 3 4 5
2. SOCIAL	a) Currently we have suitable government/industry policy to support the adaptation of livestock businesses. 1 2 3 4 5	b) I have mentored other producers about adapting their livestock production system in response to climate related changes. 1 2 3 4 5	c) There are adequate services and programs in my region to support producers to adapt our livestock production systems in response to climate related changes. 1 2 3 4 5	d) Service providers have the capacity to develop adaptation options for producers in response to climate related changes. 1 2 3 4 5	e) As a result of building connections with local networks and international contacts I am learning about how to adapt my livestock production system. 1 2 3 4 5
3. FINANCIAL	a) Adapting my livestock production system will be an affordable cost to my business. 1 2 3 4 5	b) There is likely to be a good return on investment from adapting my livestock production system. 1 2 3 4 5	c) The current terms of trade are favourable for investing in adapting my livestock production system. 1 2 3 4 5	d) Currently the financial sector provides a range of financial products to support producers in adapting to climate related changes. 1 2 3 4 5	e) I have a high capacity to invest in new ways to adapt my livestock production system based on my current financial situation. 1 2 3 4 5
4. PHYSICAL	a) I currently have the farm infrastructure and equipment (including technologies) needed to adapt to climate related changes on my property. 1 2 3 4 5	b) Producers in my region currently have the farm infrastructure and equipment (including technologies) needed to adapt their livestock production systems for responding to climate related changes on their properties. 1 2 3 4 5	c) My region has extensive and functional transport infrastructure that supports me to adapt my livestock production system in response to climate related changes. 1 2 3 4 5	d) My region has extensive and functional digital communications networks that supports me to adapt my livestock production system in response to climate related changes. 1 2 3 4 5	e) My region has extensive and functional water infrastructure that supports me to adapt my livestock production system in response to climate related changes. 1 2 3 4 5
5. NATURAL	a) My property is in a climate zone that will enable me to adapt my livestock production system out to 2050. 1 2 3 4 5	b) I already have the biodiversity on my property, which will assist me in adapting to climate related changes on my property. 1 2 3 4 5	c) Adapting my livestock production system is not currently constrained by the water resources I can access/ store on my property. 1 2 3 4 5	d) The soil types on my property provide the opportunity to experiment with different pasture species for adapting. 1 2 3 4 5	e) The breed(s) of livestock that I currently have assist me with adapting to climate related changes. 1 2 3 4 5

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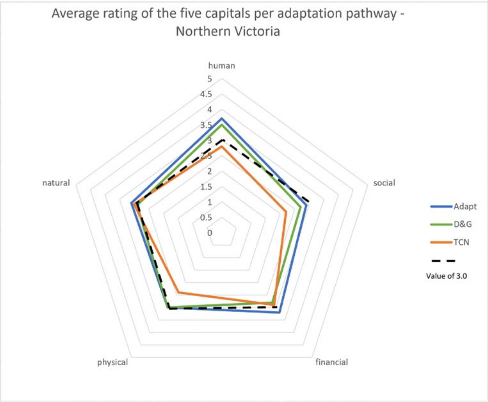
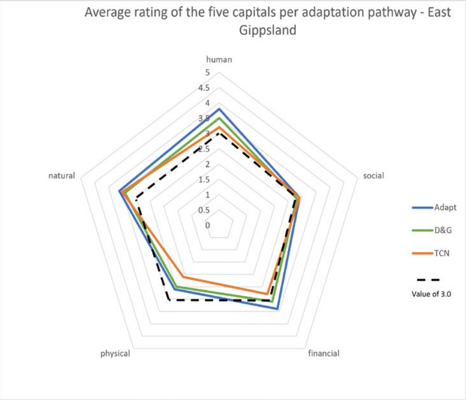
Social research – key findings

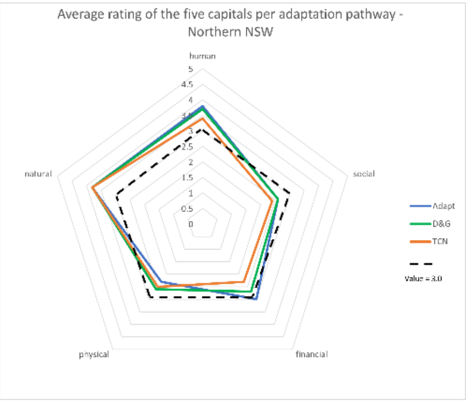
Focus group discussions – general sentiment

Pathway	Overall sentiment
Adapt	***"Doable"*** - achievable management practices that make good business and production sense for the whole industry.
Diversify and Grow	***"Desirable"*** - attractive pathway, but external factors can determine feasibility and will not be an option for whole industry.
Towards Carbon Neutral	***"An inevitable change challenge"*** - currently considered a mostly unworkable pathway whether it be viewed as an obligatory change, business cost or opportunity.
Transformational	***"Potential for significant benefits"*** - general interest in applying technological innovations.

Questionnaire – adaptive capacity







Key messages:

- less capacity to implement the towards carbon neutral pathway
- implementing the different Nexus adaptation pathways is likely to draw on both generic and specific skillsets, knowledge and abilities
- importance of investing in building the physical, financial and social capital of livestock production regions for climate change adaptation and mitigation

Social research – implications/future projects

Producer capability to implement one pathway does **not** mean having the skills and capabilities to implement other adaptation and mitigation pathways

Building extension and advisory services to cater to the specific needs of each adaptation and mitigation pathway, as well as the ability to integrate support across multiple pathways.

Support for adaptation/mitigation may be best designed not as a single discrete pathway but as an individualised ‘package’ of adaptation activities

Nexus project feedback:

Being stimulated to engage with “bigger picture” thinking about how to adapt to broader challenges

Learning what an improved farm system could look like in the future

Project has validated what producers have been doing (adapting) and need to continue doing into the foreseeable future.

Producers can’t respond solely strategically; producers also need to have the ability/options for tactical decisions and actions. Nexus project tended to focus on the strategic, not the tactical

Features for future Nexus-like projects:

- Tracking a case study of a farm implementing strategies to be carbon neutral i.e. “watch it happening”
- Greater focus on extreme weather events
- Greater focus on identifying what the decision points are for each adaptation pathway and what options are available at these various decision points in relation to each climate scenario i.e. how to make a good adaptation decision
- More focus on the triple bottom line in adaptation and mitigation

University of Melbourne, Key Nexus project contacts:

Associate Professor Brendan Cullen, email: bcullen@unimelb.edu.au

Ms Nicole Reichelt, email: reichelt@unimelb.edu.au

NEXUS Project in Tasmania

Matthew Harrison, Karen Christie, Franco Bilotto, Nicoli Barnes, Bill Malcolm, Lydia Turner, Alison Hall
University of Tasmania
June 2023

Case study 1: Campbell Town, Midlands, 580 mm/year

Case study 2: Stanley, NW Tasmania, 940 mm/year

Beneficial impacts of a changing climate for Tasmania

- Temperatures increased by 6% by 2030 and 11% by 2050, mostly in late autumn and early spring
- Rainfall declined by 4-10%, especially during winter (win) but also spring (contract growing season)
- Pasture production benefitted from warmer winters, flattening high spring growth rates
- Lamb mortality declined under warmer winters/springs
- Future climate impacts on Tasmanian livestock production appear modest, or even beneficial, but
- Greater agility in management needed for resilience to extreme events

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Rural

Carbon sequestration to plummet by 2050

New research is bad news for soil carbon markets

Kate Dowler

A new university study has destroyed the idea that soil carbon sequestration will be the silver bullet to reduce Australia's greenhouse gas emissions.

In fact, a warming climate will mean that the soil's ability to retain soil carbon will be diminished over time, making soil carbon markets a "dangerous" place for farmers, a leading independent scientist says.

The University of Melbourne and University of Tasmania study has found that within 30 years, soil organic carbon sequestration rates will have "declined by 45-133 per cent, heralding dire ramifications for nations aspiring to capitalise on enhanced soil carbon sequestration as an avenue for emissions mitigation".

University of Tasmania's systems modelling team leader Associate Professor Matthew Harrison said findings of a multidisciplinary research ...

Soil carbon markets face hot threat from climate change

ATTN: WOOLGROWERS

Soil carbon sequestration reduced by 45-133% by 2050, due to warmer temperatures, greater soil respiration, lower pasture growth

Adaptation-mitigation bundles

- Four thematic adaptation-mitigation bundles imposed onto the baseline:
- **Low hanging fruit (LHF)** simple, immediate and reversible changes suggested by RRG
- **Towards carbon neutral (TCN):** aim to reduce year on year GHG emissions (carbon sequestration plus GHG emissions mitigation)
- **Income diversification:** aim to diversify income streams and climate exposure (ie shift part of enterprise to a new area)
- **Transformational**: **what is the cost of a carbon neutral farm?** We modelled several individual interventions and are combining them to reach net-zero. Compared cost of each combination with the cost of purchasing ACCUs as offsets.

Adaptation-mitigation bundles

- Historical (1986-2005)
- Baseline farm at 2030 and 2050

- Increase rooting depth by 10% for available pastures
- Increase soil fertility by 3% for available paddocks
- Improved animal genetic feed conversion efficiency by 10% (2030) or 15% (2050)
- Shift forward calving date and target higher liveweight (LW) for steers and heifers
- Small increase in stocking rate

Low hanging fruit

- Methane vaccine - 30% of livestock on farm
- Planting trees - buy 50 ha land for planting trees
- Renovate all available perennial ryegrass pastures with lucerne

Towards carbon neutral

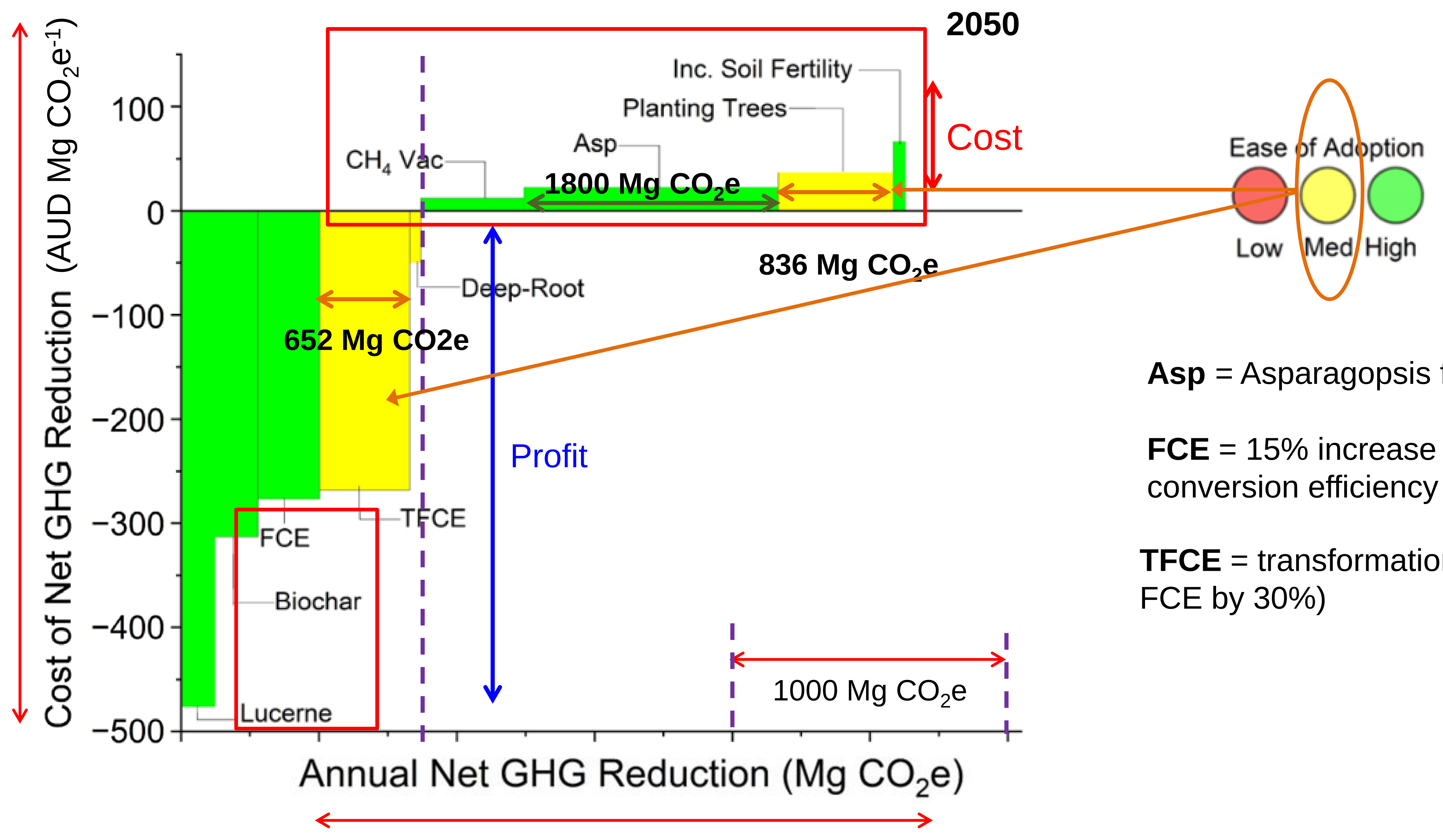
- Lease part of land to wind turbine company
- Buy and manage an additional farm in north-eastern Tasmania (750 ha)

Income diversification

- Asparagopsis feed supplement to reduce methane – 80% weaned stock, no LW change
- Feeding biochar feed supplement to weaned stock – LW gain for all young stock
- 20% (2030) or 30% (2050) improvement in genetic feed conversion efficiency

Transformational

Trade-offs between mitigation and cost by 2050 (MACC analysis)



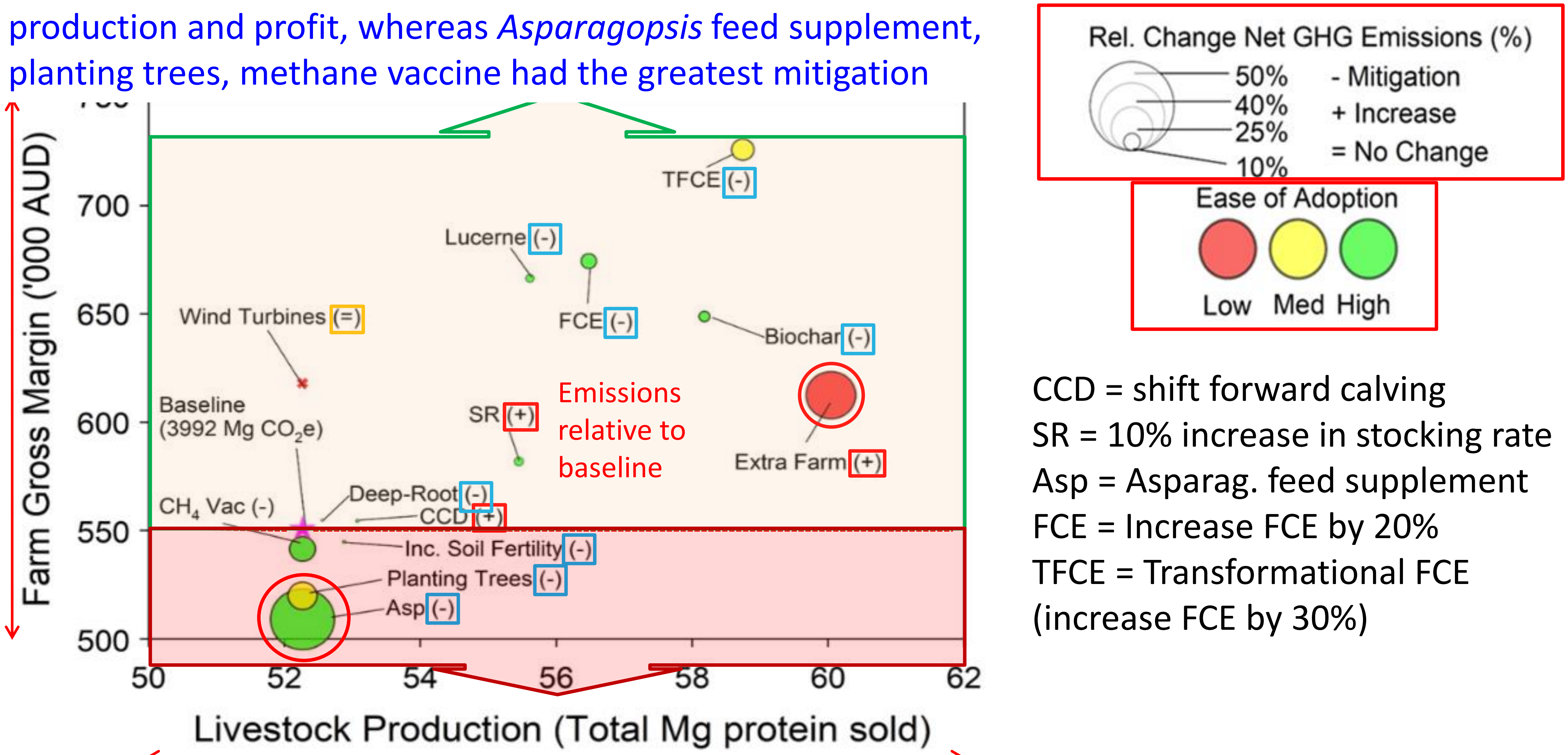
Asp = Asparagopsis feed supplement

FCE = 15% increase in feed conversion efficiency

TFCE = transformational FCE (increase FCE by 30%)

Trade-offs between productivity, profit, greenhouse gas mitigation

TFCE and purchasing extra farm greatest influence on production and profit, whereas *Asparagopsis* feed supplement, planting trees, methane vaccine had the greatest mitigation



CCD = shift forward calving

SR = 10% increase in stocking rate

Asp = Asparag. feed supplement

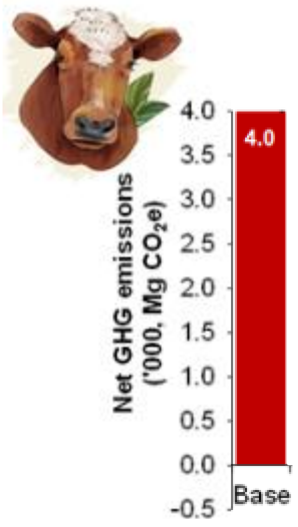
FCE = Increase FCE by 20%

TFCE = Transformational FCE (increase FCE by 30%)

1 Mg = 1 tonne

100 kg liveweight sold = 18 kg protein

What does it cost to transition to net zero?



Path 1

TFCE

- Baseline=4.0 kt CO_2e, GM= $550K
- Do nothing and purchase GHG credits; GM down $231K (cost $319K)
- Asparagopsis reduces to 2.1 kt CO_2e
- Buying residual GHG as credits and lower GM compared to base, GM= $337K (cost $223K)
- Asp+trees reduces to ~1.3 kt CO_2e
- Buying residual GHG credits, GM= $373K
- **Asp+trees+Luc (CN3) down to 1.0 kt CO2e**
- **Needs some carbon credits, GM=$514K**
- **Planting more trees to achieve net zero (CN4)**
- **GM = $571K (selling credits)**

Net Emissions | Net Mitigation | Sink | Buy Credits | Sell Credits | GM (bought credits) | GM (sold credits)

CN1= Asp+ P. Trees (50ha)+TFCE

CN2= Asp+ P. Trees (85ha)+TFCE

CN3= Asp+ P. Trees (50ha)+Lucerne

CN4= Asp+ P. Trees (85ha)+Lucerne

But wider social factors influence adoption

- Even when some interventions were prospective in terms of profit, production, and GHG emissions, wider factors influenced adoption
- Impacts of interventions on stewardship of the land and people, including intergenerational sustainability also important
- Ability to perceive 'truth' in complex, diverse and sometimes contradictory knowledge
- Acting individually or collaboratively – partnerships with learned people
- Dealing with risk and uncertainty, particularly that related to markets
- Transformational solutions seen as those changes resulting in 'winning big and failing well', balancing risk, profit, production, practicalities

Further information

Carbon, cash, cattle and the climate crisis:

https://www.researchgate.net/publication/369440724_Carbon_cash_cattle_and_the_climate_crisis

Costs of transitioning to net-zero emissions under future climates:

https://www.researchsquare.com/article/rs-2939816/v1

Concluding remarks

- **Modest, even beneficial** impacts of climate change to 2050 in Tasmania
- **Soil carbon sequestration likely to decline** under future climates
- **Trade-offs between production, profit, mitigation:** TFCE and purchasing extra farm greatest influence on production and profit, whereas *Asparagopsis* feed supplement, planting trees, methane vaccine had the greatest mitigation
- Influence of farm system intervention greater than effects of climate change
- Cost of purchasing carbon credits to offset all farm emissions was greatest (**disincentive to offset, incentive to inset**)
- Multiple pathways to net-zero. Pathways that include interventions enabling productivity co-benefit generally had lower economic cost
- **Planting trees has greater effect** on farm emissions than soil carbon sequestration
- Interventions that **reduce enteric methane, sequester carbon and enable productivity co-benefit** more profitable under future climates
- **Knowledge, skills and information** required for adoption can prevent impact, even when an intervention has triple bottom line benefit

Associate Professor Matthew Harrison
Tasmanian Institute of Agriculture
Matthew.Harrison@utas.edu.au
0437 655 139

NEXUS Project Webinar: Central Queensland Case Study

Duc-Anh An-Vo

David Cobon

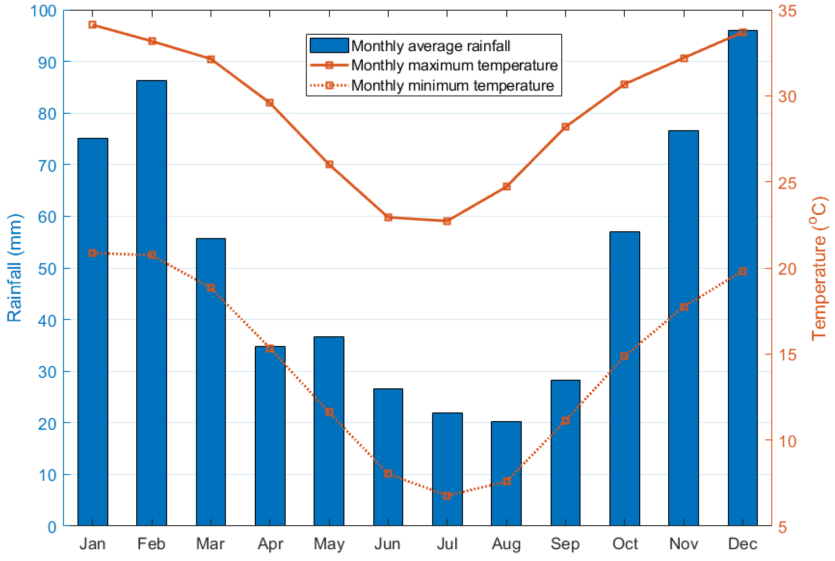
Jo Owen

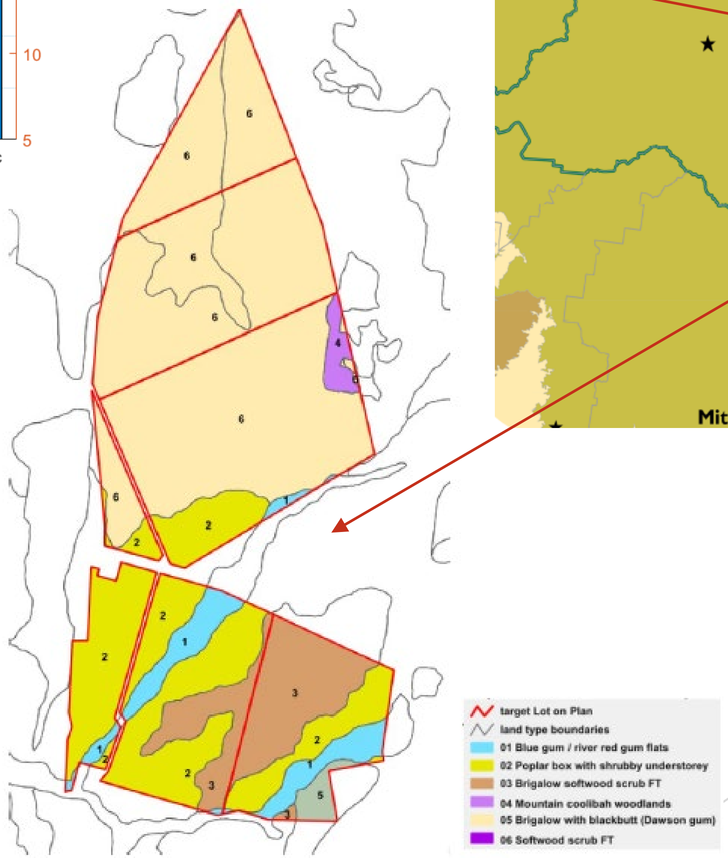
Centre for Applied Climate Sciences, University of Southern Queensland (UniSQ)

Adam Liedloff

CSIRO Land and Water

Central Queensland (CQ) beef enterprise





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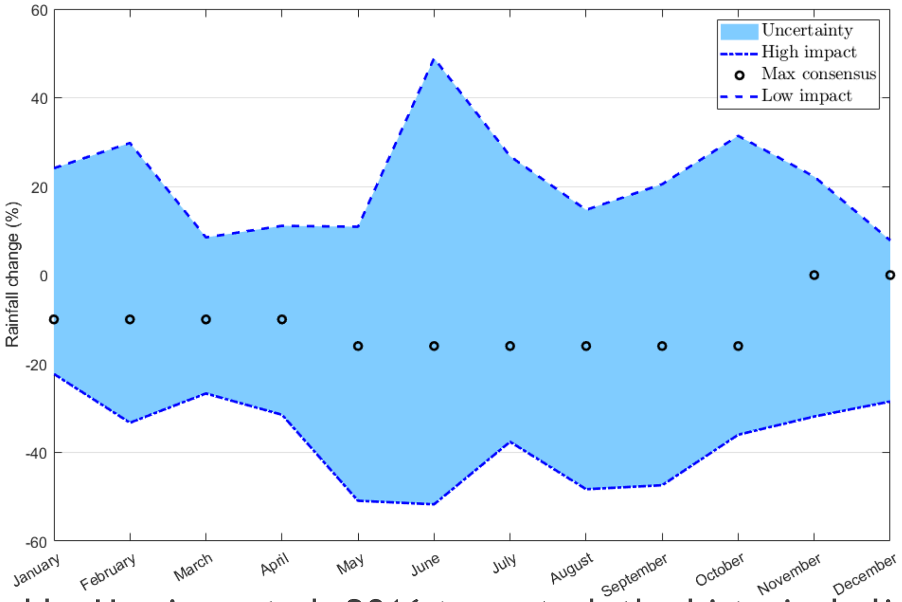
Modelling approach

- The future climate for Australian cluster East Coast 2030 (AR5 projections, RCP 8.5)



Month	Mean temperature change (°C)	Consensus (%)
January	0.5 to 1.5	90
February	0.5 to 1.5	85
March	0.5 to 1.5	78
April	0.5 to 1.5	84
May	0.5 to 1.5	79
June	0.5 to 1.5	75
July	0.5 to 1.5	79
August	0.5 to 1.5	82
September	0.5 to 1.5	87
October	0.5 to 1.5	88
November	0.5 to 1.5	85
December	0.5 to 1.5	95

- Method by Harrison et al. 2016 to perturb the historical climate data (1975-2013) with the change factors and generate climate data for 2030.
- Historical and 2030 climate files were then used in GRASP for simulation of pasture growth and build historical and climate change pasture datacubes.
- The datacubes were then used in CLEM for animal and herd dynamic simulation.
- Three initial land conditions (LC = 1 – good; LC=6 – moderate; LC=10 –not good) were simulated and analysed.
- Four adaptation options were modelled as recommended by CQ steering committee.

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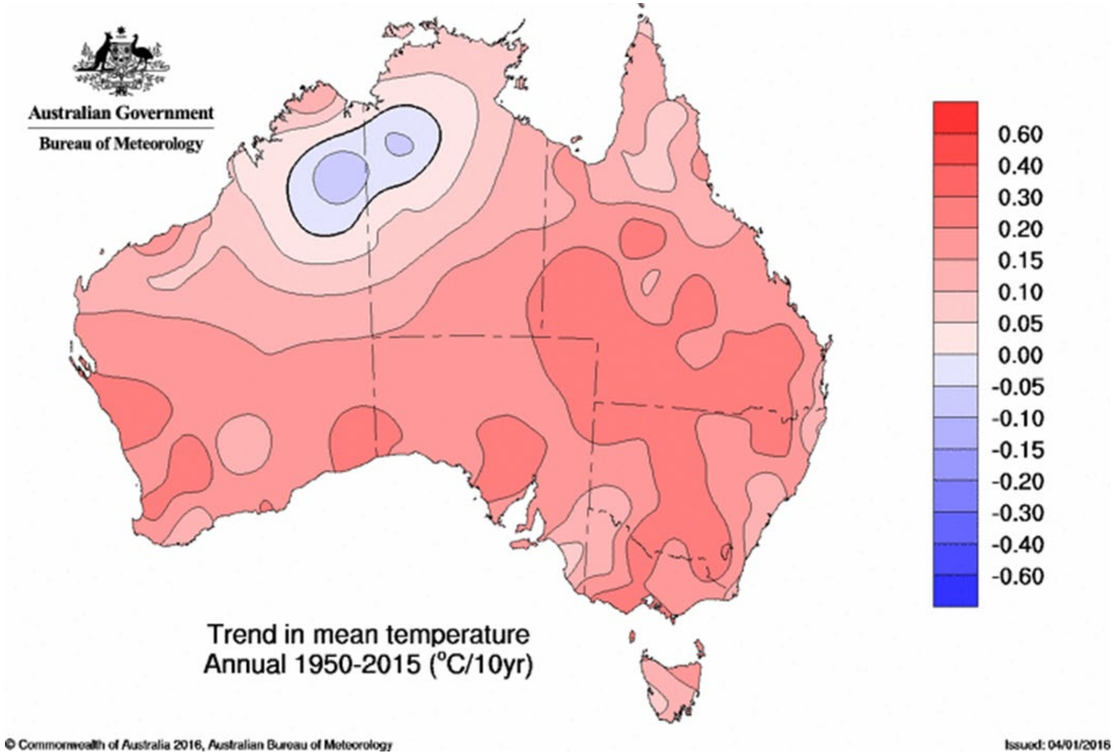
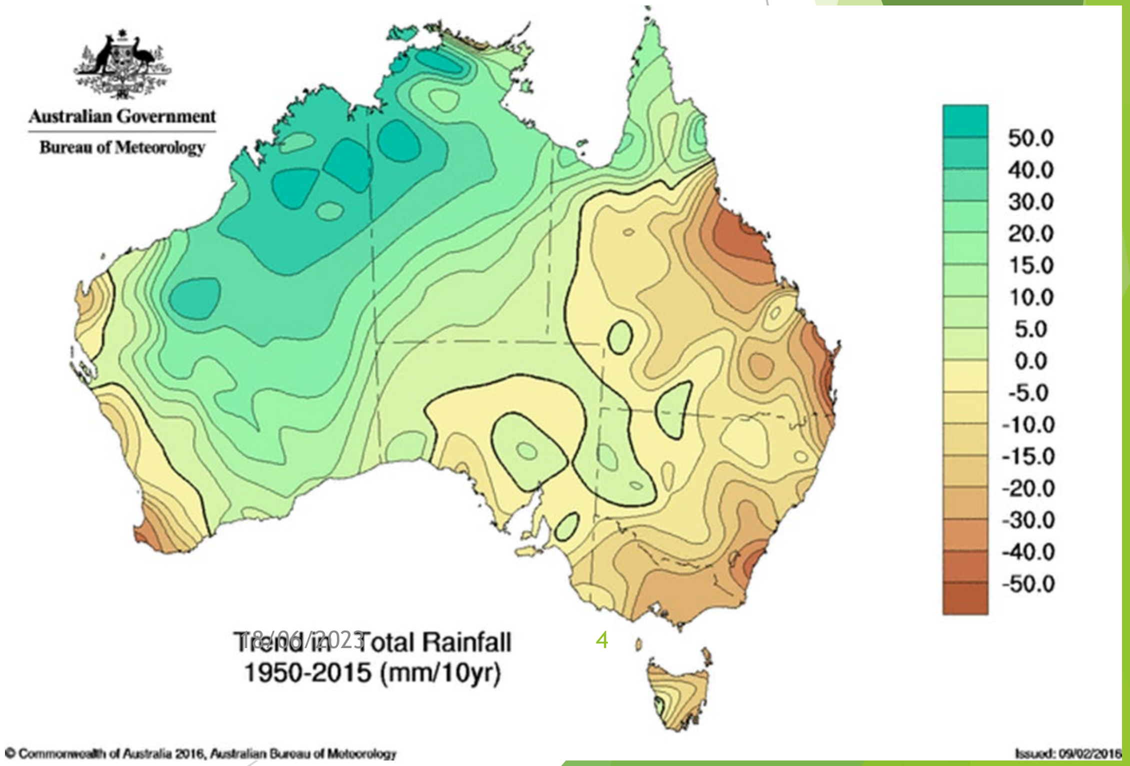
Australia’s climate has changed

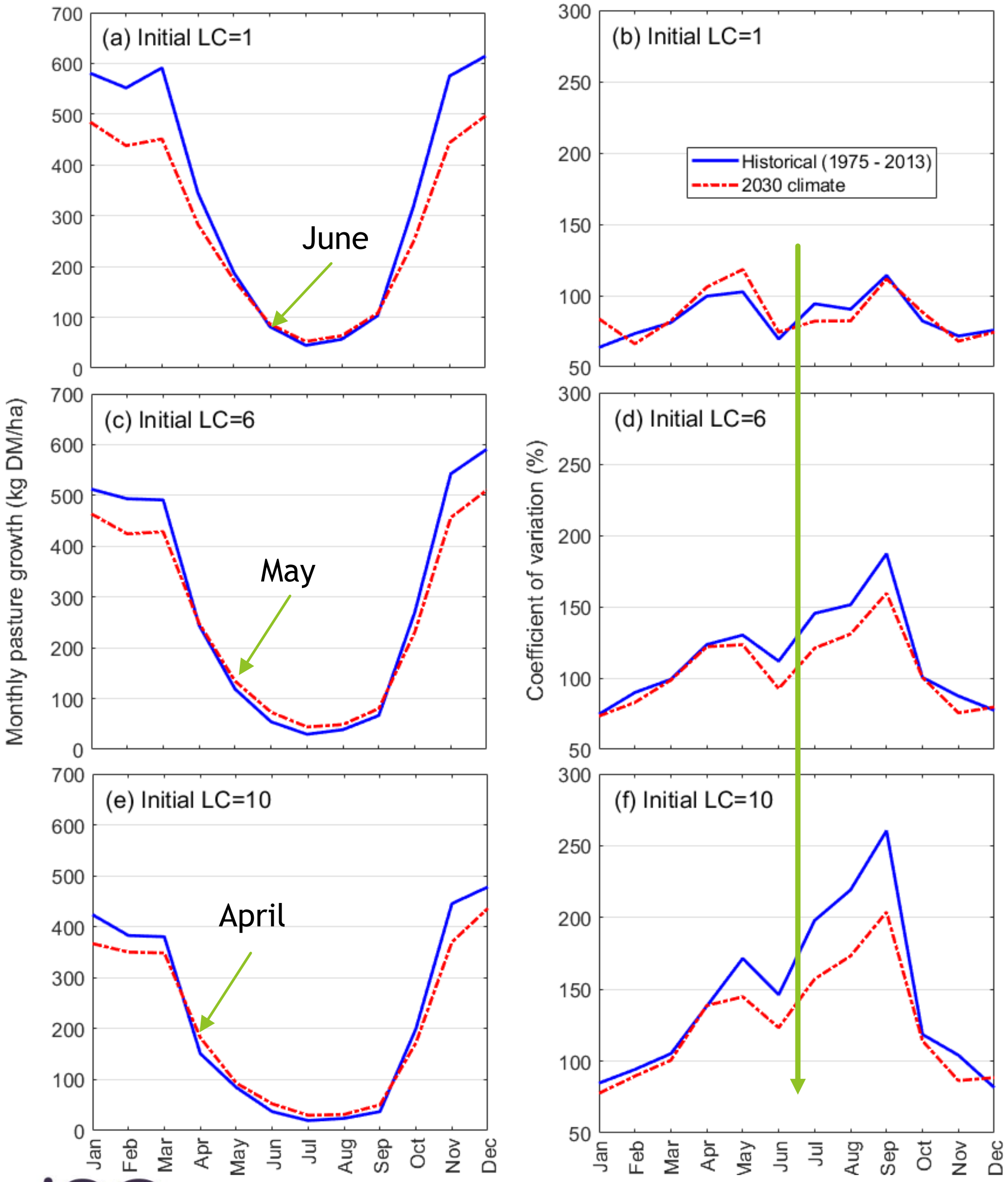


Temperature: 0.9C warming since 1950. Greatest warming in eastern and central Australia, with more extremely hot days and fewer frosts

Rainfall: wetter in the northwest and drier in the southwest and east

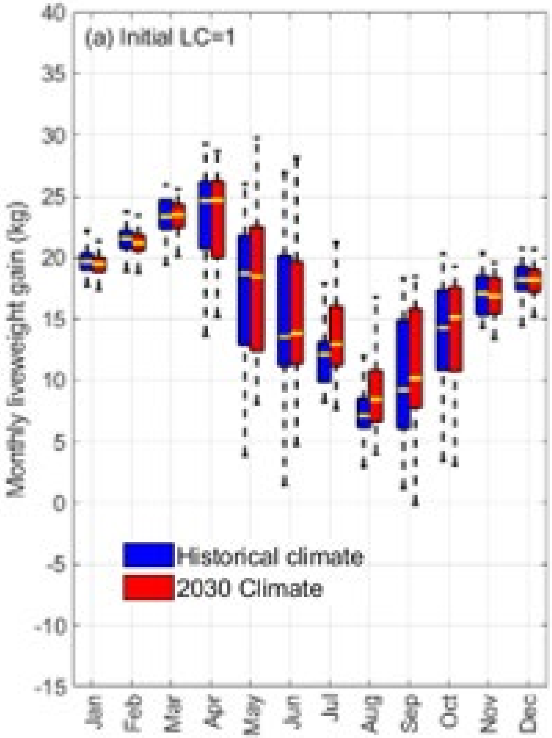


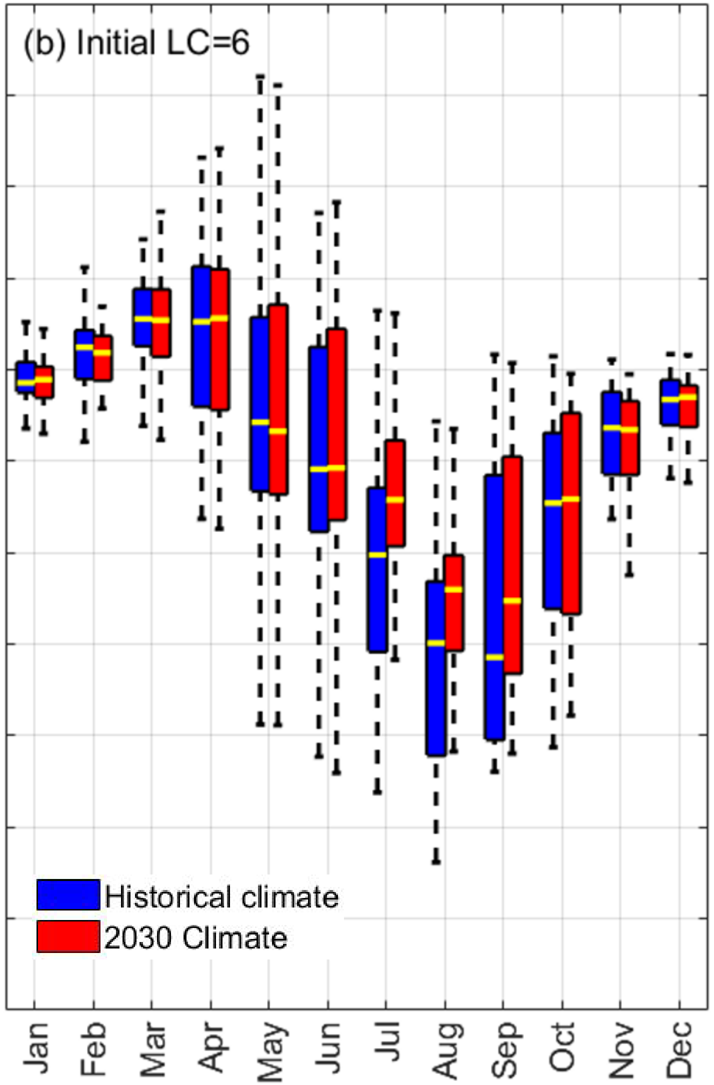
Impacts on pasture growth

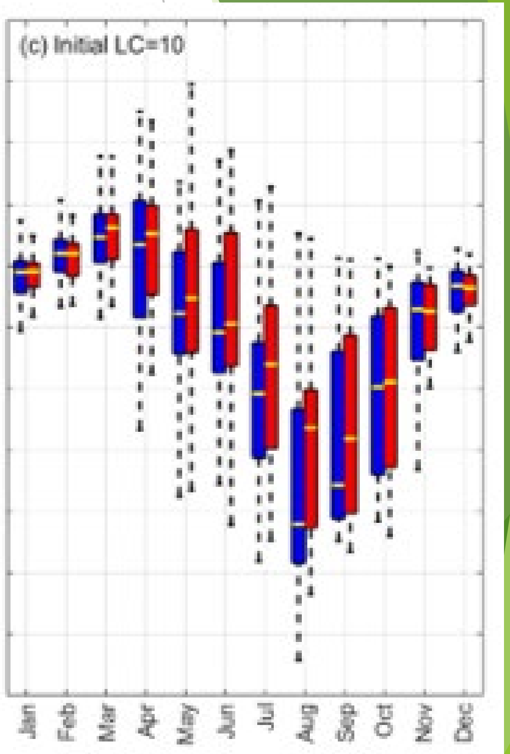


Initial land condition	Initial Land condition index	Average annual pasture growth ($kg\ ha^{-1}$)	
		Historical climate	Climate change
Good	1	4077	3352
Moderate	6	3474	3162
Poor	10	2679	2498

Impacts on liveweight gain

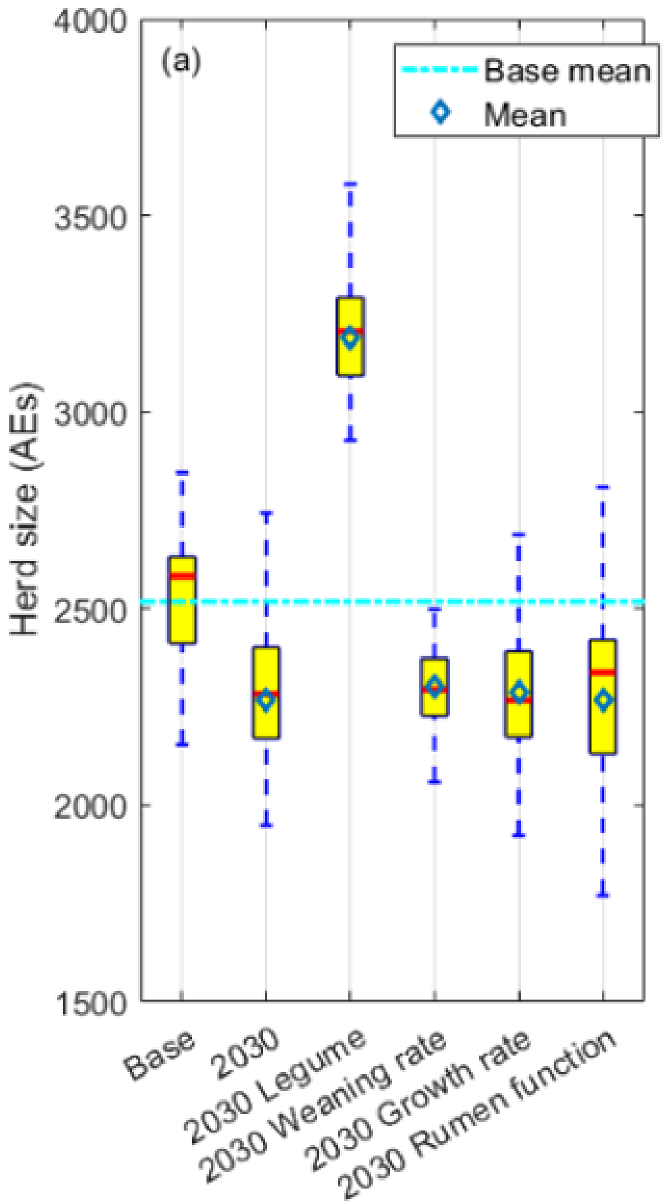




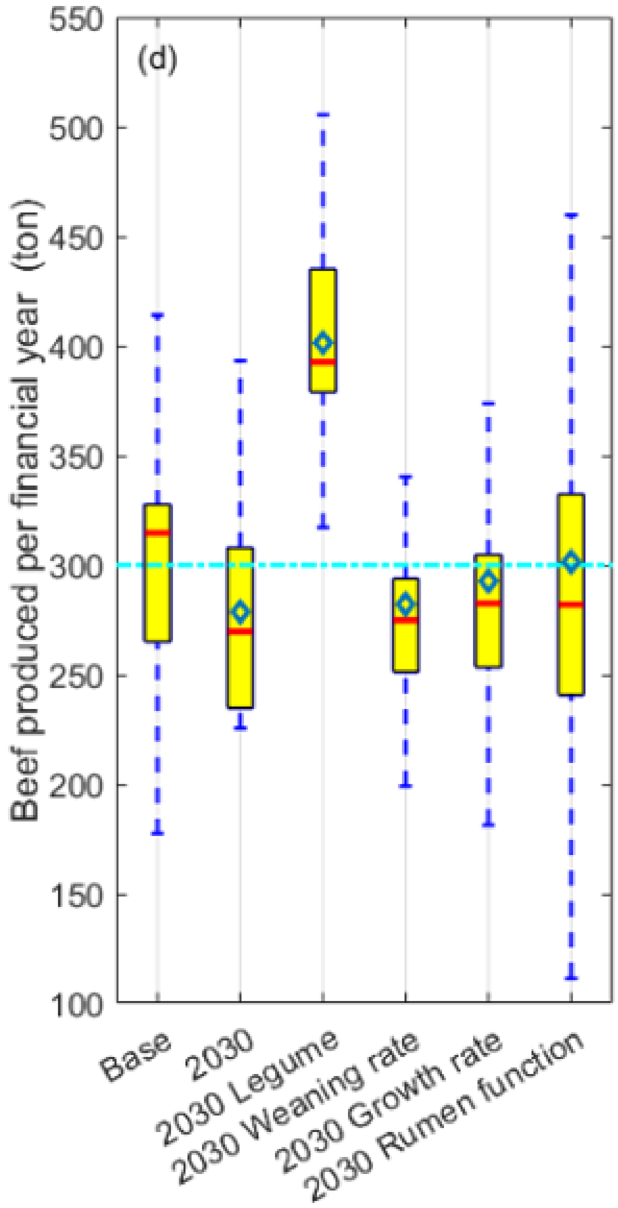


Initial land condition	Initial Land condition index	Average annual weight gain (kg)	
		Historical climate	Climate change
Good	1	197	201
Moderate	6	184	191
Poor	10	172	183

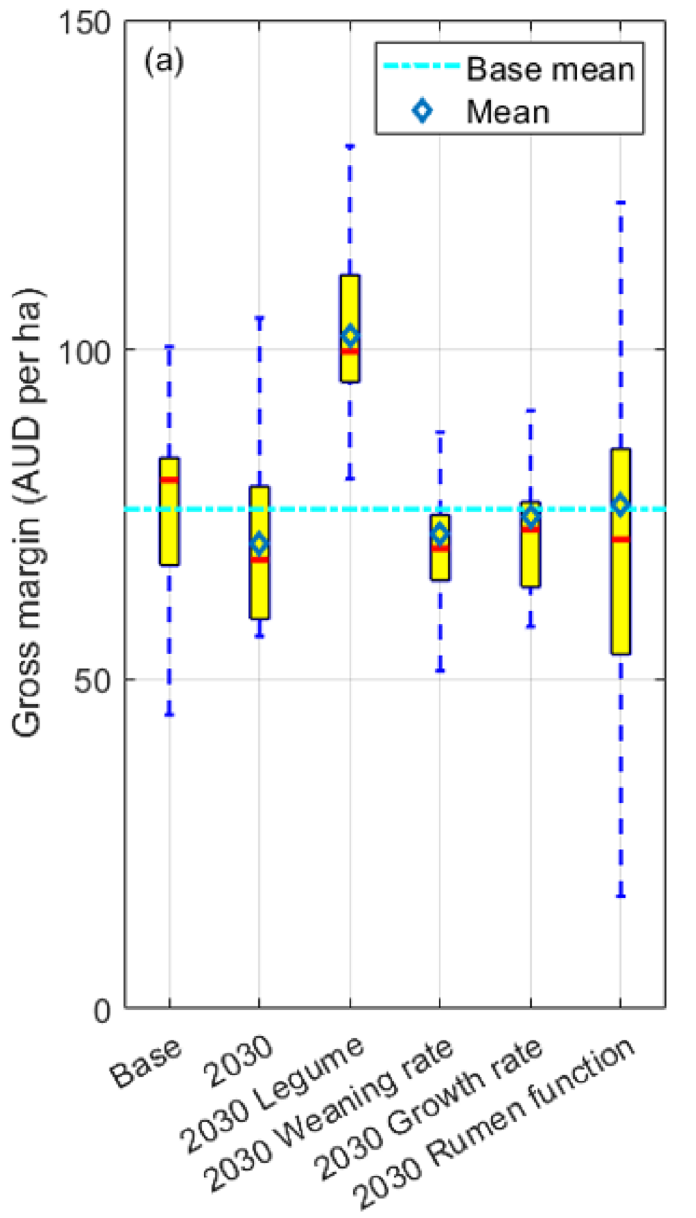
Adaptation



(a)
Base mean
Mean
Herd size (AEs)
4000
3500
3000
2500
2000
1500
Base
2030
2030 Legume
2030 Weaning rate
2030 Growth rate
2030 Rumen function



(d)
Beef produced per financial year (ton)
550
500
450
400
350
300
250
200
150
100
Base
2030
2030 Legume
2030 Weaning rate
2030 Growth rate
2030 Rumen function



(a)
Base mean
Mean
Gross margin (AUD per ha)
150
100
50
0
Base
2030
2030 Legume
2030 Weaning rate
2030 Growth rate
2030 Rumen function

Synopsis

- Projected 2030 climate (*max consensus*) at the studied region will reduce monthly rainfall by more than 10% (*low confidence*), and increase monthly temperature by about $1^{o}C$ (*high confidence*).
- Based on the max consensus projection, 2030 climate will cause reduction in overall annual pasture growth but being not consistent among the seasons. Warmer climate will increase pasture growths in winter and thus weight gain in winter and spring (carry-over effect), resulting in better overall annual weight gain per head (with smaller herd sizes).
- While 2030 climate won't change the emission intensity but will cause increased drought sensitivity of the enterprise due to rainfall reduction with more dry days and longer dry spells. Better land conditions are more resilient to drought.
- 2030 climate will reduce the herd size, reducing beef production and thus the annual income. This results in significant reductions in gross margins per ha.
- Improved pasture is a promising adaptation option in 2030 climate, increasing beef production, gross margin per AE and the enterprise profits, while does not increase emission intensity.
- Other 3 adaptation options can also help maintain the economic viability of the enterprise in 2030 climate.
- Combining improved pasture and conception is the next step.
- Projected rainfall uncertainty need to be addressed by considering low and high impact scenarios.

Thank you!

- Contact: Dr Duc-Anh An-Vo, Senior Research Fellow at UniSQ

  Email: duc-anh.an-vo@usq.edu.au
- Contact: Associate Professor David Cobon at UniSQ

  Email: David.Cobon@usq.edu.au

Department of Primary Industries and Regional Development
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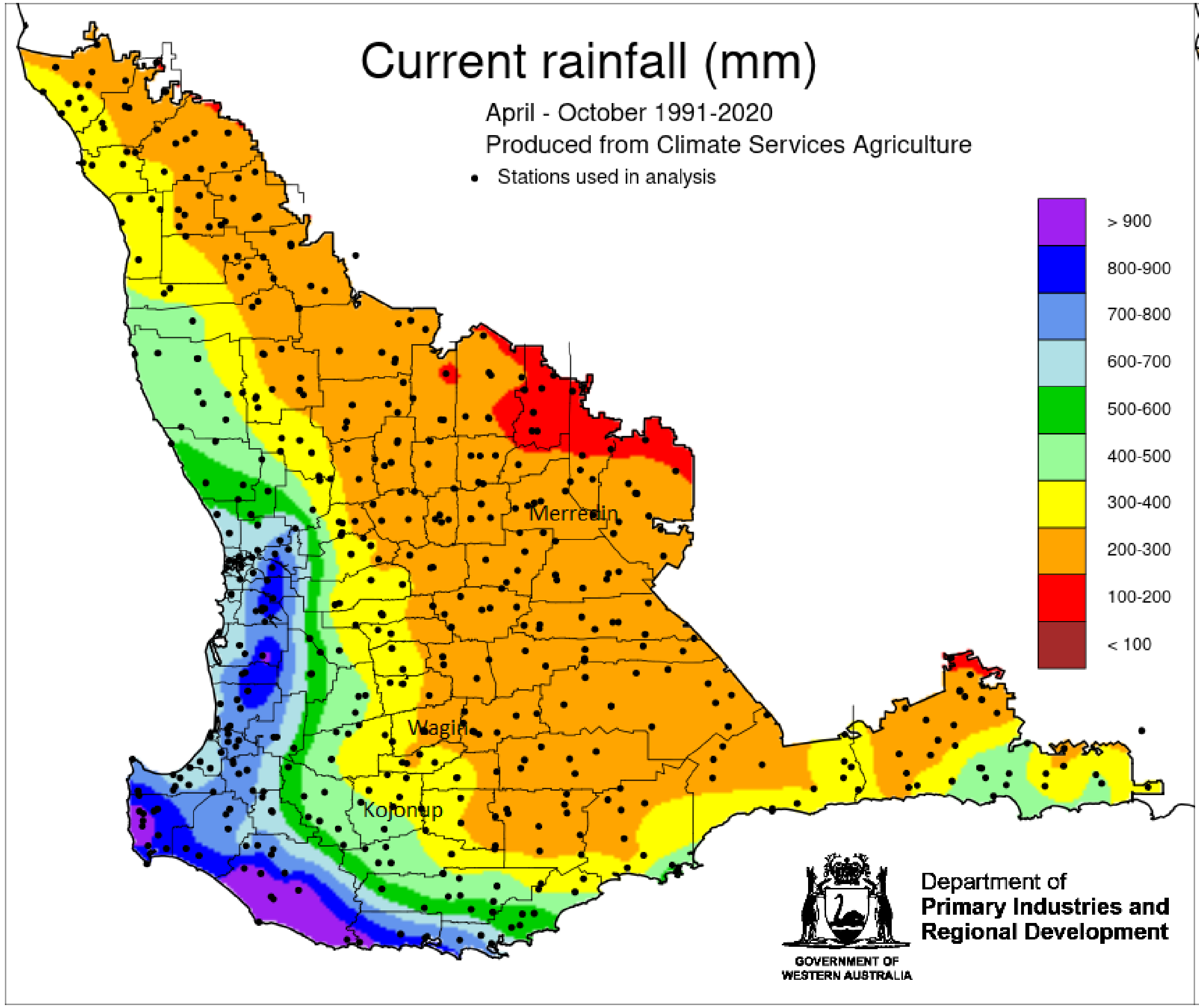
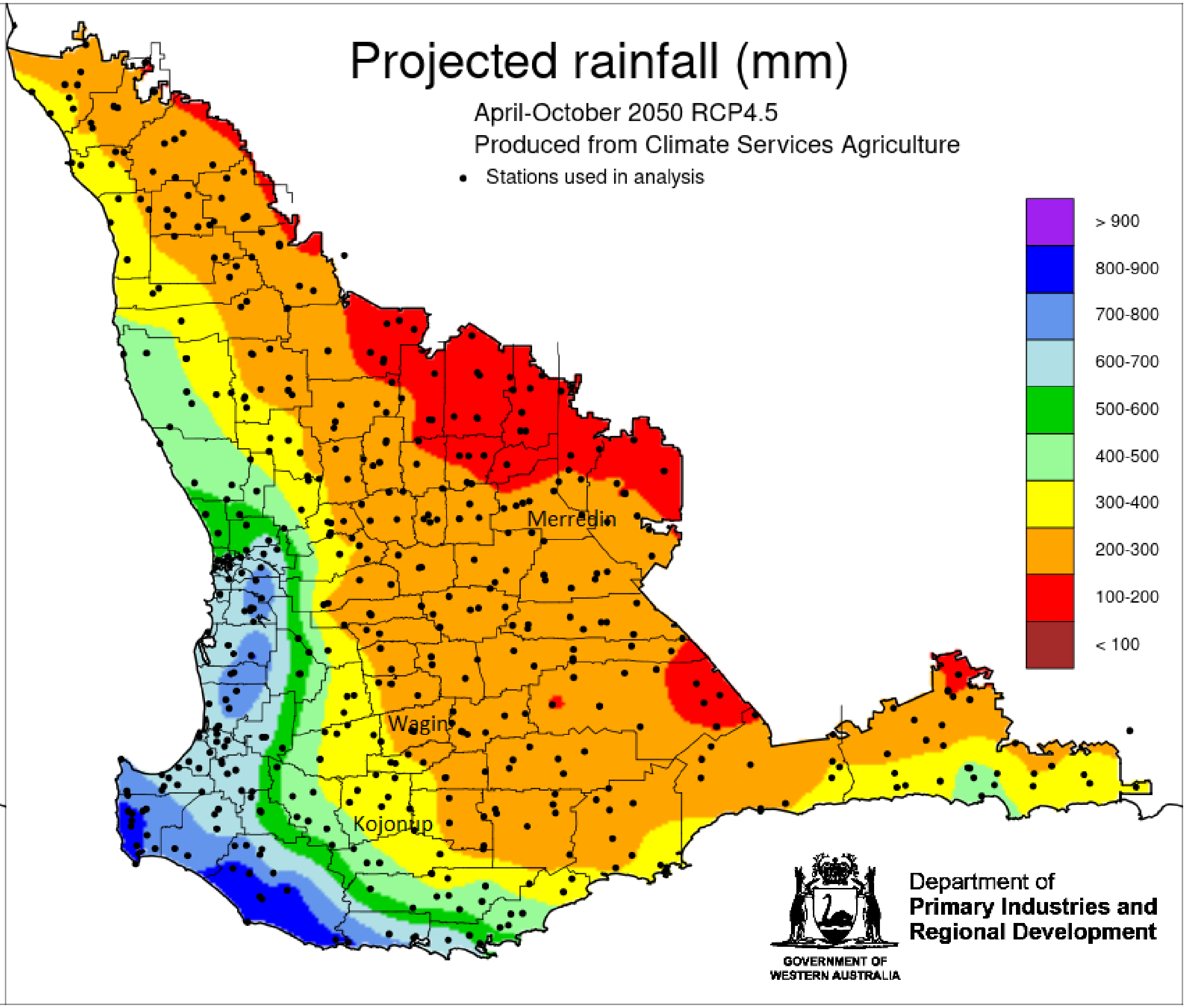
MEAT & LIVESTOCK AUSTRALIA

Protect Grow Innovate

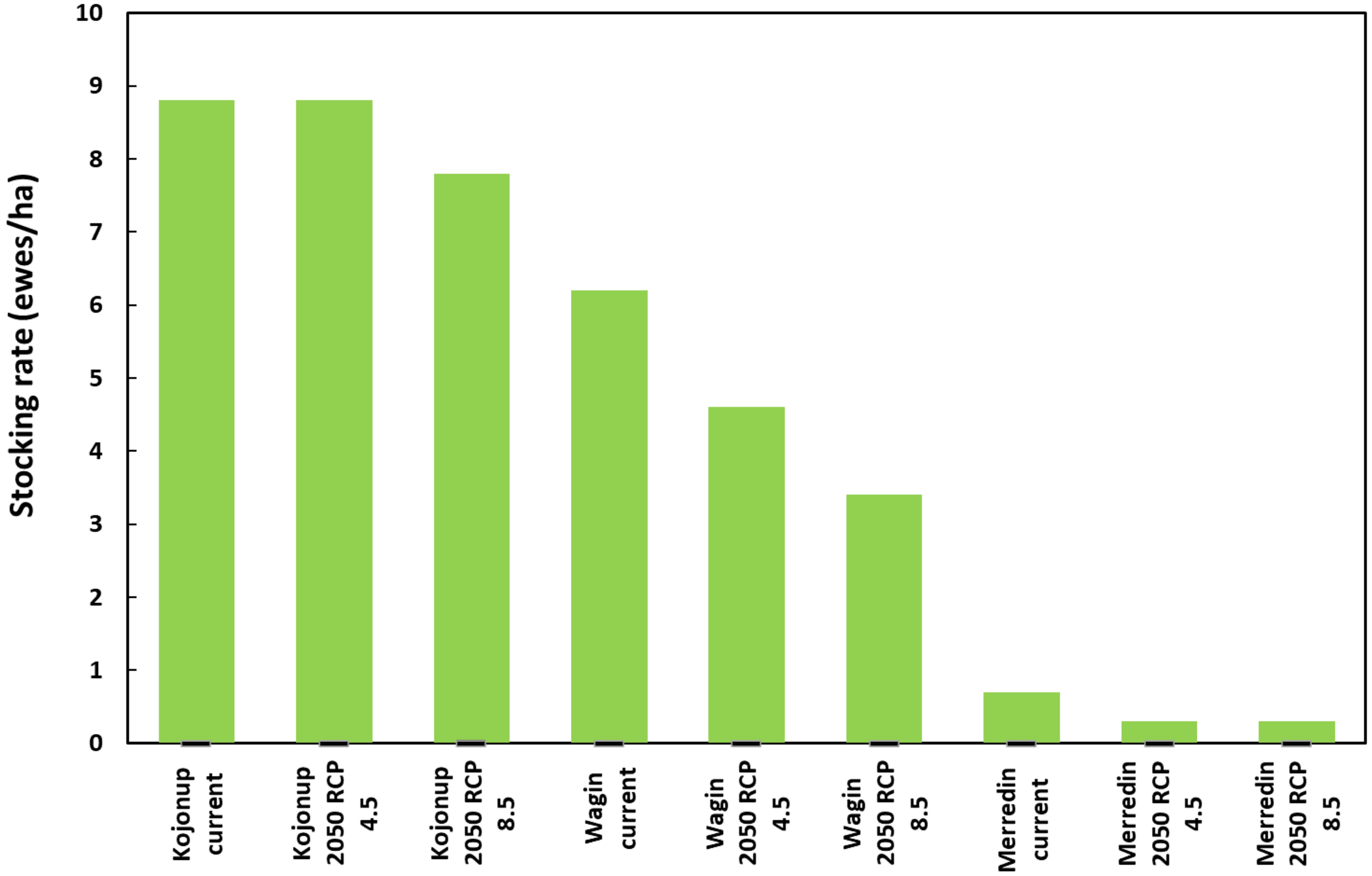
FutureSheep Team

Future climate (Dr Meredith Guthrie)
Pasture modelling GrassGro (Paul Sanford)
Crop modelling APSIM (Dr Imma Farre)
Environmental Social Governance (Janet Conte)
Whole farm economical analysis EVALUS (Sud Kharel)
Supply chain, red meat processors, case studies (Dr Kevin Foster)
Feedbase manager (Dr Clinton Revell)

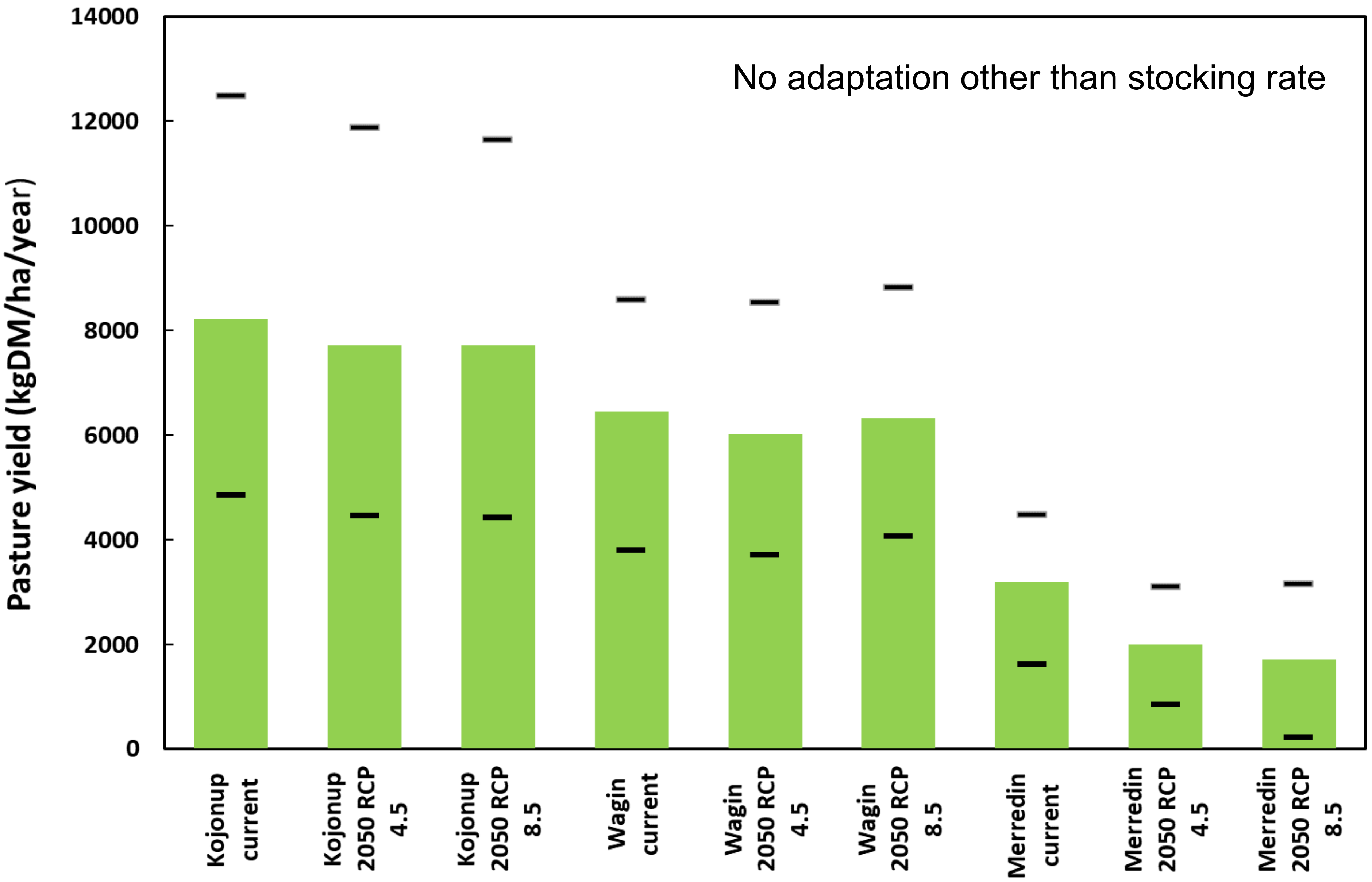




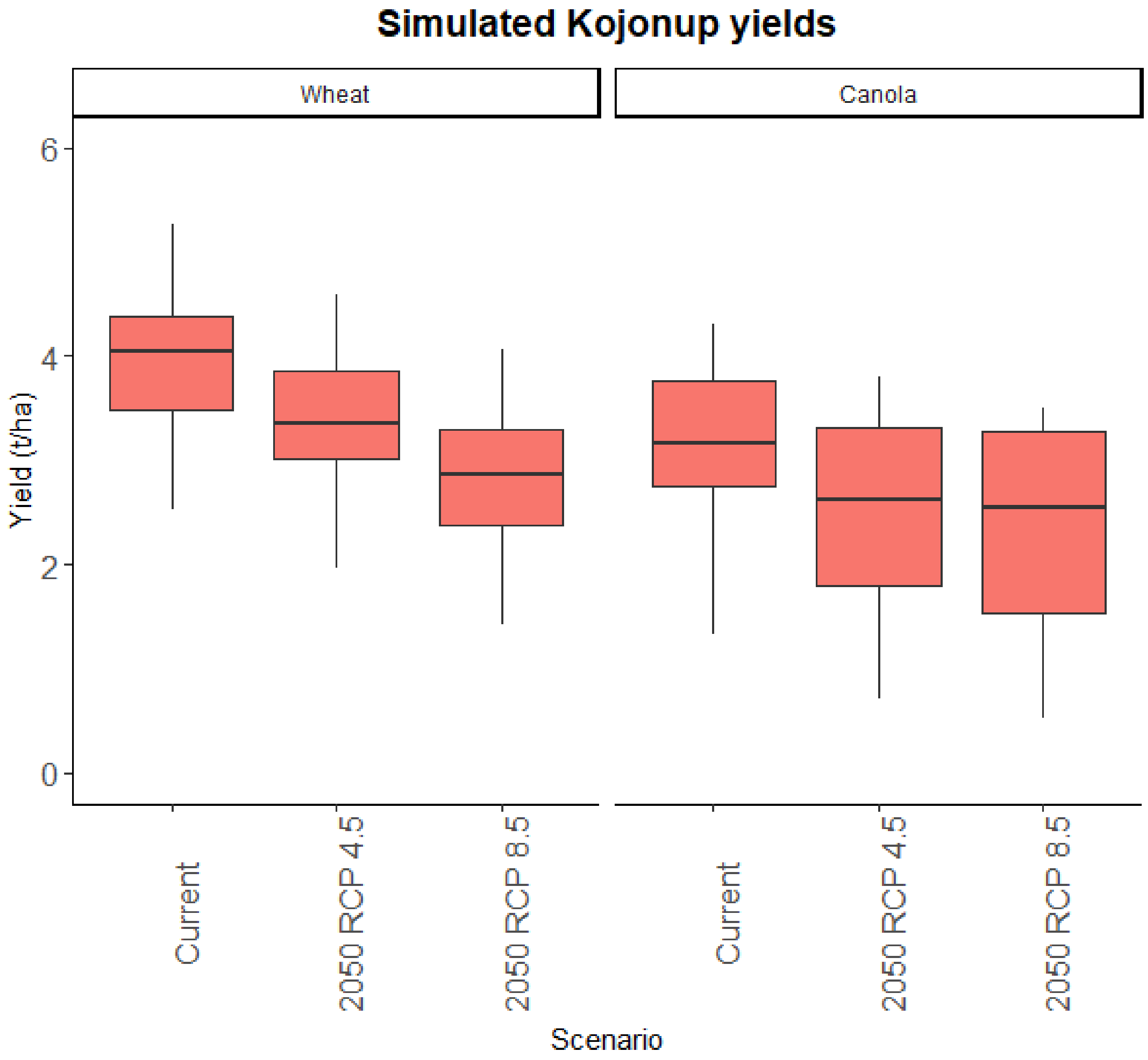
- **Three locations – Kojonup (520mm), Wagin (425mm) and Merredin (325mm)**
- **Dual purpose Merino**
- **Annual pastures – legume, grass and broadleaf, no crop stubbles**
- **Model validated with Pastures from Space**



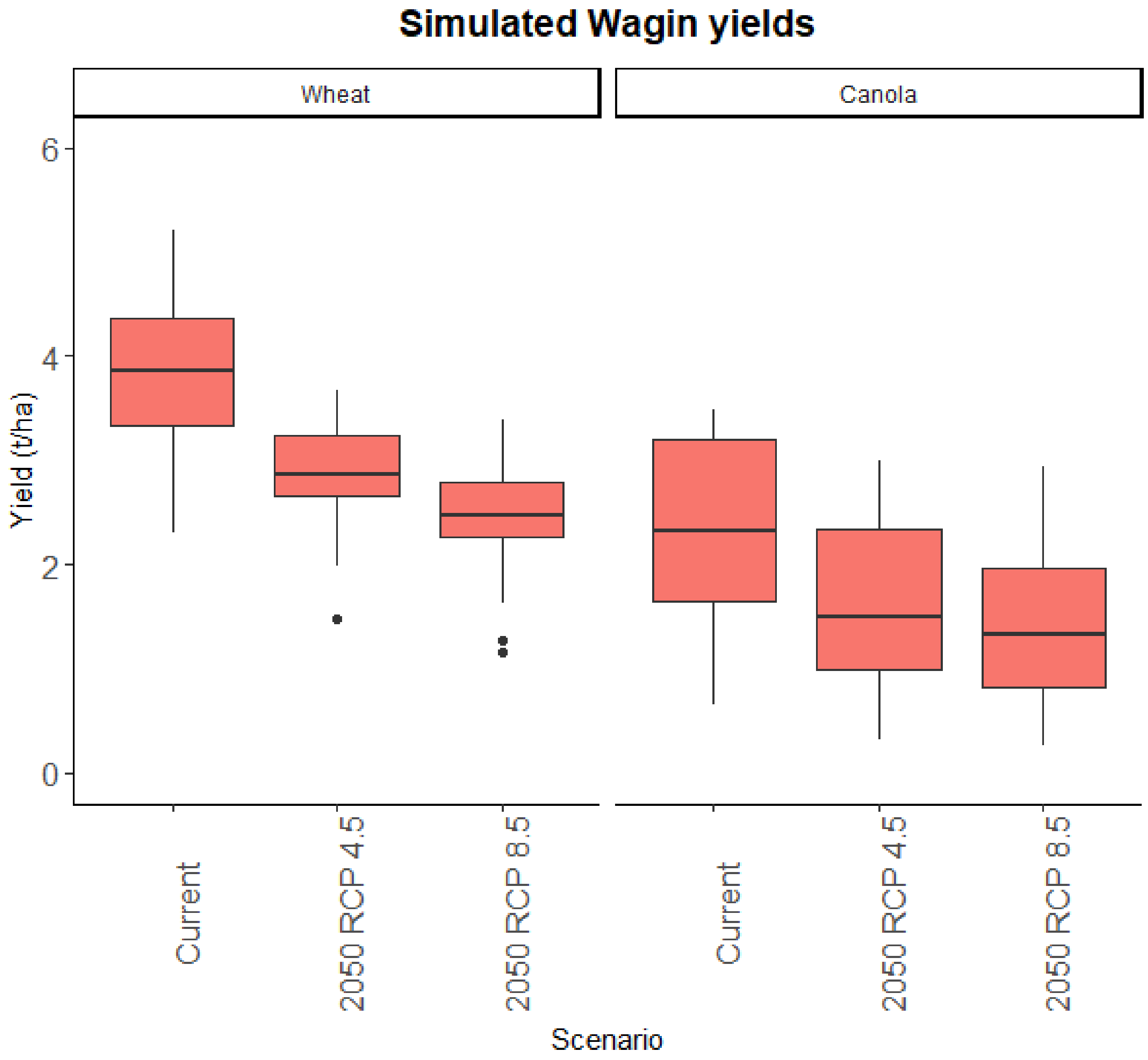
10
9
8
7
6
5
4
3
2
1
0
Stocking rate (ewes/ha)
Kojonup current
Kojonup 2050 RCP 4.5
Kojonup 2050 RCP 8.5
Wagin current
Wagin 2050 RCP 4.5
Wagin 2050 RCP 8.5
Merredin current
Merredin 2050 RCP 4.5
Merredin 2050 RCP 8.5

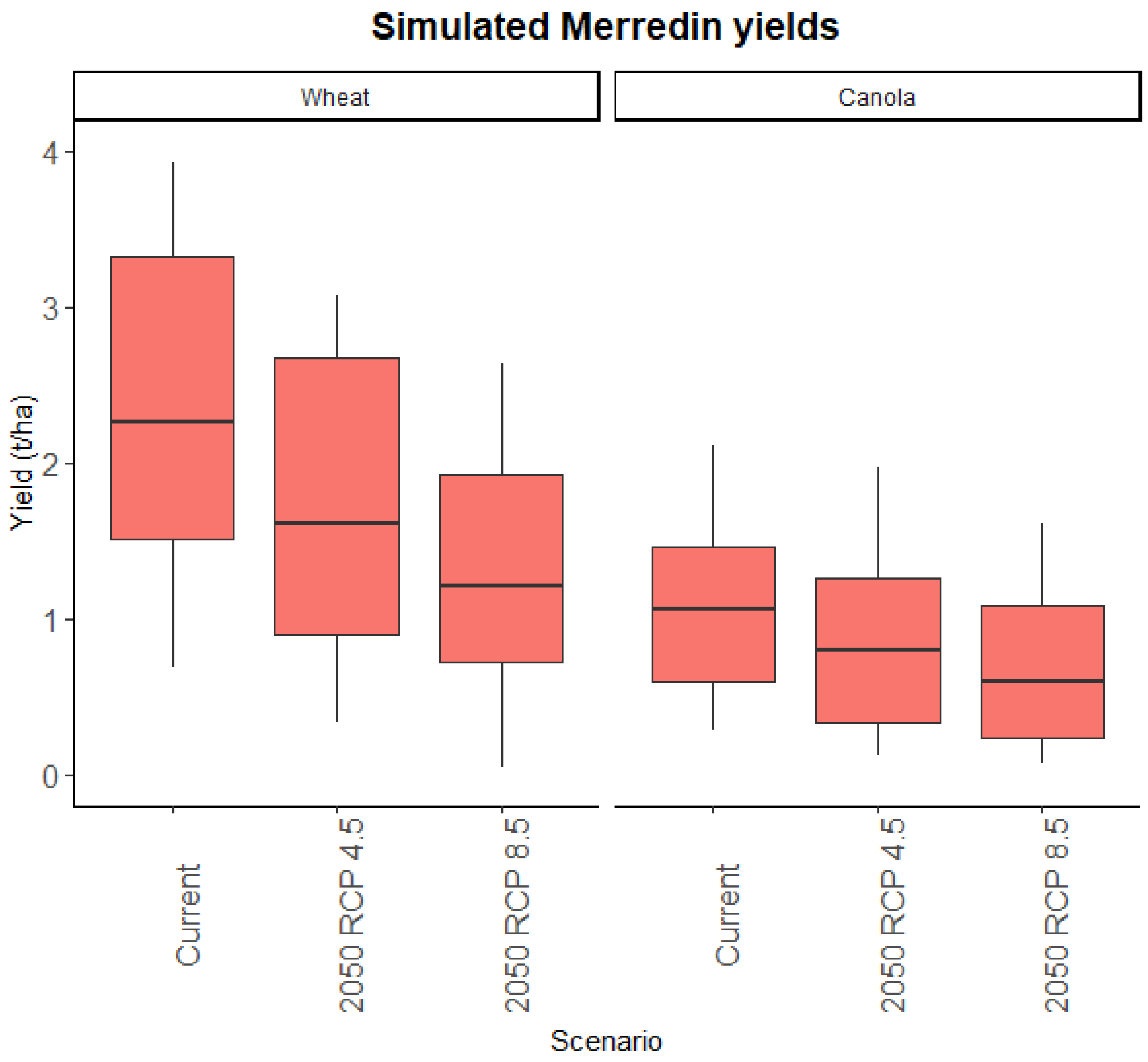


Extreme climatic events



Simulated Kojonup yields
Wheat
Canola
Yield (t/ha)
0
2
4
6
Current
2050 RCP 4.5
2050 RCP 8.5
Current
2050 RCP 4.5
2050 RCP 8.5
Scenario


Simulated Wagin yields
Wheat
Canola
Yield (t/ha)
6
4
2
0
Current
2050 RCP 4.5
2050 RCP 8.5
Current
2050 RCP 4.5
2050 RCP 8.5
Scenario


Simulated Merredin yields
Wheat
Canola
Yield (t/ha)
0
1
2
3
4
Current
2050 RCP 4.5
2050 RCP 8.5
Current
2050 RCP 4.5
2050 RCP 8.5
Scenario

Adaptation Kojonup and Wagin

Pastures

- Adaptation is likely with current technology e.g. high yielding forage crops, perennials, grazing crops in winter, changes in grazing management.

Livestock

- Given pasture adaptation livestock systems will maintain profitability.
- Stock drinking water and heat stress - smart dams to reduce evaporation, shade, more watering points.

Adaptation Merredin

Pastures

- Low input/low risk systems based primarily on pasture legumes but with high yielding annual grasses.
- Deep rooted perennials.
- Shrubs and rangeland system.
- Contraction of conventional pastures to particular soil types and land management units.
- Summer sowing annual legumes.
- Soil mulching.

Livestock

- Reduced stocking rate but with higher weaning rate.
- Change lambing time plus turn lambs off earlier.
- Number of ewes joined dependent on season outlook.
- Change sheep breeds and enterprise.
- Confinement feeding.
- Stock drinking water and heat stress. Smart dams to reduce evaporation, shade, more watering points.

Adaptation Crops

- More drought and heat tolerant species and cultivars.
- Timing of planting (earlier sowing).
- Change the proportion of cropping to pastures (different for different environments).
- More frost tolerant cereals.
- Increased row spacing, changed plant density.
- Increased water and nutrient use efficiency.

Thank you

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Important disclaimer

The Chief Executive Officer of the Department of Primary Industries and Regional Development and the State of Western Australia accept no liability whatsoever by reason of negligence or otherwise arising from the use or release of this information or any part of it.

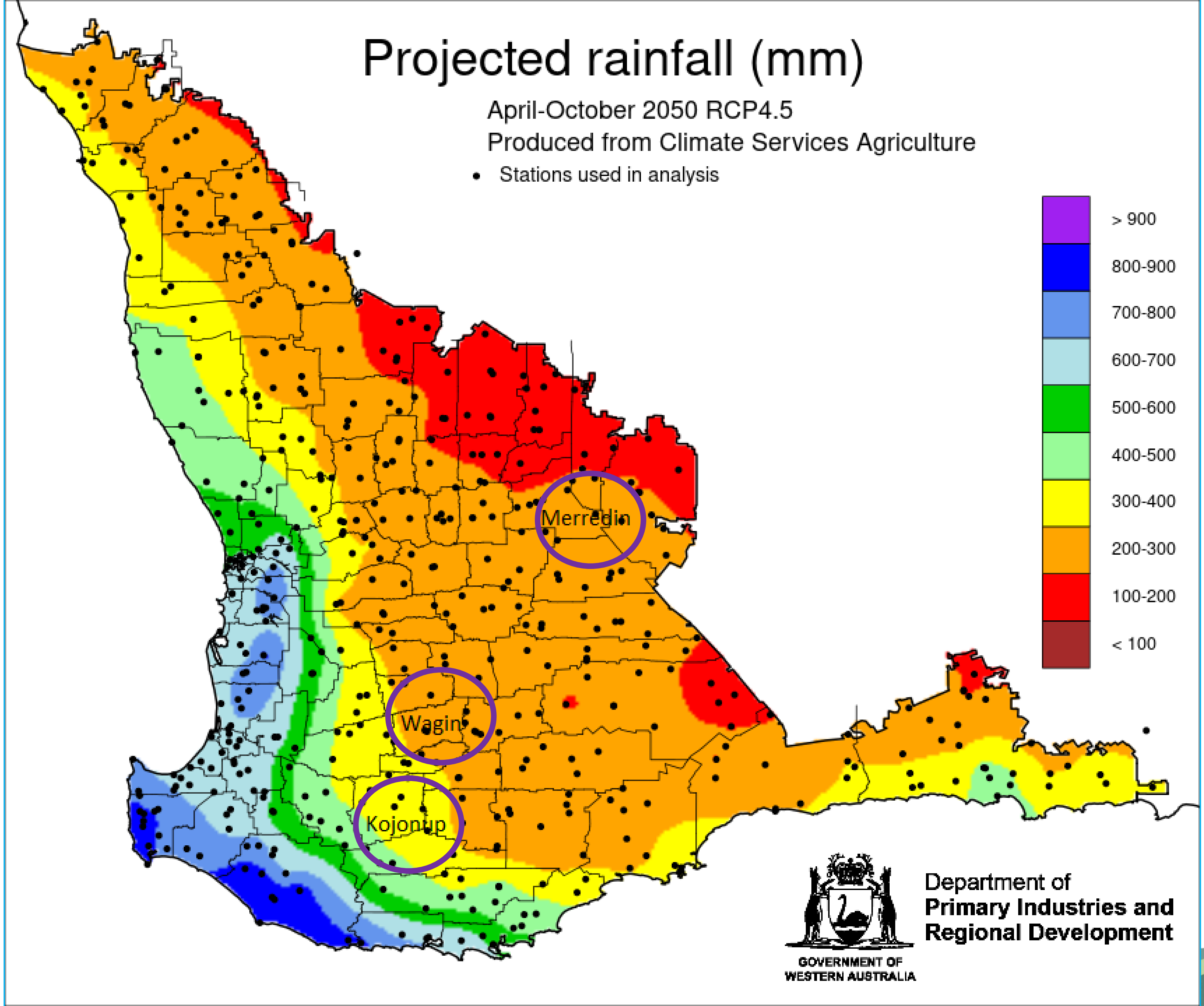
FutureSheep case studies

(Meat & Livestock Australia and DPIRD)

Peer-to-peer learning and extension approach

- Aiming for 6 producer case studies
  - 3 in low rainfall zone – eastern wheatbelt near Merredin
  - 2 medium rainfall zone – Wagin
  - 1 high rainfall zone – Kojonup
- In-depth semi-structured face-to-face interviews covering:
  - previous & planned adaptations (feedbase, sheep genetics, water points, shade)
  - triggers for change, putting climate change in context of other drivers
  - altering enterprise mix, changing rotations, altering stocking rates, conserving feed?
  - use of within season forecasting, information sources, advice
  - producers' priorities for levy $ investment on climate change

- Developing case study protocols for our project (PhD research Janet Conte)
- Written case studies for publication (DPIRD/ MLA webpages, GGA, field days)
- Potential for video case studies with producers in partnership with GGA
- In-depth content analysis on learning and extension for climate change adaptations
- Outcomes will be recommendations for planning and investment
- Three other sites are also been investigated (Mt Barker, Beacon and Kulin)


Projected rainfall (mm)
April-October 2050 RCP4.5
Produced from Climate Services Agriculture
• Stations used in analysis
> 900
800-900
700-800
600-700
500-600
400-500
300-400
200-300
100-200
< 100
Merredin
Wagin
Kojonup
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Annual legumes play a critical role in farming systems in WA now (9 Mha across wheatbelt)

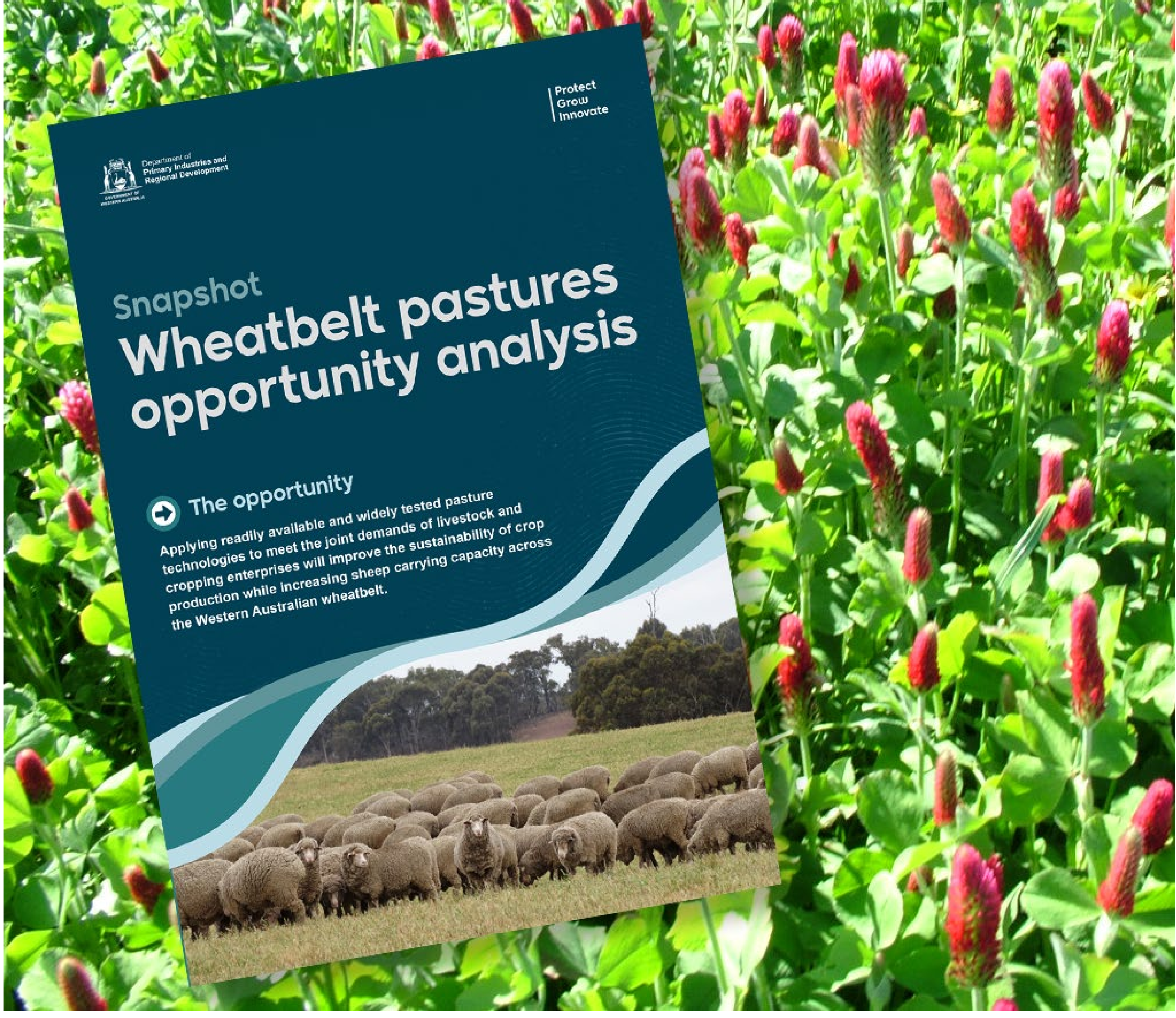
Will become even more important in the face of

i) climate change,

ii) increased N prices,

iii) GHG mitigation,

iv) carbon sequestration



New low - medium rainfall pasture options

SerraMax PBR (yellow serradella) can be grown on acidic, sandy soils in 300 to 600mm annual rainfall areas

French serradella (& other aerials) can be established efficiently over large areas at min cost without clashing with cropping programs

(Photos courtesy of Graham Barret-Lennard October 2022. Varley 420km SE of Perth

Fran2o pink serradella

(Narembeen GSR 260mm)

Estimated 30,000ha Fran2o sown across WA's low to medium-rainfall regions in 2022

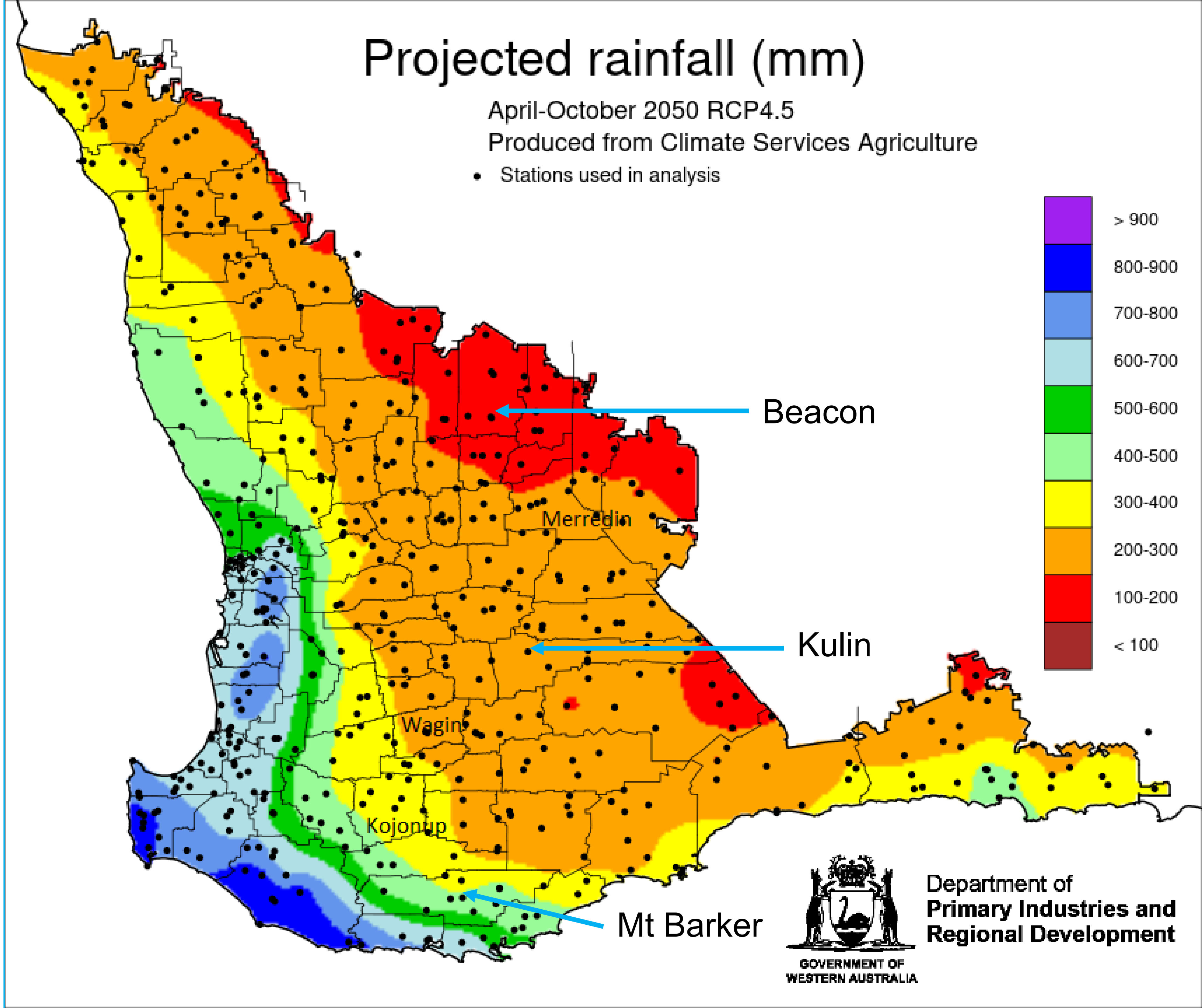
Around 20,000ha of biserrula sown across NSW low to medium-rainfall regions (2017-2022)

(Photos courtesy of Clint Butler from Narembeen. 280 km east of Perth)

Fran2o harvested for seed and as standing feed for summer

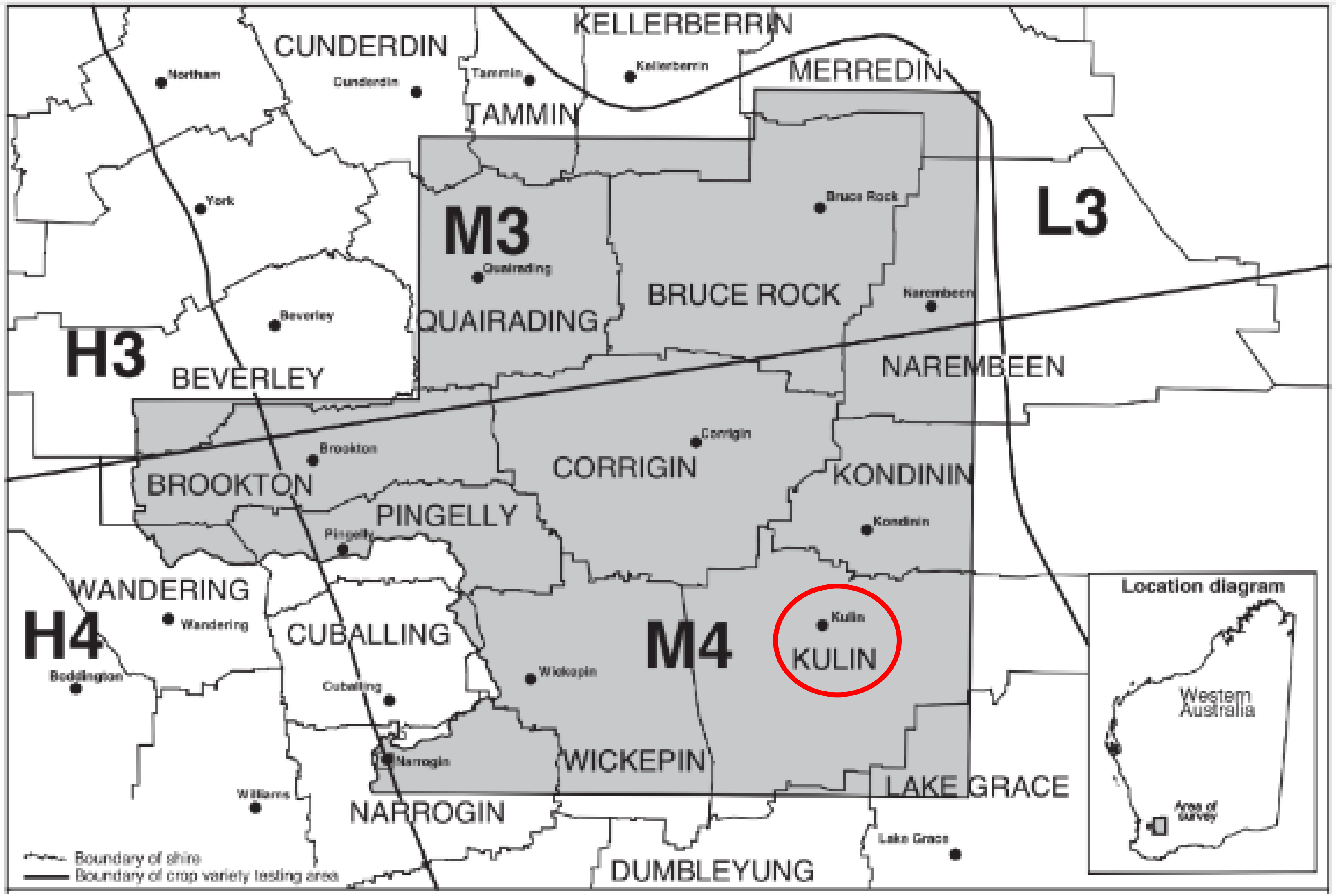
Other case studies underway outside the 3 districts

Reference group farmer in upcoming MLA Feedback article



"An economic case study of unusual production, financial and net emissions performance at Tolga Farm. New questions for researchers"

B. Plunkett, D. Roberts, S. Kharel, K. Foster, T. Overheu, B. Savage



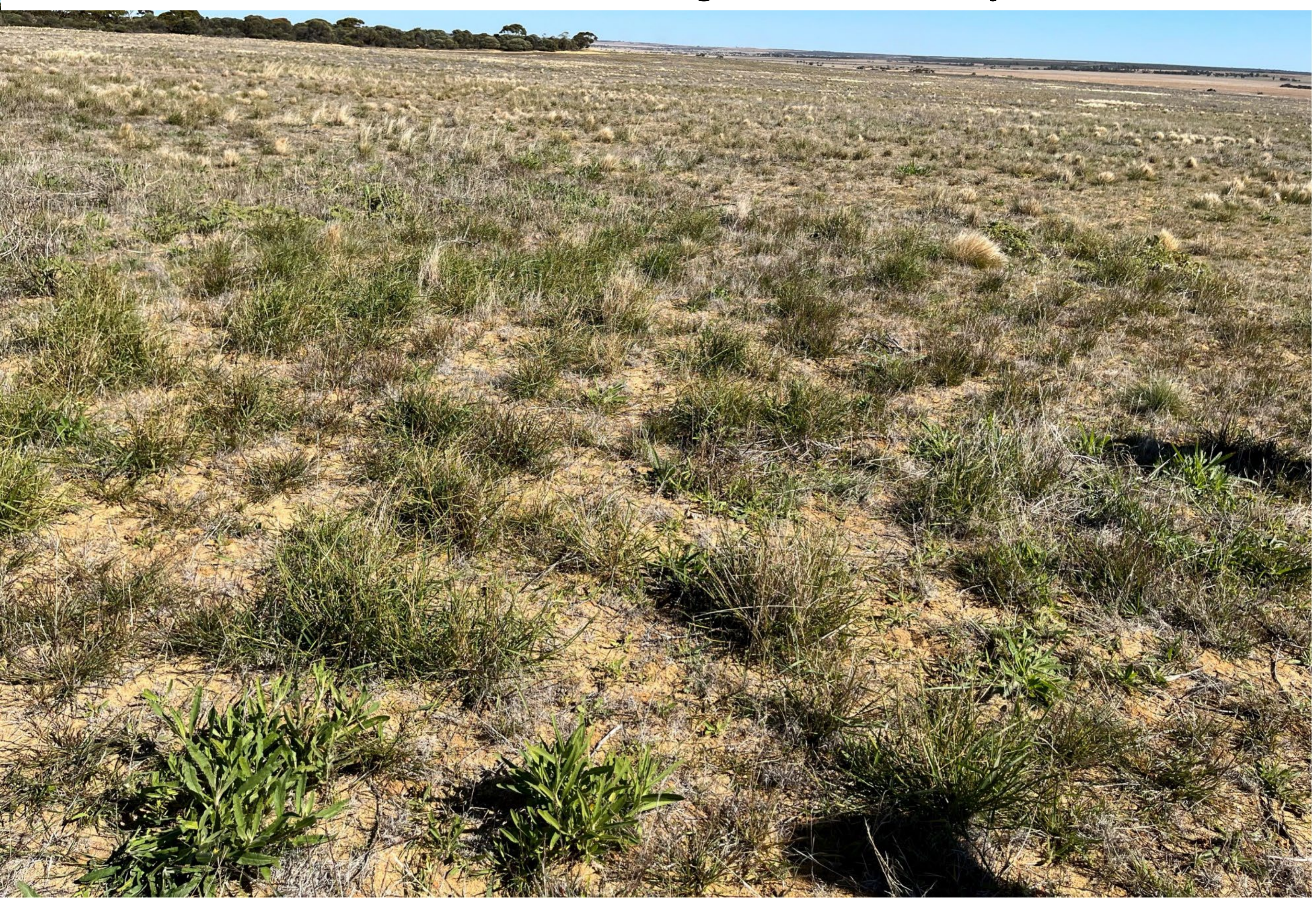
Farm case study Kulin

220mm GSR

- A low-input 60:40 mixed farming system (5200ha)
- Transitioning from high synthetic inputs-based production system to low input system
- Supplementary nutritional packages for pastures animals and soils
- DPIRD examining the economics, carbon emissions & climate resilience on farm
- Includes studying and modelling farming system (EVALUS)
- Generates low levels GHG emissions by industry standards
- SOC appears to be high for the area and similar systems

Beacon
(200mm GSR and 300mm annual rainfall)

Could benefit from a legume in the system



Central wheatbelt 25,000ha (low input- low risk system)

Current grazing system is operating as extensive rangeland/pastoral system

Flock size 3500 with 7000 lambs at peak

Peak stocking rate: 0.25 DSE/ha if peak cropping program is in

Focus on soil health as driver of productivity & profit

Thank you

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