EAST COAST
NRM CLUSTER

CLIMATE CHANGE IN AUSTRALIA

IMPACTS & ADAPTATION
INFORMATION
FOR AUSTRALIA'S NRM REGIONS

Climate Change and Grazing: a study for the Greater Sydney Local Land Services

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Climate Change and Grazing

Greater Sydney LLS

Background

- In the 2012-2013 period, grazing in Australia comprised 340,163,891 ha *(Figure 1) (ABS 2014)*
- In New South Wales there was 45,328,336 ha of grazing land *(ABS 2014)*
- The Greater Sydney Local Land Service region covers an area of 12,474 square kilometres *(Greater Sydney LLS 2014).* In the 2010-2011 period, the Sydney Outer West and Blue Mountains region had 11,129 ha of land used for grazing *(ABS 2014)*

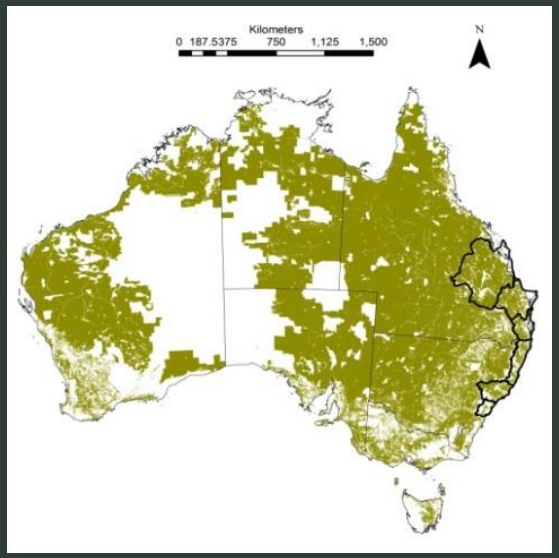


Fig. 1 Current extent of grazing (ABARES 2012) . East Coast Cluster NRM regions defined in black.

Climate Change and Agriculture

SEQ Catchments

Aim

- To investigate the potential impacts of future climate change on cropping production, avocado production, and grazing
- To provide information to NRM groups regarding planning for climate change adaptation in a changing agricultural landscape

Methods

We developed potential 'best' and 'worst' case climate change impact distribution models for future cropping and grazing using software called MaxEnt *(Phillips et al. 2006*). MaxEnt predicts the probability that an area will be suitable for agricultural production based on changes in the climate variables most appropriate for each commodity.

We considered two Global Climate Models (GCM) under the current (baseline) climate and the A1FI emission scenario for 2025 and 2035 representing: 1) a 'worst' warmer and drier future (CSIRO Mk3.5) and 2) a 'best' cooler and wetter future (CSIRO MIROC-M) *(CSIRO 2014).*

Climate data used in the suitability models

The A1FI emission scenario

Describes a future world of very rapid economic growth, global population growth that peaks a mid-century with a fossil fuel-intensive energy system (i.e. business as usual)

Global Climate Models

Both of the climate models used here provide plausible projections of the future climate, even though they may differ considerably in their results. They were recommended by the CSIRO climate projections team and reviewed in the scientific literature.

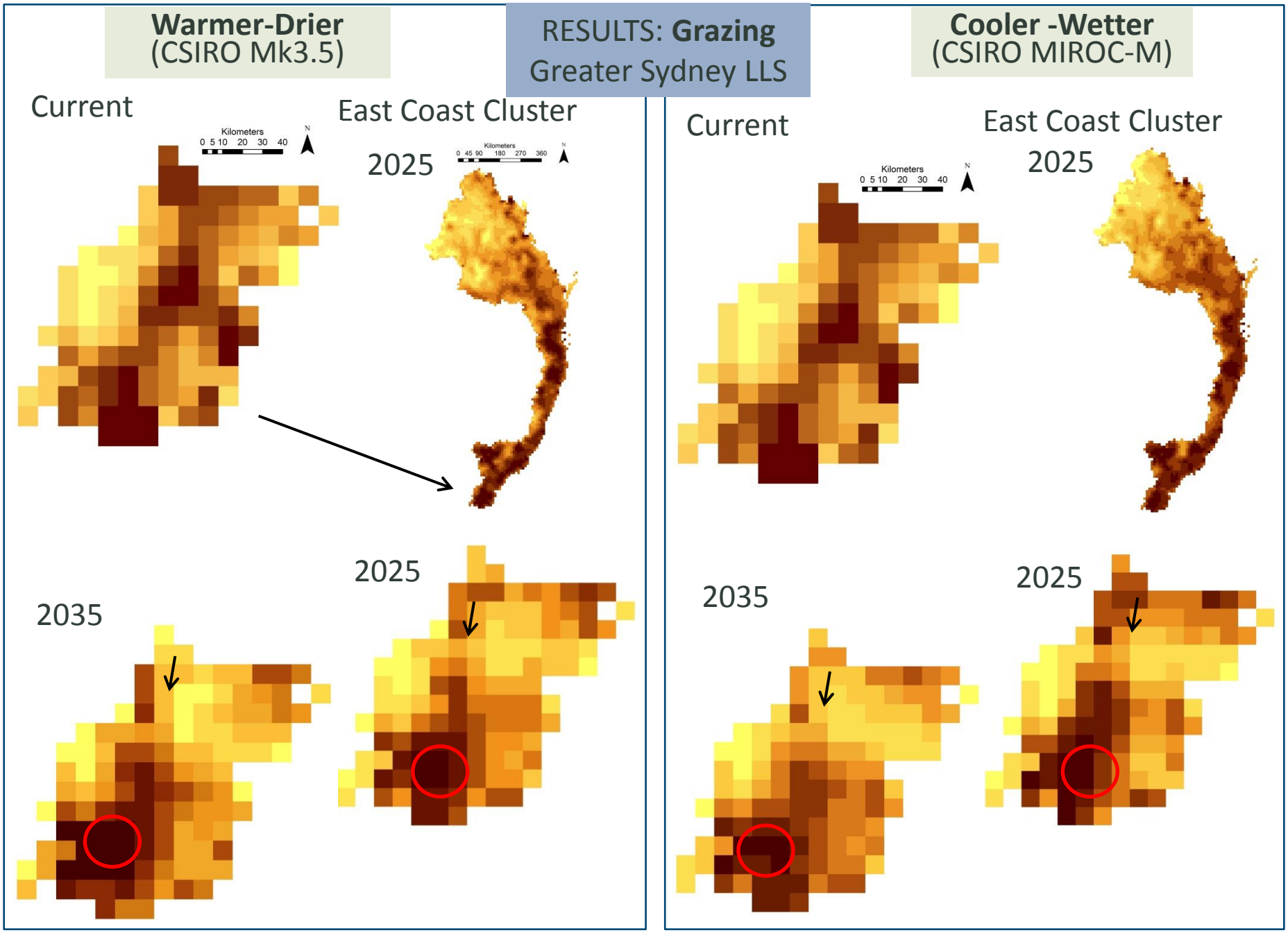
Climate data used in the suitability models

1. Warmer and drier future 'worst' (CSIRO Mk3.5)

- Annual-average rainfall decreases across all of Australia, except for increases along the east coast
- Widespread rainfall decreases in all seasons, but increases in the south and east in summer and over NSW and southern Qld in autumn
- Increases in annual temperature across all of Australia, with smaller increases along the southern coast of Australia

2. Cooler and wetter future 'best' (CSIRO MIROC-M)

- Decreases in rainfall to the west of Western Australia and increases elsewhere
- Moderate temperature increases across all of Australia, smaller to the south and east


Warmer-Drier
(CSIRO Mk3.5)
RESULTS: Grazing
Greater Sydney LLS
Cooler -Wetter
(CSIRO MIROC-M)
Current
East Coast Cluster
2025
2035
Kilometers
0 5 10 20 30 40
0 45 90 180 270 360
N
Lowest predicted suitability
Highest predicted suitability

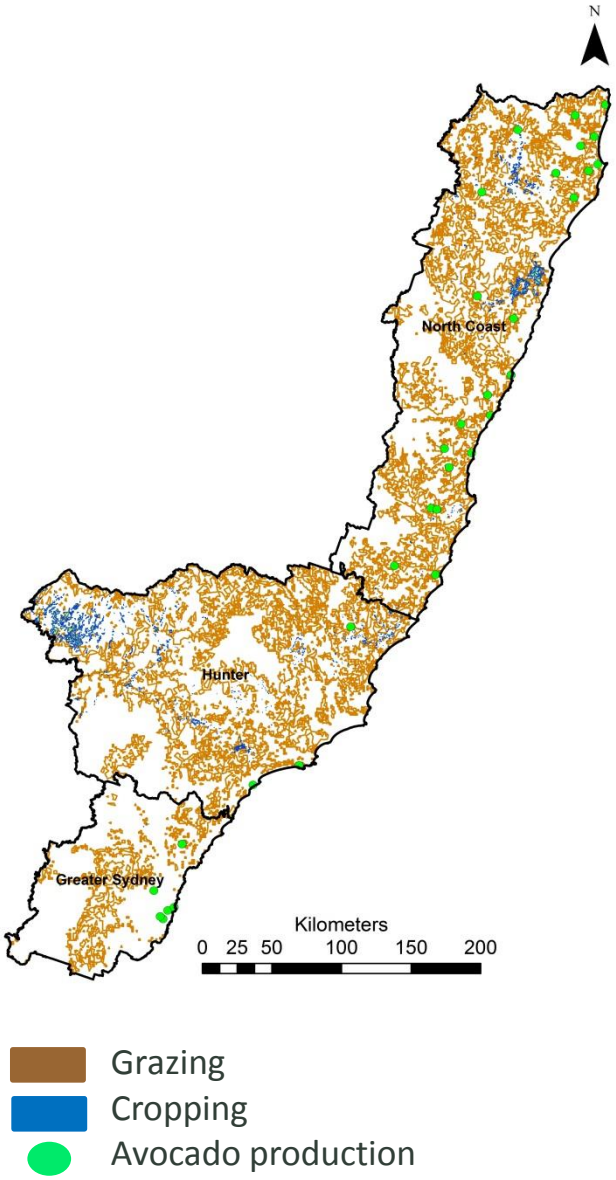
MaxEnt Results: Climate Change and Agriculture

Commodity	Variables incorporated in the model	Reason for inclusion in the model	*AUC	Contribution to the model (%)
Grazing	Average annual temperature	Growing period	0.654	54.8
	Average rainfall-summer	Growing period		15
	Erodibility			10.6
	Soil-yellow duplex			10
	Elevation			5.3
	Soil-cracking clay			1.9
	Minimum temperature-July	Frost-induced fodder protein loss		1.7
	Soil-massive earths			0.5
	Soil-red duplex			0.2

* The AUC value provides a measure of the model's predictive performance. A no better than random prediction AUC = 0.5. The lower AUC value for grazing is expected, due to the wide distribution of grazing in Australia.

Key Points

- **Agriculture in the Greater Sydney LLS Region will be impacted by climate change**
- **Grazing is predicted to shift and contract, predominantly to south west regions, but remains patchily suitable in some other areas**
- **Average annual temperature was the most important predictor for the grazing model**



Climate Change and Grazing
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Assumptions and Limitations

- Future novel climates may vary from those used in this study
- The models presented here are based on the CSIRO A1FI emission scenario that reflects continuing fossil fuel dependence and high population growth, i.e. business as usual
- The two Global Climate Models that were used here were based on the best information available. Results can vary under different GCMs
- The results of this study are based on particular environmental variables chosen using the best information available. The results will vary if different climatic variables are used when developing the MaxEnt models
- MaxEnt's mathematical models do not consider human interventions such as future changes to agricultural practices or land use change
- These models were developed at a 10 x 10 km^2 scale to provide indicative information. Finer scale models would potentially provide more site-specific information

Acknowledgements

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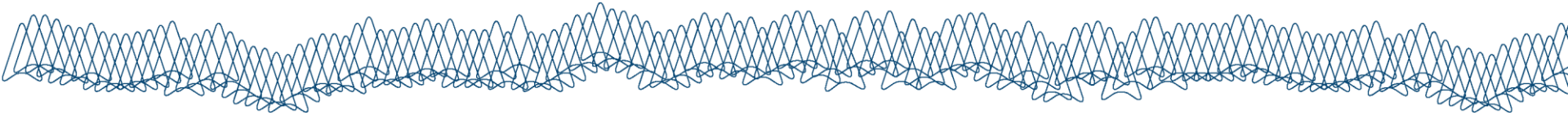
Thank you

From the East Coast Cluster



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