Climate change systemic adaptation and financial value across the southern Australian livestock industry

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The GRAZPLAN biophysical models were used to simulate the dynamics of coupled climate-soil-grassland-livestock systems at 25 representative farms across Australia's extensive grazing region under historical and a range of projected climates (4 GCMs at 2030, 2050 and 2070 under SRES A2 scenario). The modelling analysis suggests that primary production of grasslands and livestock are likely to decrease across most of southern Australia's grazing lands under future climate. By including changes in on-farm management in our models we were able to evaluate the effectiveness of certain adaptation options.

Options considered individually were not always effective but a combination of Incremental grassland management and animal genetic improvement options (currently available to graziers) was able to offset productivity declines at cross-regional scale. Through implementation of the optimal combination of adaptation options, profitability across southern Australia was shown to increase by +69%, +84% and +116% in 2030, 2050, and 2070, compared to no adaptation.

Optimal systemic adaptation could make addition of $A 2.00 billion in 2030, $A 2.10 billion in 2050, and $A 2.12 billion in 2070 to industry with current farm management. In comparison with historical production, adaptation value to industry would be $A 1.51 billion in 2030, $A 1.51 billion in 2050, and $A 1.12 billion in 2070 (all for a full adaption).

If the most-profitable combination of adaptations is used at the baseline instead of the current-practice, then the optimal combinations of grassland adaptations would provide a further increase in operating profitability at 28%, 28%, and 16% of sites in 2030, 2050, and 2070. If the livestock genetic adaptations –cannot be adopted at the present for lack of seed stock – are also included, the optimal systemic adaptations would be more profitable than the alternative baseline including grassland management options at 60%, 56%, and 48% of the locations in 2030, 2050, and 2070.

We discuss 3 conceptual issues which arose during our study: (i) how to estimate impact when current management is environmentally infeasible under future climates; (ii) estimating the effectiveness of combinations of adaptations, only some of which are currently available to graziers; and (iii) dealing with the tension between modelling best-practice systems, so that present and future can be compared, versus modelling typical practice for economic valuation.