Exploring Adaptation Options for a Region Nominally Affected by Climate Change - A Tasmanian Case Study

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Tasmanian agriculture has a farm gate value of ~$1,100m or 5% of gross State product - the largest % for any State - with post-farm activities contribute ~11% to gross State product. Changes to production, including from climate change, are of considerable significance. The sector, dominated by crop-livestock farms, is structurally diverse & regionally influenced by edaphic, climatic & infrastructure constraints & opportunities. Agricultural production is particularly sensitive to climate variability & potential changes in the baseline climate.

Future climate?

Although geographically small, Tasmanian regional climates & farming systems are diverse (Fig. 1), affected by different synoptic influences, & the impacts of changes in climate variables will likely vary across them. A regional assessment of the impacts under a range of general circulation model & emission scenarios has identified the scope for positive yield gains in some crops & pastures due largely to a warming trend, & reduction in frost events (Holz et al. 2010). This affects the scope for changing the geographic domain of some existing crops & pastures, or possibly introducing new ones with consequent effects on enterprise structures & productivity patterns.

Modelling yield impacts – regional case studies.

Engagement: The study approach to identifying possible impacts of climate change combined principles of farming systems analysis with a strong emphasis on farmer participation. The project centred on 5 regions (Fig. 2) with varying farming systems. Five ‘representative’ farm types were defined at regional workshops (Table 1) & a case study farm was selected for enterprise modelling under a range of possible climate scenarios (Fig. 3).

Climate projection data: 2 sets of future climate data were assembled, reviewed & employed - Climate Futures Tasmania (CFT) for whole-farm modelling (A2 scenario outputs for 6 GCMs - CSIRO3.5, GFDL2.0, GFDL2.1, ECHAM5, MIROC3.2, UKMO-HadCM3) & Oezclim for paddock scale modelling (A2 & A1F1 emission scenario outputs for 4 GCMs - ECHAM5, GFDL2.0, GFDL2.1, MIROC232) the former having a higher resolution, the latter for national comparisons.


Results.

Yields were simulated for the baseline, 2030 & 2050 for (APSIM) wheat, barley, oats, peas (irrigated), beans (irrigated), lucerne (irrigated) & beef cattle, wool sheep & lambs grazing semi-improved pastures (GrassGro) by region (Table 1).

Crops & pastures: Mean crop yields (+ moderate N supply) either increase or marginally decline. For example, wheat responses at Sassafras (Fig. 4 left) increase being more temperature limited than Cressy (Fig. 4 right) where the response is limited more by the lack of adequate N supply cf. temperature.

Simulated pastoral yields & animal responses increased in all regions. For example, at Bothwell (Table 2) increased pasture growth in late winter to spring is largely due to rising temperature & adequate soil moisture.

Farm economics: Each GCM suggests either a modest increase in projected total gross margin between the baseline & 2030 & 2050, or for Southern Midlands & Coal Valley a limited decline due to small declines in cereal yields (Table 3). The impact on farm profitability is small without adaptation.