Impacts and Adaptation to Climate Change in Beef Production Systems in Central Queensland

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Introduction Trends in Queensland's grazing lands related to climate change, and increases in atmospheric carbon dioxide (CO_2) raise questions about the future productivity of various industries, particularly those on the climatic margins (Howden et al., 1999). Here we investigate the impacts of climate change at Emerald (23°31′S, 148°10′E, mean annual rainfall 648 mm) using a pasture growth model (GRASP) to examine the sensitivity of pasture growth to a range of climate change scenarios and two stocking strategies (constant and responsive).

Materials and methods Climate change scenarios were generated based on output from the CSIRO Mark 3 General Circulation Model. Changes in pasture growth were assessed for 2030. For each climate change projection combinations of higher (H) and lower (L) levels of predicted temperature (T) and rainfall (R) were generated to form four combinations that consisted of T-lower/R-lower (LL), T-lower/R-higher (LH), T-higher/R-lower (HL) and T-higher/R-higher (HH). Constant (based on average annual pasture growth) and responsive (based on the amount of pasture available on the 1st June each year) stocking strategies were used for a native pasture on a light textured soil of average fertility without trees. An average CO_2 enrichment scenario was applied where the base CO_2 level in 1990 was about 355ppm, and in 2030 it was 452ppm.

Results and discussion Variability of annual growth increased under low rainfall scenarios, and particularly under the high temperature/low rainfall scenario (Figure 1). The higher variability of simulated growth between years under low rainfall, compared to 1990 and high rainfall scenarios, was associated with greater under-use of available nitrogen in dry years, more nitrogen build up in the soil and relatively more nitrogen being available for growth in wet years. The risk of less than 1500 kg/ha of annual growth was increased under the low rainfall scenarios. The median growth of pasture was not affected by climate change.

Conclusions The higher variability of annual growth under low rainfall scenarios will make it more difficult to sustainably manage stocking rate. Finding the balance between utilising pastures for animal production and leaving them understocked for recovery will become more difficult and better tools are needed to help pastoralists assess pasture quantity and quality, sustainable stocking rates and recovery times of pastures.

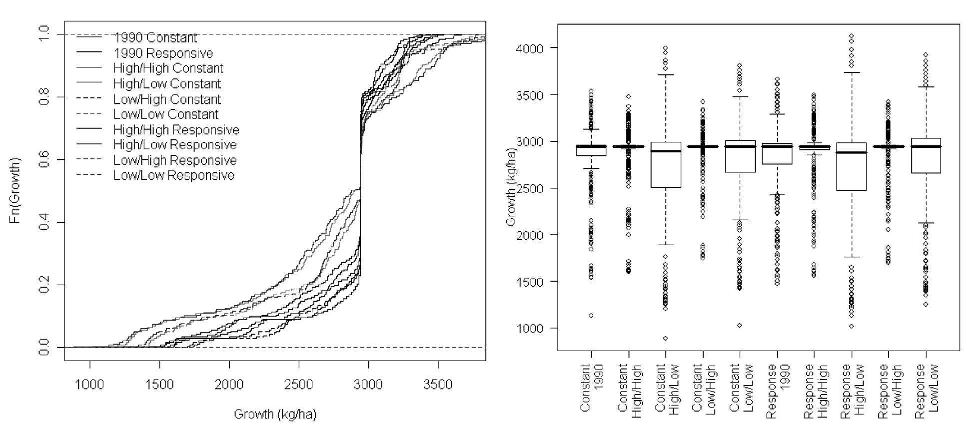

Figure 1 *Growth for 1990 and different climate change scenarios for 2030 using two types of stocking strategy.*

Reference

Howden, S.M., McKeon, G.M., Walker, L., Carter, J.O., Conroy, J.P., Day, K.A., Hall, W.B., Ash, A.J. and Ghannoum, O., 1999. Global change impacts on native pastures in south-east Qld, Australia. Environ Model Software 14, 307-16.