Investigating the value of seasonal climate forecast for beef grazing enterprises: Charters Towers case study

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Introduction

Seasonal climate forecasts (SCFs) have potential to improve productivity and profitability in agricultural industries (e.g. McIntosh et al., 2007; Meza et al., 2008; Klemm & McPherson, 2017), but are often underutilised by farmers in making key farm management decisions. This is attributed to the perception that SCFs are far from certain, despite significant advances over recent decades (e.g. Kirtman & Pirani, 2009; Doblas-Reyes et al., 2013). Unless uncertainty is explicitly and realistically incorporated into models of forecast use, a gap will always exist between expectations of forecast use and actual adoption by farmers (Kusunose & Rezaul, 2016).

In this study, we demonstrate the value of integrating SCFs at various forecast quality (skill) levels to reduce investment or opportunity losses for a grazing enterprise case study at Charters Towers, Queensland.

Methods

- A seasonal forecast system based on ENSO (El Niño Southern Oscillation) phases was parameterised by forecast quality to predict seasonal precipitation tercile (i.e. wet, neutral and dry) categories.
- Using ag-systems production simulation software (i.e. GRASP, NABSA) calibrated using the case study information, we simulated pasture growth, herd dynamics and annual economic returns under different climatic conditions.
- We developed a bio-economic model of forecast use, explicitly incorporating forecast uncertainty, allowing the value of imperfect SCFs to be determined.
- We then employed a regret and value function approach to quantify the potential economic value of using SCFs at various forecast skill levels in decision making in grazing enterprise management.

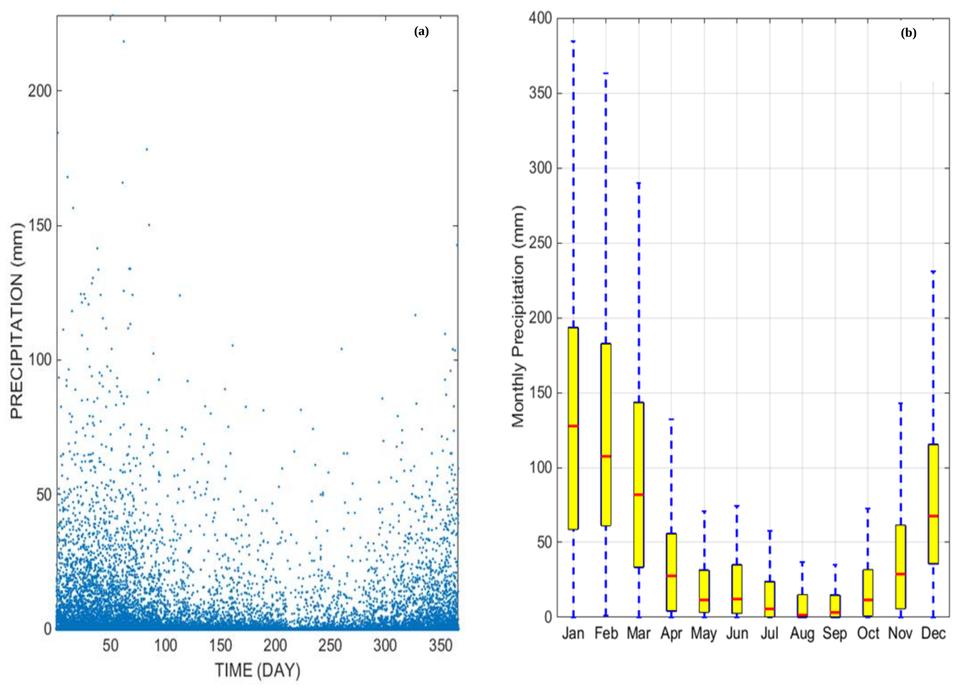

Figure 1: Daily (a) and monthly (a) rainfall at Charters Towers by daily historical climate record at Charters Towers post office station used to parameterise the climate scenarios

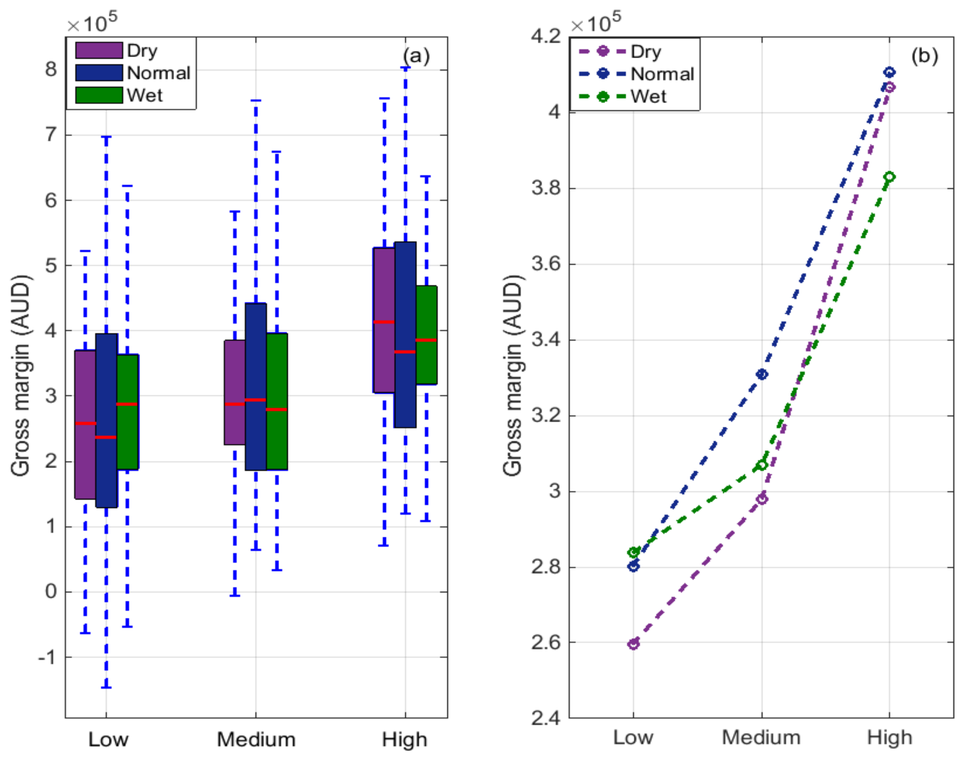

Figure 2: Gross margin distribution (a) and average value (b) as outputs of the NABSA simulations at the Charters Towers case study for low, medium, high feed supply scenarios and the three climatic conditions (dry, normal, wet).

Results and Discussion

Applying this conservative economic modelling approach, we show that skilled SCF systems contribute considerable value to farm level decision making. At the current SCF skill level of 60% (derived by correlating the ENSO signal and historical climate data at Charters Towers), a forecast value of AUD 6,000 per annum was realised; improvement of 10% in forecast skill (to 70% accuracy) would potentially result in AUD 2,000 additional annual benefit; and a perfect (no regret) forecast could result in increased return of AUD 19,000 per annum (18% of the case study average annual net profit of AUD 104,000).

Significance

Improvements in the skill and reliability of SCFs is likely to drive wider uptake of climate forecasts in agricultural decision making. We also anticipate that an integrated framework, such as that developed in this study, will provide a pathway for better communication with end users to support improved use of forecasts in agricultural decision making.

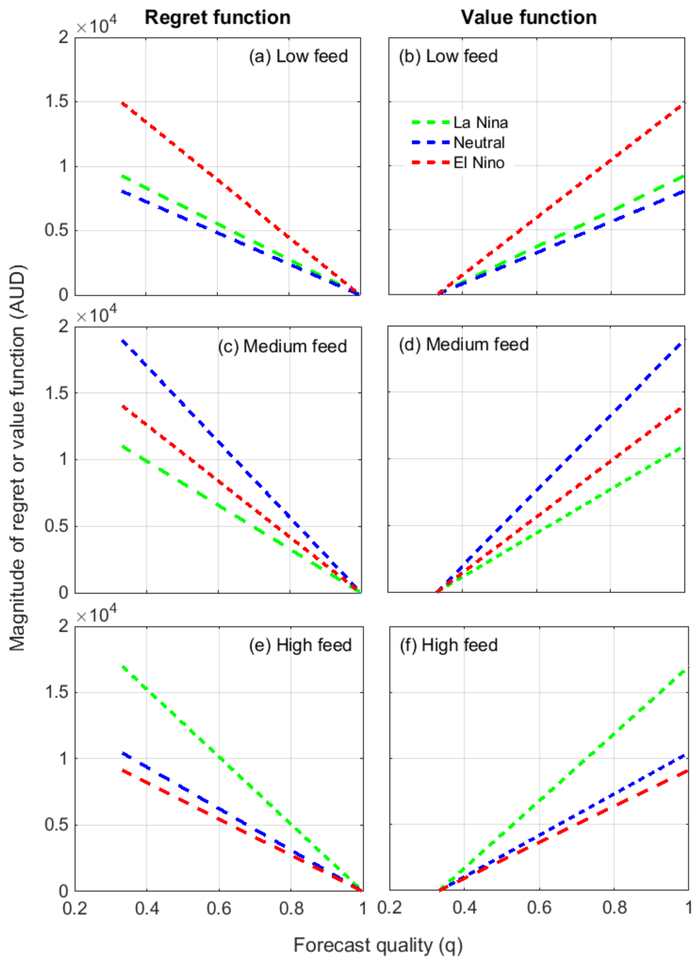

Figure 3: Regret and value functions of the La Niña, Neutral, and El Niño forecasts in the three feed supply scenarios (low, medium, high)

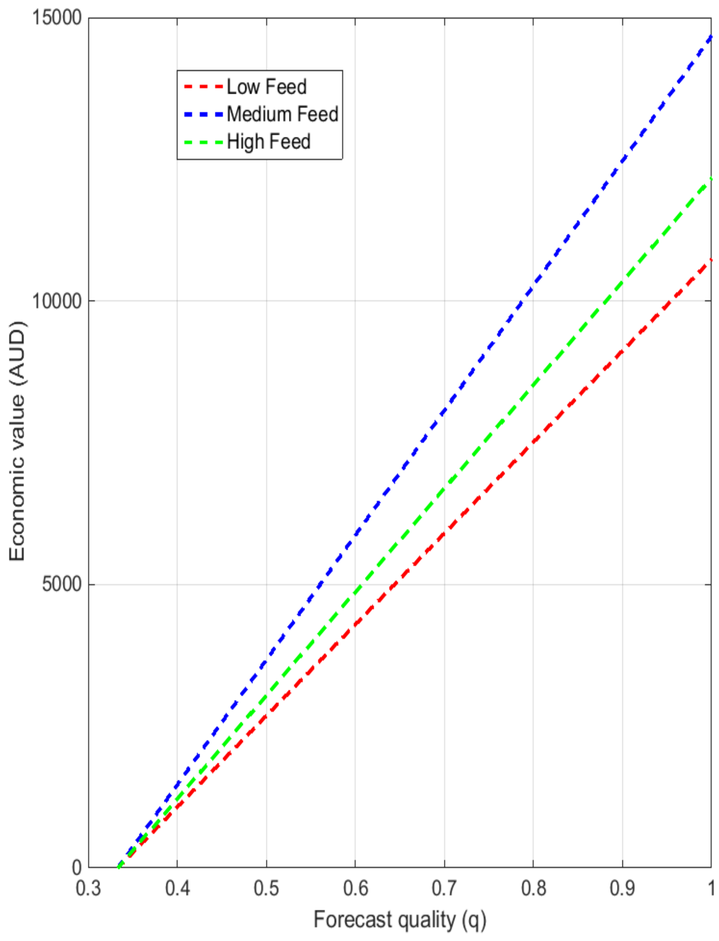

Figure 4: Economic values of the forecast system as functions of forecast quality in the three feed supply scenarios (low, medium, high).

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