Grazing systems management into 2030

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RESEARCH

Key messages

The main impacts of climate change by 2030 on grazing livestock enterprises is likely to be shorter growing seasons, greater variability in pasture growth, reduced pasture quality, less available pasture, reduced wool quality and increased variability in farm gross margins. Possible adaptations to alleviate some of these impacts are;

- **Minimising the need for supplementary feed by reviewing lambing and calving times, age at first joining, stocking rates and sale times,**
- **Increase flexibility in systems by varying sale times/rules, confinement feeding, movement, more animal trading (core breeding), agistment , matching feed demand to pasture production, and**
- **Improved pasture utilisation by grazing management.**

Why do the trial

Livestock managers have been challenged in recent years by many weather extremes including heat waves, drought, floods, late breaks, dry springs, and more. As a result livestock producers have been innovative in how they manage their systems. They have increased the flexibility in their systems by being able to adjust animal numbers more easily in response to seasonal conditions. During a suite of workshops across SA, 150 livestock producers said that they wanted a tool or process to review their stocking rates, lambing or calving dates, weaning rates and other management practices. The computer model Grass Gro (Moore et al, 1997) allows livestock managers to review these and other management decisions under a changing and variable climate without actually having to physically implement them on farm and then wait for the result.

In response to livestock producers needs the Department of Agriculture Forestry and Fisheries (DAFF) and Meat and Livestock Australia (MLA) funded a project which combined the use of sophisticated biophysical models such as Grass Gro with localised rainfall, temperature and carbon dioxide levels predicted from various climate models out to 2030. This allowed SARDI staff to work closely with livestock managers in order to analyse and test the most viable farm management adaptation options to meet a range of climate scenarios in the future.

How was it done?

Climate change projections were made using four Global Circulation Models (GCM's). Rainfall and temperature data was downscaled using the "Weather Maker, 2009". Simulations were run within Grass Gro for the period 2016-2045 (for 2030) and for the periods 1970-1994, and 1995-2005 for comparative purposes for many locations in South Australia. Rainfall is shown using Tod River in the Eyre Peninsula below (Figure 1). We assumed 450 ppm carbon dioxide across the 2030 time period. Various locations were selected in the high, medium and low rainfall areas across SA. On the Eyre Peninsula, Pillaworta station Merino ewe x Suffolk enterprise and a self replacing Merino ewe enterprise were used with Tod River rainfall to investigate a range of management decisions including optimum pasture species, lambing dates, weaning dates and stocking rates. The pasture compared was an improved pasture of annual ryegrass, Seaton Park sub clover, cocksfoot and annual grass on a moderately high soil fertility with 9300 kg/ha average annual pasture production versus a native grass pasture of annual ryegrass, Dalkeith sub clover, *Danthonia sp*, *Austrostipa sp* and early annual grasses on a moderately low soil fertility with 6750 kg/ha average annual pasture production. Pasture growth simulations using the improved pasture base is shown in Figure 2.

Measurements taken

Using these livestock systems we used the Grass Gro model to investigate the impact of climate change and climate variability on pasture and livestock production and then analysed the effects on supplementary feed requirements, gross margins, ground cover and animal sale weight. Various climate change projections and comparative time periods were used in order to promote discussion about alternative management options and adaptations for their livestock enterprises under a variable and changing climate by 2030. During workshops producers were shown these outputs and then asked to suggest adaptation options for testing within Grass Gro. The data shown here is a representation of what was demonstrated on Eyre Peninsula.

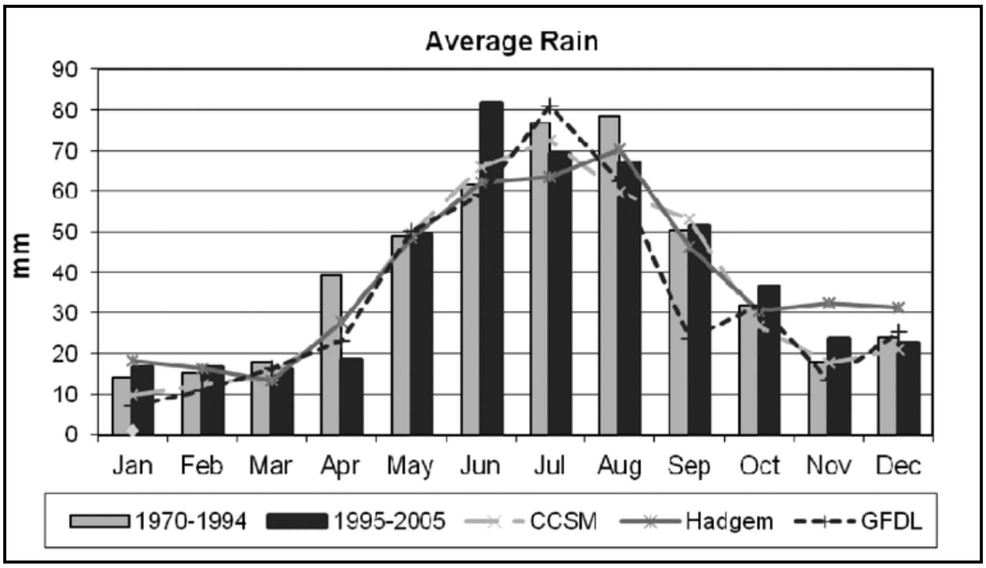

Figure 1 Actual average rainfall for 1970-1994 and 1995-2005 vs simulated rainfall averages for 2030 at Tod River on the Eyre Peninsula. The simulated rainfall for 2030 uses 3 Global Climate models (CCSM, Hadgem and GFDL)

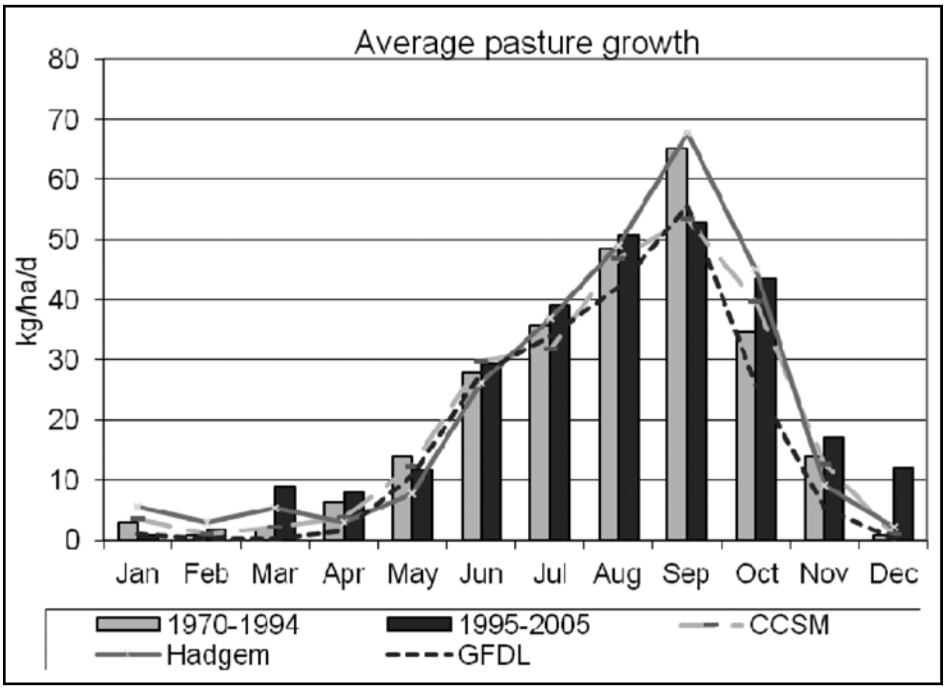

Figure 2 The improved pasture using Tod River rainfall at Pillaworta station simulated using Grass Gro for 1970-1994, 1995-2005 and comparing 3 different rainfall scenarios for 2030 using generated data from Global climate models (CCSM, Hadgem and GFDL)

What happened?

Rainfall at Tod River for 1995-2005 was 5% lower than the long term average. The projections for both rainfall and pasture growth for 2030 using the CCSM and Hadgem climate scenarios for 2030 were similar to that of 1995-2005, however the 2030 projections show that the pasture growth begins later in the season and cuts off earlier (Figure 2). Similarly, tests over the remainder of the state using Grass Gro show that by 2030 the main impact of climate change to South Australian livestock managers is likely to be increased climate variability and a shortened growing season. This has flow-on affects to livestock systems such as more variable gross margins. Below is the comparison of gross margins for a Merino ewe x Suffolk enterprise using the improved cocksfoot pasture for 1995 to 2005 rainfall (Figure 3) compared with the 2030 CCSM model projections (Figure 4).

The best gross margins for the improved cocksfoot pasture using 1995 to 2005 rainfall is an April lambing at 6.5 DSE/ha. Using the 2030 rainfall a May lambing on improved cocksfoot pasture has slightly improved average gross margins with the 6.5 DSE/ha. The CCSM model projections for 2030 show a greater range in gross margins with greater opportunities for gain but also for loss. This is partially due to the uncertainty of rainfall projections into the future but also due to the fact that the seasons may cut off earlier. The same April lambing with 6.5 DSE/ha seemed best under a native pasture situation. Under the set up we had in Grass Gro at times the native pasture produced higher gross margins, however native pasture also has many more opportunities for loss and there was greater variability with the native grass based pastures (Figure 5). The gross margin for improved pastures included an additional $70/ha for establishing and maintaining these pastures compared to native pastures.

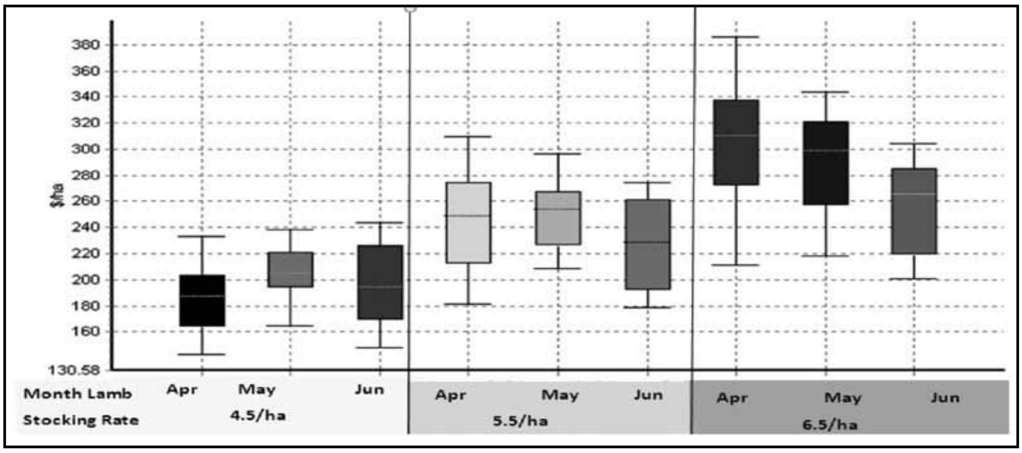

Figure 3 Gross margins for a Merino ewe x Suffolk enterprise on improved cocksfoot pasture using 1995-2005 rainfall at Pillaworta. Looking for optimum lambing time and stocking rate (DSE/ha). See 'Understanding box plots' for assistance in understanding Figures 3, 4 and 5

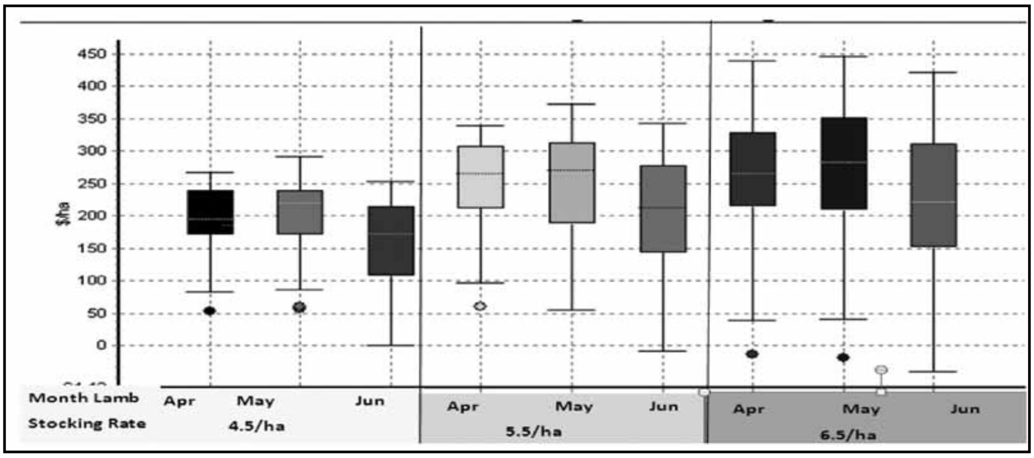

Figure 4 Gross margins for a Merino ewe x Suffolk enterprise on improved cocksfoot pasture using 2030 projected rainfall with the CCSM model at Pillaworta. Looking at optimum lambing time and stocking rate (DSE/ha).

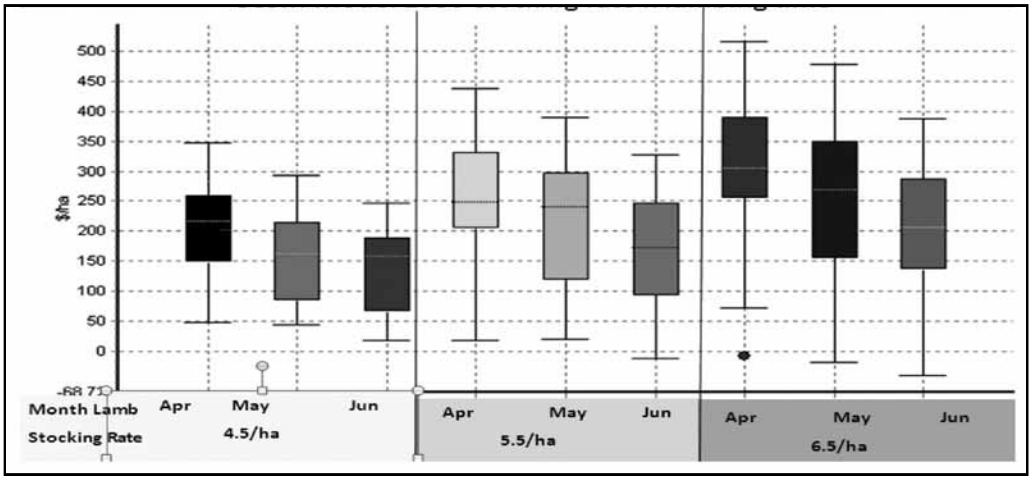

Figure 5 Gross margins for a Merino ewe x Suffolk enterprise on improved native pasture using 2030 projected rainfall with the CCSM model at Pillaworta. Looking at optimum lambing time and stocking rate (DSE/ha).

What does this mean?

The Grass Gro model is a powerful tool providing an opportunity to run many simulations. This shows its power to interrogate various management strategies for any enterprise. These gross margin results and more comparisons of supplementary feed, sale weight of lambs, and ground cover were shown to a group of 15 livestock managers and 3 consultants at the Pillowarta station. We also compared these same graphs with a self replacing Merino ewe enterprise. The results were discussed and producers were then asked what they may do differently to manage their enterprises both in the short and longer term. Responses were as follows;

- Early lambing created more profit.
- Cocksfoot pasture more productive (sow some more).
- Ensure adequate nutrition to pregnant ewes to ensure secondary fibre production.
- Improved pasture the way to go.
- Feed crop to stock.
- Consider the practicality of early lambing.
- Grazing management timing is important to gain better pasture utilisation.
- Plan your pasture and management of stock.
- Soil test for nutrition.
- Tactically manage the variability in the season.
- Don't compromise ground cover (management).
- Keep 1000 kg/ha feed ahead of stock.
- Rest paddocks (plan for stock nutrition).

Over the last 3 years in SA we have run 10 other farmer workshops across a wide range of geographical locations representing over 20 different livestock enterprises. Across these locations we have tested many management changes and discussed these with over 150 producers. These producers said the main impacts of climate change by 2030 on their livestock enterprises would be; generally shorter growing seasons, greater variability in growth, reduced pasture quality, feed available for less time, less pasture, high heat days reducing livestock production, wool quality reduced and more variable and potentially lower farm gross margins.

The adaptations tested and accepted by these livestock producers included;

- Minimise the need for supplementary feed by reviewing lambing and calving times, age at first joining, stocking rates, sale times.
- Increase flexibility in their systems to respond to seasonal conditions by varying sale times/rules, confinement feeding, stock movement, more animal trading (core breeding), self replacing system, agistment and matching livestock feed demand to pasture production.
- Improve pasture utilisation by grazing management systems including controlled, cell, rotational, confinement, or movement of stock and maintaining pasture growth in phase II (Figure 6).

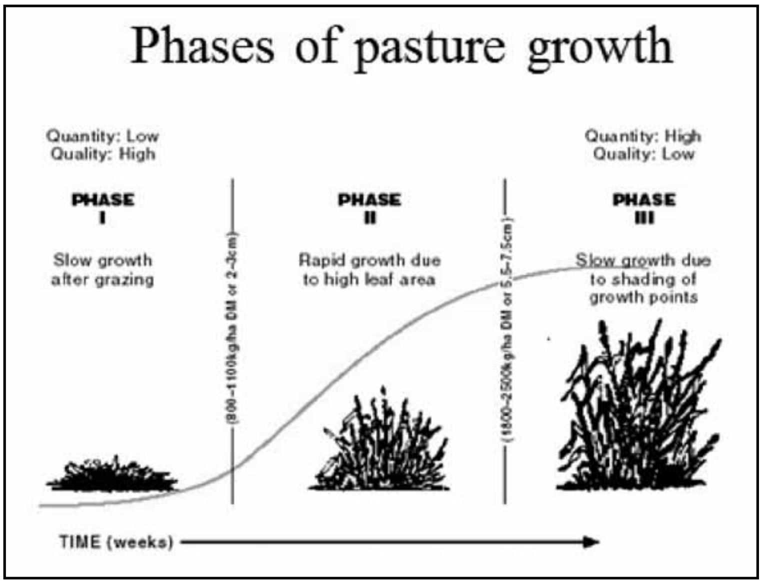

Figure 6 Phases of pasture growth [Source: MLA Prograze SA manual, editor T Prance]

Future Directions

There are many more simulations possible with Grass Gro and it can be used as a powerful tool to help plan into the future and also make decisions about the current season. There could be endless analyses performed in all areas, however we need funding to do this and capability. So far there are not more than 2 people that can adequately run Grass Gro in SA.

In the future we have proposed to do some work coupling Grass Gro with a model called Ausfarm. This will allow us to provide numbers on methane and nitrous oxide emissions for the case study scenarios already set up.

Acknowledgements

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