An historical analysis of the changes in pasture production and growing season in three dairy regions of South East Australia

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Biophysical Modelling approach

- SE Vic, SW Vic and Tas dairy regions are predominantly pasture based.
- Changes in the “wetness”, “dryness” and “length of growing season” will be key drivers for adaptation.
- Why ?
  - Strong influence on key management decision such as:
    - Stocking rate and calving date
    - Wintering off and implementation of infrastructure such as feedpads, herd homes etc.
    - Nitrogen usage and conservation practices
    - Drying off times and herd culling
    - Planting of forage crops, irrigation start up, scheduling and requirements

Biophysical Modelling approach

- What have we done?
  - Defined growing season
    - 14 day average growth rate > “break even” point.
      - Eg. At 2.0 cows/ha and 15 kg DMI/day = 30 kg DM/ha.day.
  - Defined wetness
    - Soil moisture > field capacity
  - Defined dryness
    - Readily Available Water (0.5PAW) removed
  - Modelled with biophysical pasture simulation model DairyMod (Johnson *et al*. 2008).

Johnson IR, Chapman DF, Snow VO, Eckard RJ, Parsons AJ, Lambert MG, Cullen BR (2008) DairyMod and EcoMod: Biophysical pastoral simulation models for Australia and New Zealand. Australian Journal of Experimental Agriculture 48, 621–631.

DairyMod: Simulation 2 15 Oct 07.dmx

File Edit Simulation Options Help

Stock: dairy cow

Show graphs

1/07/2000
16/06/2002
30/06/2007

Pause on:
Jan 1

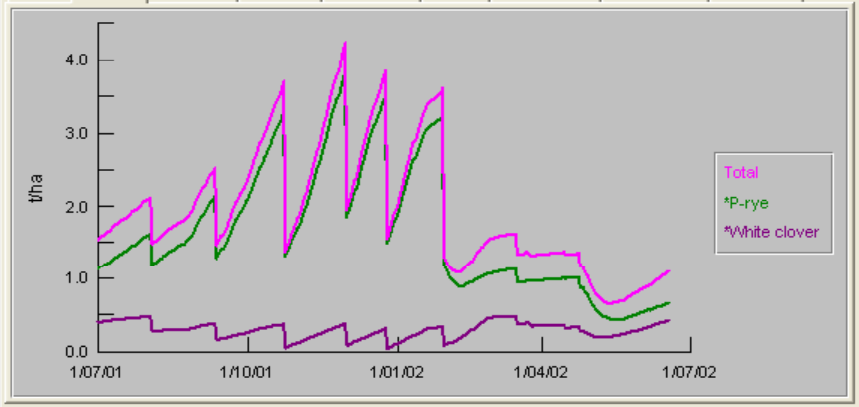
Slow Fast

Show data
Cumulative

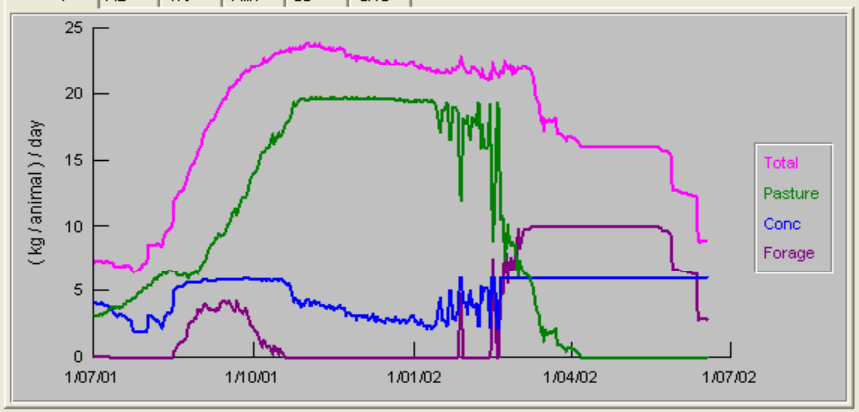
Soil
Depth
Time

2 cm
5 cm
10 cm
15 cm

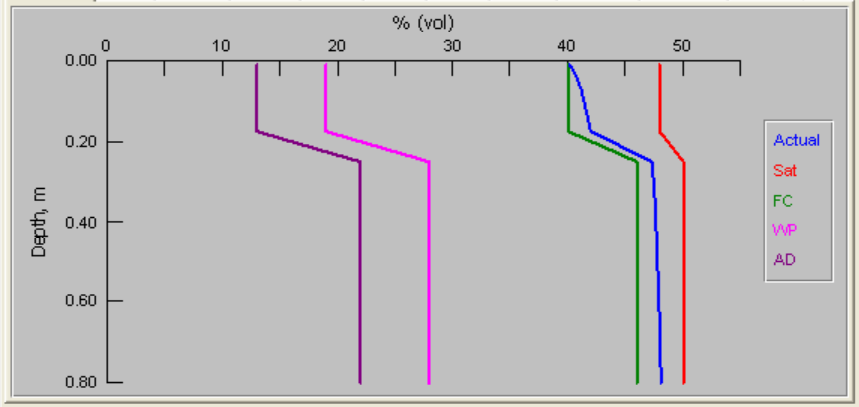
D. Wt. | Species | Species % | Nutrients | Digestibility | Gr rate | Mean gr rate | Leaf interval | Leaf stage



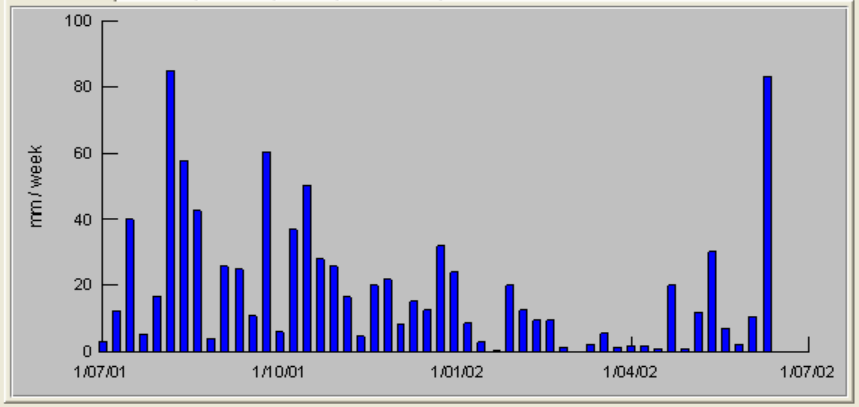
Intake, W | ME | Wt | Milk | SD | GHG



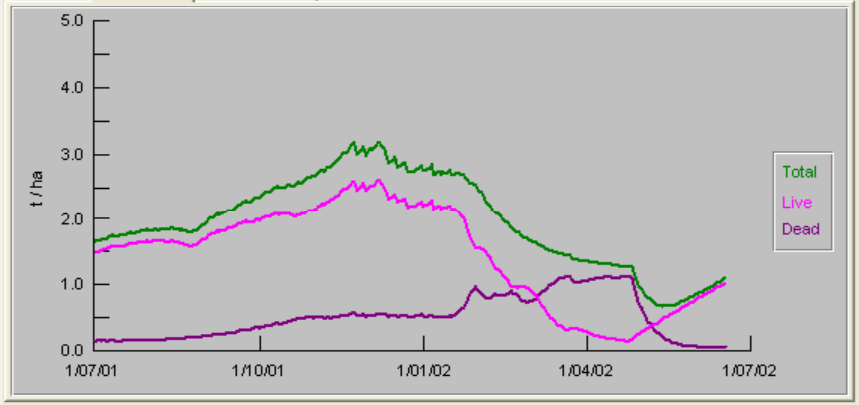
Vol water | Soil N | Soil test | Soil OM | C : N | Dung | Evap | Runoff | Drainage | mm water | N losses



Precipitation | Irrigation | Air temp | Light | Potential ET



Paddocks | Farm cover | Farm allocation



Farm info | Grid

Pasture intake	9.31 t/ha	3401 kg/animal
Supp. intake	7.90 t/ha	2887 kg/animal
Cut	1.59 t/ha	
Milk	18269 L/ha	7311 L/animal

Display paddock 5

Select the paddock to display on the interface. This can also be done by clicking on the grid

Are the models accurate ?

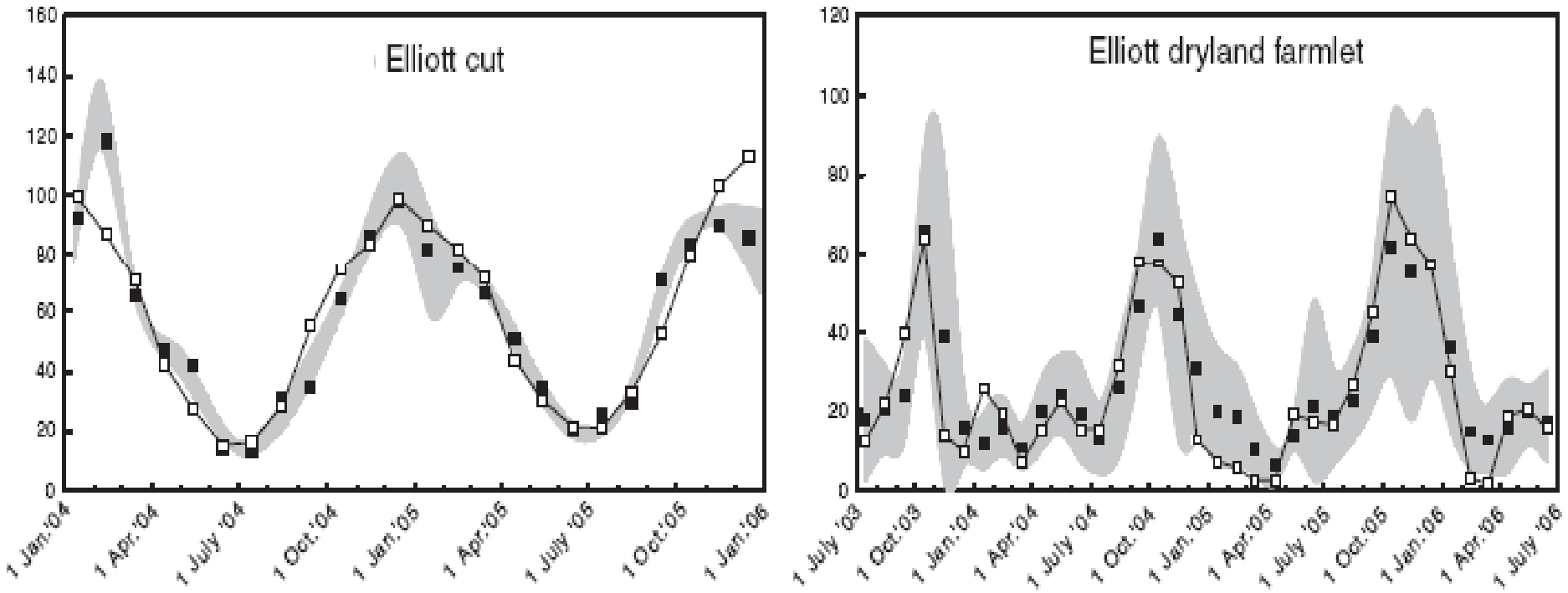


Figure 1. Measured and modelled monthly mean daily net herbage accumulation rates (kg DM/ha.day), including measured variability (grey shaded). Adapted from Cullen et al. 2008.

Cullen BR, Eckard RJ, Callow MN, Johnson IR, Chapman DF, Rawnsley RP, Garcia SC, White T, Snow VO (2008) Simulating pasture growth rates in Australian and New Zealand grazing systems. *Australian Journal of Agricultural Research* **59**, 761-768.

Historical Analysis of SE Aus

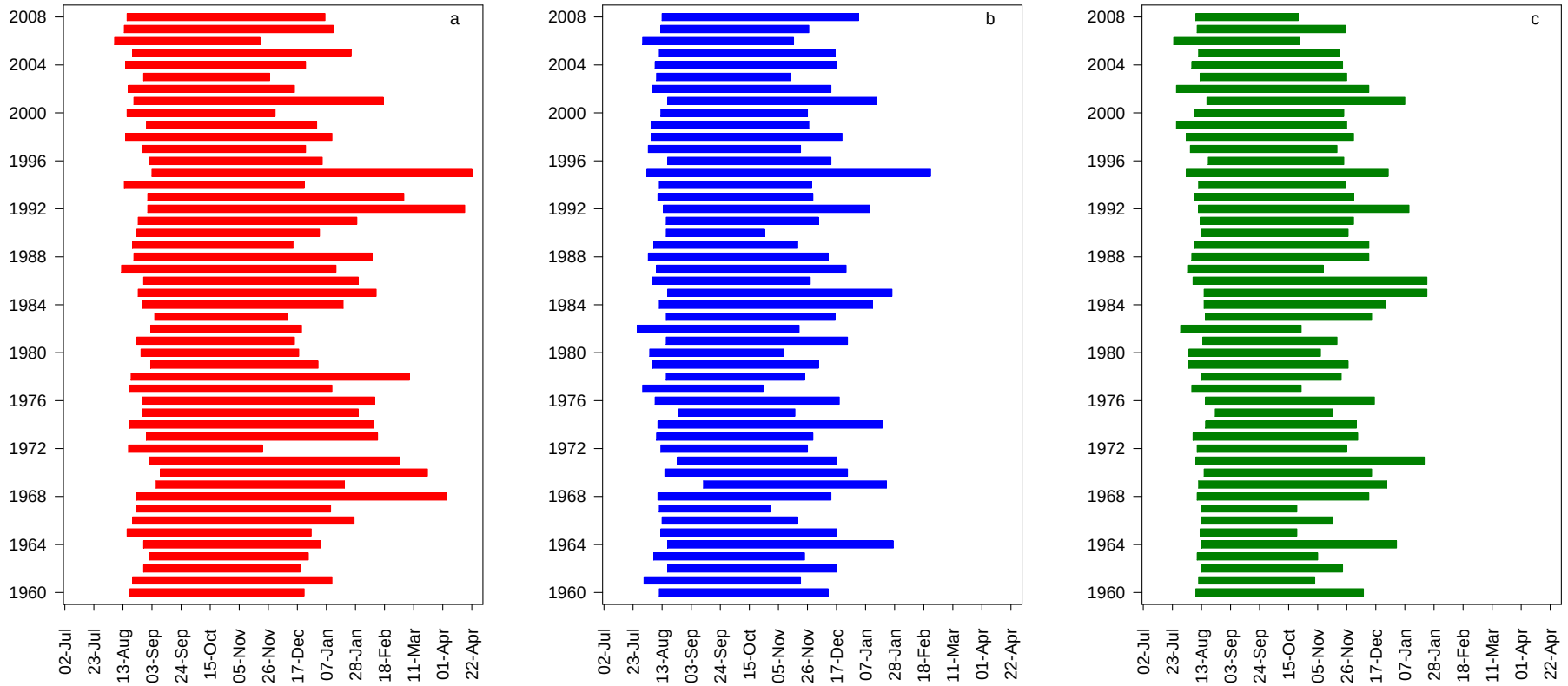


Figure 2 The simulated commencement date and duration of the growing period, for years 1960/61 to 2008/09 at Elliott (a), Ellinbank (b) and Terang (c).

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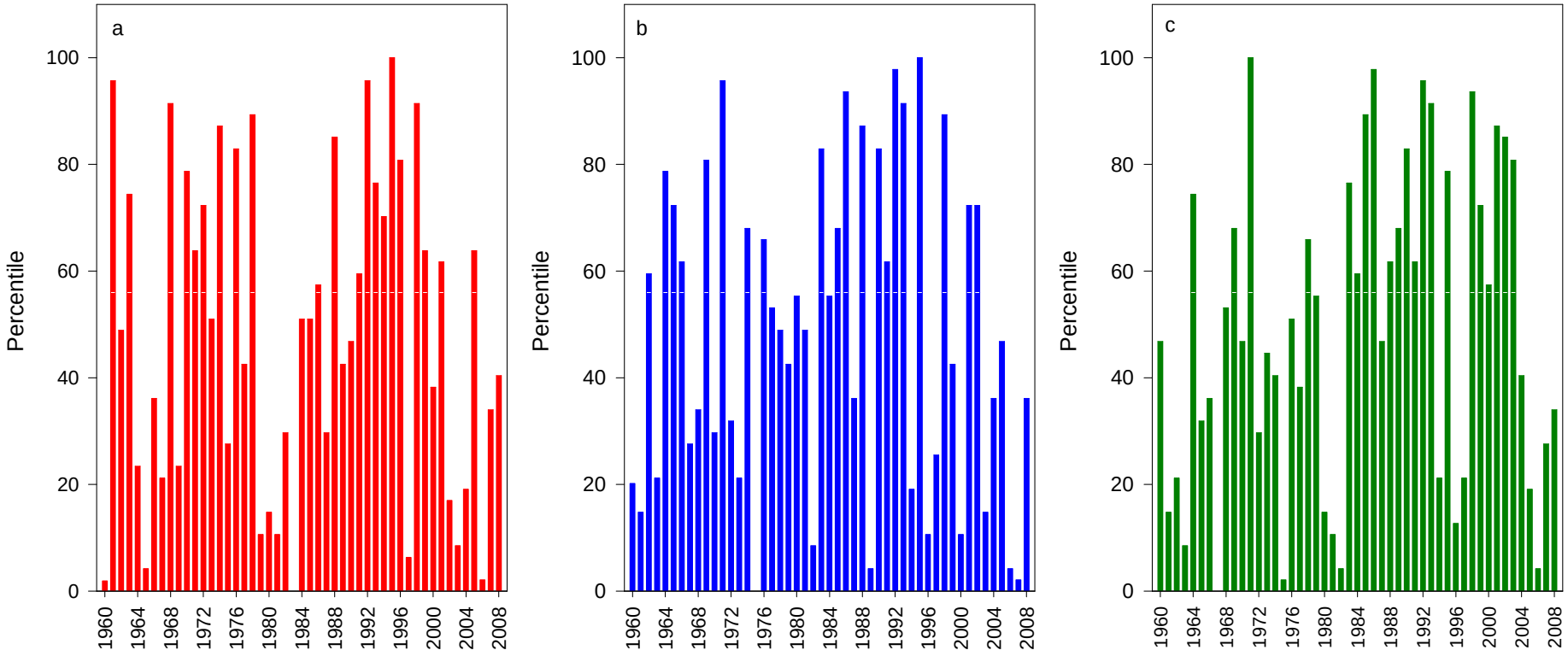

Figure 3 The simulated number of days in years, expressed as yearly percentiles that the 14 day mean pasture growth rate > 30 kg DM/ha , for years 1960/61 to 2008/09 at Elliott (a), Ellinbank (b) and Terang (c)

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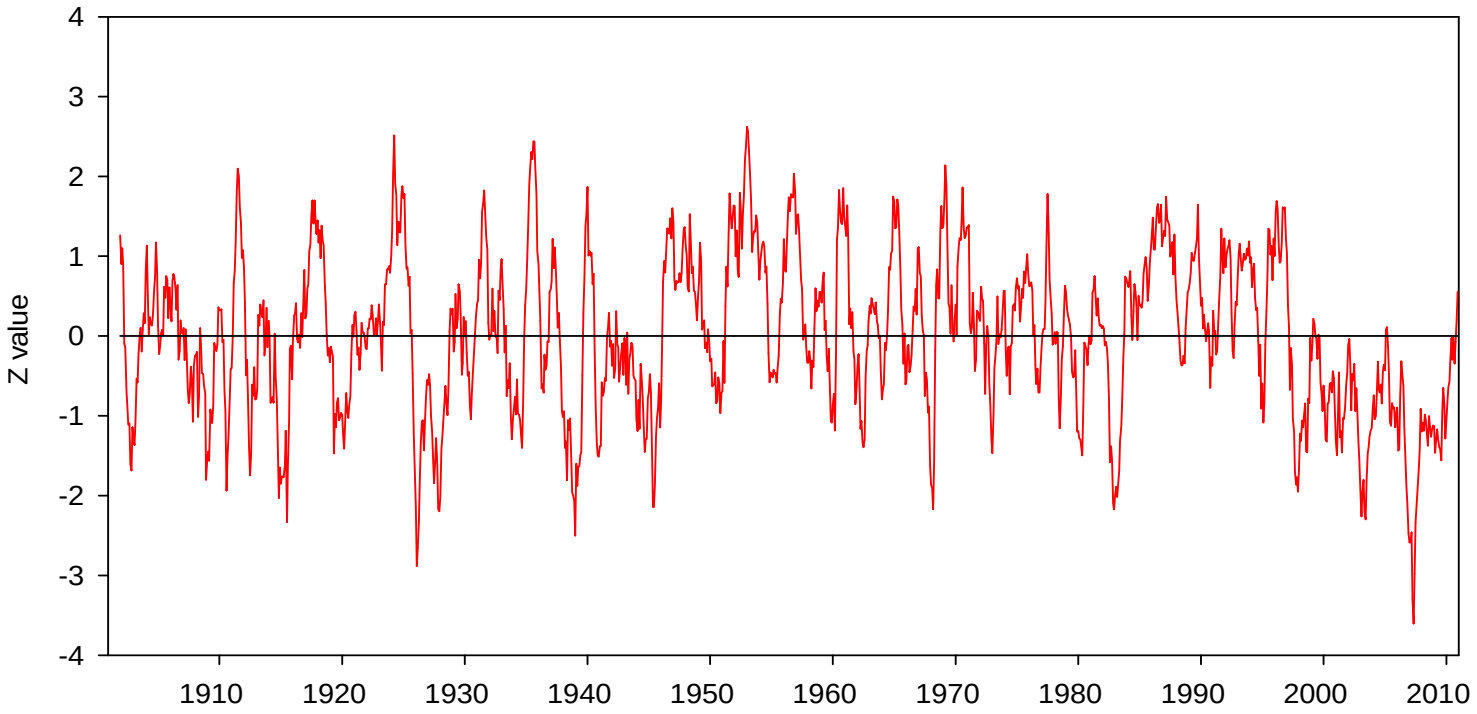

Figure 4 The Standardised Precipitation Index (SPI) for cumulative 12 month precipitation (1900-2010) for Ellinbank

Historical Analysis of SE Aus

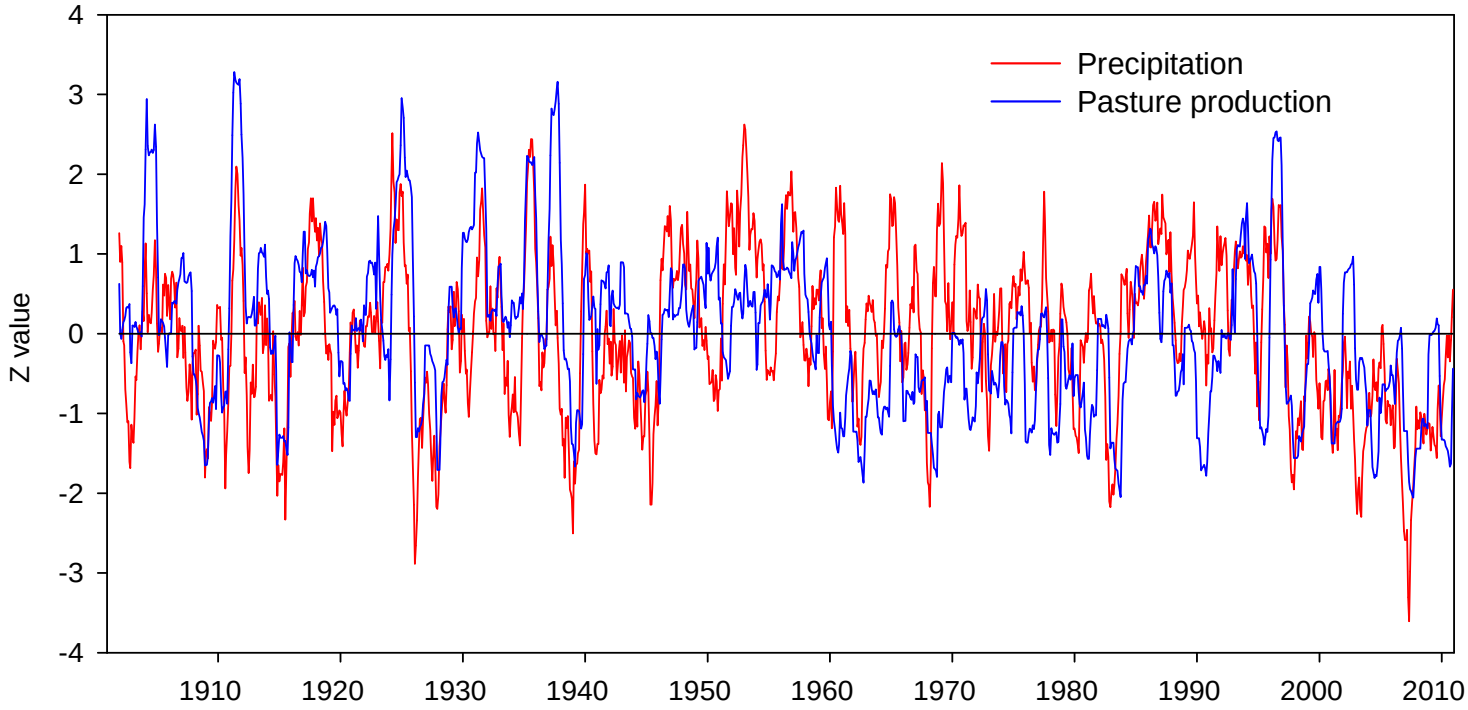

Figure 5 The Standardised Precipitation Index (SPI) for cumulative 12 month precipitation (1900-2010) and the corresponding Z value for simulated annual pasture production for Ellinbank

Historical Analysis of SE Aus

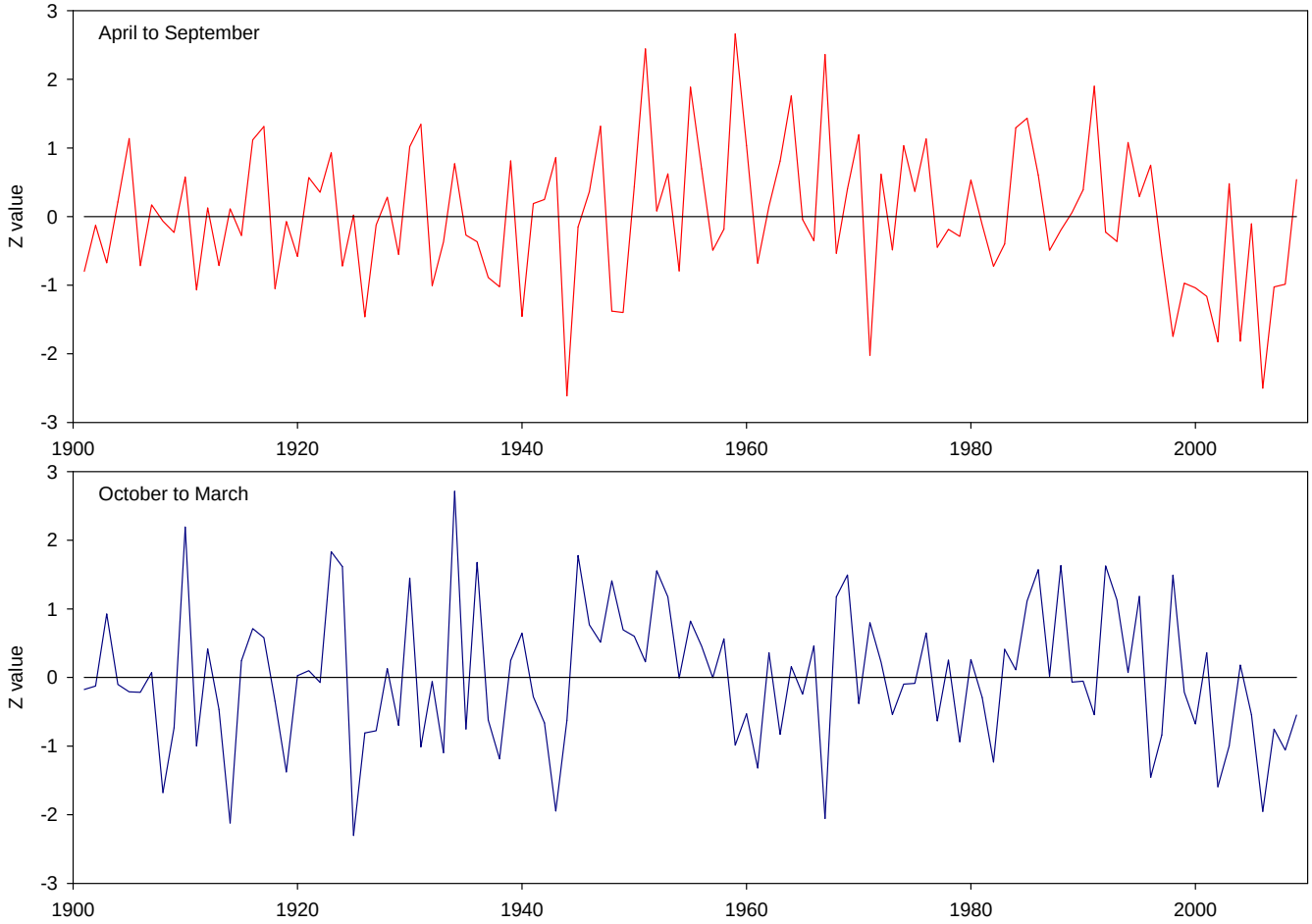

Figure 6 The 6 month Standardised Precipitation Index (SPI) for April to September (RED) and October to March (BLUE) for Ellinbank

Historical Analysis of SE Aus

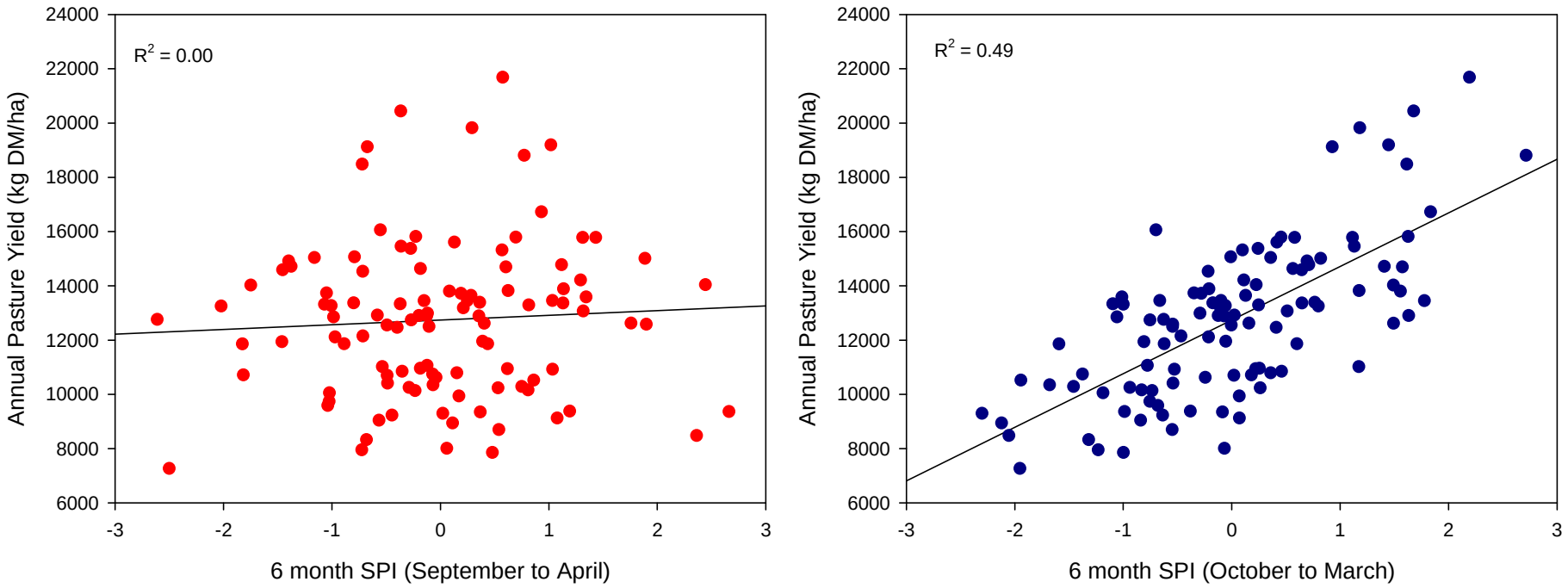

Figure 7 The regression between simulated annual pasture yield (kg DM/ha.year) against the 6 month Standardised Precipitation Index (SPI) for April to September (RED) and October to March (BLUE) for Ellinbank

Summary

- In recent years the number of days that feed supply > feed demand has declined at all three sites
- There is sufficient variation in historical records to examine adaptation options
- There is an urgent need for whole of farm system analysis to accurately simulate production, profitability and risk
- There are potentially three levels of adaptation that need be explored
  - Adapting within the current feed base
  - Modifying the feed base by adopting different forage options
  - Adapting to a new farming system

Acknowledgments

This project is supported by funding from Dairy Australia, Meat and Livestock Australia and the Australian Government Department of Agriculture, Fisheries and Forestry under its Australia's Farming Future Climate Change Research Program