'GrassGro helped me fine tune my farming system, how can it help you?'

O Cay

Monaro grazier, "Pineleigh", Bungarby, NSW 2630: ojcay@bigpond.com

Abstract: *This paper outlines how a computer decision support tool was used to try to optimise the profitability of a Monaro grazing enterprise coming out of drought and having recently purchased extra land. In this situation the farm was understocked and the option of purchasing stock looked risky due to purchase price after the eastern states of Australia had received general rain following an extended drought. The main decision support tool used was GrassGro, which was used to explore how a change in lambing time could increase the stocking rate with only the same number of ewes. Modelling results indicated that economic goals could be reached without the risk and cash costs of livestock purchases so all the ewes were joined in January for an earlier lambing and half were scanned in lamb. The scanned empty ewes were rejoined for a normal lambing. With this strategy there was an increase in the enterprise DSE (dry sheep equivalent) rating earlier than would normally have occurred. GrassGro correctly indicated the strategy would increase profitability.*

Key words: decision support, modelling, grazing system, profitability, lambing time, stocking rate

Introduction

A recent purchase of extra land in 2010 left our farm enterprise with the challenge of optimising profit while at the same time recovering from drought. This situation meant our stock number were below the carrying capacity, but the opportunity to purchase stock looked risky due to elevated prices after good rain in eastern Australia following the extended drought.

Around this time the Monaro Farming Systems (MFS) producer group had received funding to purchase the GrassGro decision support tool and receive training in its use. GrassGro is a biophysical model of grazed pasture systems which uses historical weather data to evaluate management options both in terms of production and economic risks in the context of a variable climate. I received training in the use of GrassGro as a member of a core group of MFS members charged with developing farm system analyses which could be used to test the general applicability of management options to grazing enterprises on the Monaro.

In the context of our particular business challenges we used GrassGro to assess options for increased utilisation of pasture without the need to purchase stock. The option to bring forward joining (lamb earlier) was analysed using GrassGro to assess the impact on stocking rates and profit in the context of physical and financial risks

On our farm we observed a steady decline in feed supply from 2006–09 and by winter 2009 the stocking rate had fallen to just 1.5 dse/ha (Figure 1). A late spring in 2009 inspired some restocking and this optimism continued with restocking purchases and retaining extra stock until the later half of 2010. At this point we became cautious about buying sheep as restocker ewes were selling for $180 and store lambs for $130 indicating significant risk of losses in inventory value for additional purchases as well as the obvious cash-flow implications.

Method

GrassGro was characterised to represent the farm system at 'Pineleigh'. The model requires initial inputs related to soils, pastures and animals and uses historical daily weather data to simulate the pasture growth and animal performance on a daily time step. Model outputs can be aggregated and analysed in terms of averages as well as probabilities of certain outcomes occurring. The pasture growth model used by GrassGro is described by Moore *et al* (1997) while the animal production is modelled in the same manner as GrazFeed (Freer *et al* 1997)

A long term historical simulation was conducted based on the normal management at "Pineleigh" in order to check that GrassGro was providing a robust representation of the historical productivity of the farm. Although there are three basic soil types on "Pineleigh", a Stony Chocolate Basaltic soil (Table 1) was chosen to represent the farm system so as to make it simpler to validate the model outputs.

Pastures were composed of a mix of phalaris, sub clover, medics and annual grass. With initial herbage mass, root mass, phenology and seed pools set to typical levels for the starting day (1 January). The long term nature of the simulation served to negate the impact of any errors in the initial inputs.

The enterprise simulated was a ewe breeding enterprise using fine Merino genetics (Table 2). Regardless of the lambing time adults were shorn on the 1st of February and weaners on the 1st of April. Ewes were cast for age at 6.5 years of age on the 2 February. Surplus young ewes sold as hoggets on the 2 February while all young wethers were sold at 46 weeks of age to free up pasture for the breeding ewes in the last 6 weeks of pregnancy.

Since mortality is calculated at a fixed rate maintenance feeding of livestock at a minimum threshold must be specified. From 1 January to 1 September all animals older than weaners were fed barley as required to maintain a minimum flock average of condition score (CS) 2 while from 2 September until 31 December the minimum target was set to CS 1. In addition weaners were also fed an 80:20 mix of barley and lupins as required, sufficient to reach a body weight of 25kg by 1 March.

Weather data for the simulation was sourced as a Silo data drill file from the Qld Department of Environment and Resource Management Long paddock web site (http://www.longpaddock.qld.gov.au/silo/) and imported into GrassGro using standard protocols. Figure 2 shows the historic

Table 1. Physical Characteristics of a typical free drained Stony Chocolate soil of Basaltic Origin at Bungarby NSW.

	Top soil	Sub Soil
Cumulative depth	300	1000
Plant Available Water (Volumetric)	13%	8%
Field Capacity (1 bar)	35%	45%
Wilting Point (15 bar)	22%	37%
Bulk Density	1.16	1.2
Initial Water Content	18%	0.42

Table 2. Genotype parameters for a straight bred fine wool merino flock

Standard Reference weight [a]		55 kg
Greasy Fleece Weight		5.5 kg
Micron		19 microns
Yield		70%
Annualised Mortality	Adults	5%
Weaners		10%

[a] The weight of an empty clean shorn ewes in condition score 3.

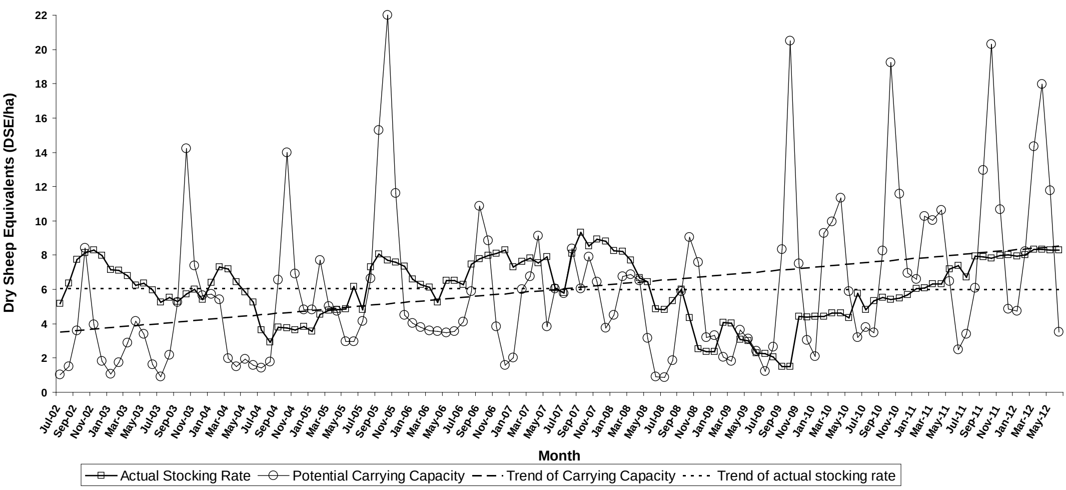

Figure 1. Results of Stocking rate and carrying capacity charting for Pineleigh from 2002 to 2010.

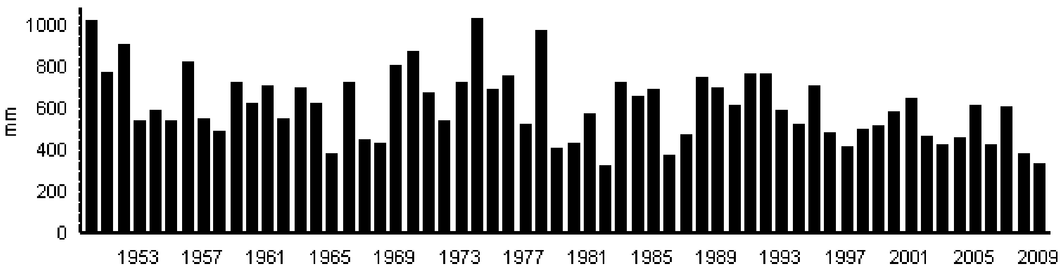

Figure 2. Annual rainfall (614 mm average) from a Silo data drill for Pineleigh from 1950–2009

Table 3. Assumptions about prices received and the costs expended in running the described enterprise.

Prices received:		
Wool prices based on median price from 2002–2007	18 micron	1208 c/kg clean
	19 micron	1099 c/kg clean
	20 micron	1017 c/kg clean
	21 micron	1000 c/kg clean
	Average price as a percentage of average fleece price	90%
Ewe Sales (mutton) (based on the projected market)	<18 kg dressed	300 c/kg
	>18 kg	350 c/kg
	Dressing %	38%
	Skin Value	$1/hd
Ewe Lamb Sales	Flat price	450c/kg
(projected restocker value)	Dressing %	42%
Wether Lamb sales	<16 kg Dressed	350 c/kg
	16–18 kg	400 c/kg
	>18 kg	450 c/kg
	Dressing %	42
	Skin value	$3 /hd
Lamb Price Scalar	Jan	1
	Feb	1.1
	Mar–May, Sep	1.2
	Jun	1.4
	Jul–Aug	1.5
	Oct–Dec	0.9
Enterprise costs		
Shearing	Ewes	$7.00
	Lambs	$6.50
Husbandry	Ewes	$3.00
	Lambs	$5.00
Selling Costs	Sheep	
	Sheep Transport	$2/hd
	Wool	5%
Pasture Costs	Fertiliser to maintain fertility to achieve 70% of potential growth.	$25
Supplement Costs	Barley	$500/t
	Lupins	$600/t

annual rainfall used in the baseline historical simulation.

Economics were analysed using base assumptions about costs and prices received (Table 3). Average wool price was determined as a percentage of average fleece price. Wether lamb prices varied with the month of year that they were sold.

Grassgro was then used to compare the outputs of four different lambing dates with stocking rates optimized to the sustainable maximum for each lambing date. The earliest lambing date tested was the 1st of July as the joining date to achieve the earliest possible due to the necessity to wean lambs before the ewes could be rejoined.

Maintenance of ground cover above minimum levels was used as the method to set sustainable stocking rates (Alcock *pers com*, Warn *et al.* 2006). We determined that for our historical system ground cover was held above a minimum of 70% in 70% of years so stocking rates were adjusted at each lambing time in order to maintain the same level of ground cover. In this way no system was given an unfair advantage through higher utilization The ultimate sustainable stocking rates are shown for each of the four lambing dates in Table 4.

Results

A continuous historical simulation of the defined farm system generated a long term output for herbage mass shown in Figure 3. Our observed general decline in herbage availability from 2006–2009 was reflected well by the outputs of the base simulation giving us confidence that the model was producing sensible results.

The maintenance of ground cover was checked (Figure 4) and the chance of exceeding a minimum ground cover of 70% was still 7 years in ten for each of the new lambing dates once the stocking rates had been adjusted.

Boxplots of annual Gross Margin (Figure 5) indicate that despite being able to join less ewes, bringing lambing forward did not substantially change the economic output or the riskiness (variability) but it did bring forward the increase in overall DSE's per hectare due to lambing serving to increase the DSE's carried in the year of implementation.

Looking at the average Gross Margin and the contribution from Income and Expenses line items (Table 5), lambing in July represented an $80/ha saving in the capital cost of sheep (0.5 ewes/ha) and $24 ha in variable sheep cost.

Table 4. The combination of lambing date and stocking rates compared to determine the impact of lambing at different times at Pineleigh.

Mean Lambing Date	1 July	1 August	1 September	1 October
Stocking Rate (ewes joined/ha)	4.5	4.8	5	5

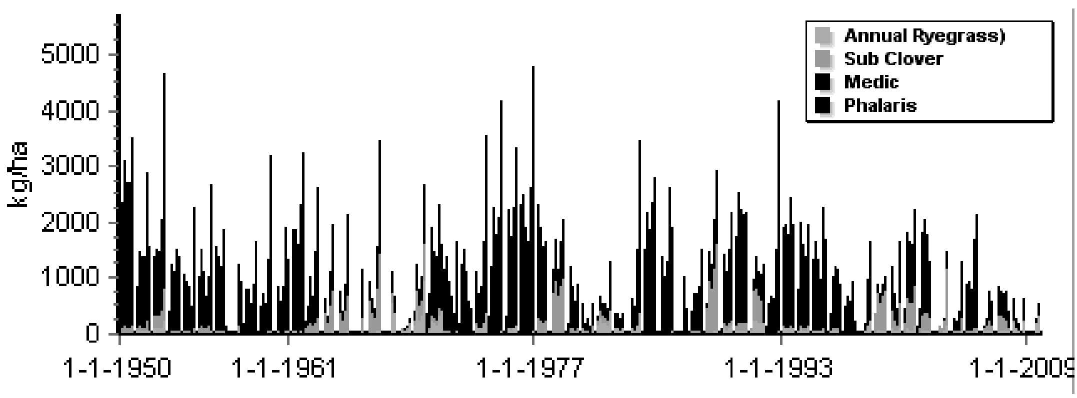

Figure 3. Simulated available herbage and species composition from 1950 to 2009

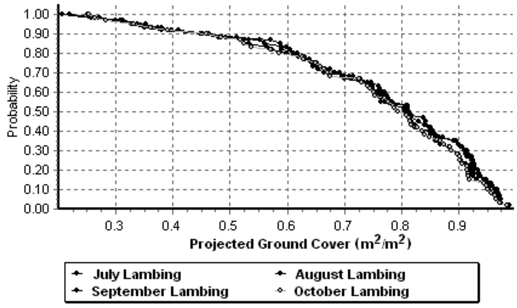

Figure 4. Probability that annual minimum ground cover exceeds the 70% target level at each combination of lambing time and stocking rate.

Action taken

Based on the GrassGro results it was decided to join for a July lambing. The lambs were weaned and all the ewes immediately joined for an early lambing. The ewes were scanned and 50% scanned in lamb. The 505 that scanned empty were rejoined for a spring lambing. Since there were pregnant and lactating ewes in the system earlier there was an increase in the DSE (dry sheep equivalent) rating earlier than would normally have occurred. GrassGro indicated this earlier increase in stocking rate would increase profitability and it was correct.

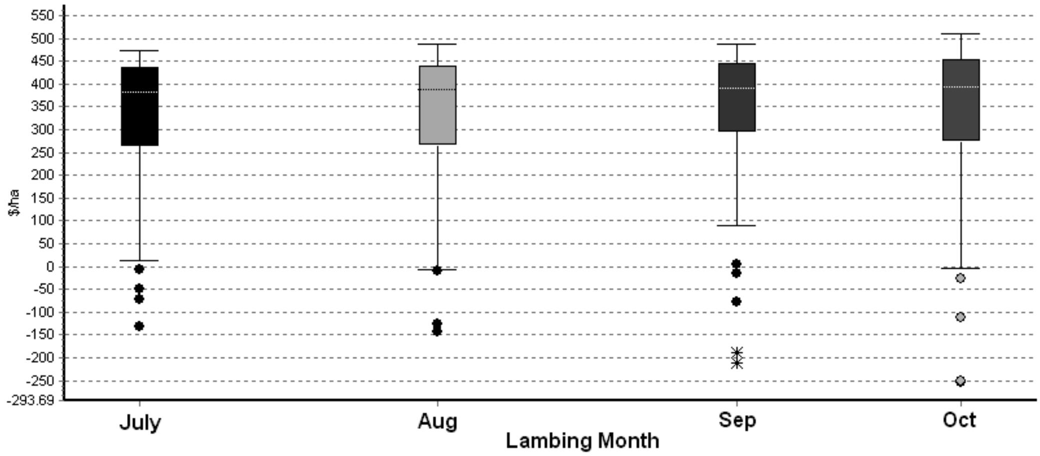

Figure 5. Gross margin variability if lambing in each of the four months from July to October

Table 5. Long term average itemised income and expenditure for the four lambing dates tested.

Lambing date		1 Jul	1 Aug	1 Sep	1 Oct
Stocking rate (ewes joined/ha)		4.5	4.8	5	5
Net wool Income–ewes	$/ha	185	194	200	196
Net wool income–young stock	$/ha	68	60	51	43
Sale Income–young stock	$/ha	220	226	238	254
Sale income – CFA	$/ha	49	52	53	52
TOTAL INCOME	$/ha	522	531	542	546
Animal Husbandry	$/ha	33	34	36	37
Shearing Costs	$/ha	44	47	49	50
Rams Purchased	$/ha	21	23	24	24
Maintenance Supplement	$/ha	49	56	56	59
Weaner Supplements	$/ha	2	1	1	2
Pasture Costs	$/ha	25	25	25	25
TOTAL EXPENSES	$/ha	194	205	211	218
GROSS MARGIN	$/ha	329	326	331	327

Conclusions

Now, 18 months after the decisions were taken, we can confidently say that GrassGro helped to make a success of an unorthodox management option. There were also some added benefits not accounted for in the original assessment which proved to be the icing on the cake.

- As the scanning results from the January Joining were 50 % in lamb, only the best of the rams were used for the April Joining saving on ram costs and increasing genetic progress in that drop of lambs.
- With two lambings the labour requirements were not as intense for lamb marking and weaning saving the hassle of finding casual labour.
- Previous restocking purchases had introduced lice that cost $10,000 to eradicate. With this method of increasing stocking rate there was no risk of introducing pests or disease.
- In the period from 2010 to now there has been a book value right down of breeding ewes in the order of $80/hd.

The training required to run GrassGro was a 2 day face to face workshop and about another two days intermittently at home. There is a cost to purchase the program, but having the confidence to make this one decision has paid for it many times over. The creativity of the question asked is the main limitation to the programs ability to help in making better decisions about complex grazing systems. I encourage all farm business people to use GrassGro in aiding their decision making.

Acknowledgements

Monaro Farming Systems. CSIRO Plant Industry Canberra. Doug Alcock (NSW DPI Cooma).

References

Moore AD, Donnelly JR, Freer M (1997). GRAZPLAN: Decision support systems for Australian grazing enterprises. III. Pasture growth and soil moisture submodels, and the GrassGro DSS. *Agricultural Systems* **55(4)**: 535–582.

Freer M, Moore AD, Donnelly JR (1997) GRAZPLAN: Decision support systems for Australian grazing enterprises--II. The animal biology model for feed intake, production and reproduction and the GrazFeed DSS. *Agricultural Systems* **54(1)**: 77–126.

Warn L, Webb Ware J, Salmon L, Donnelly J, Alcock D (2006) Analysis of the profitability of sheep wool and meat enterprises in southern Australia. Final Report for Project 1.2.6. Sheep Co-operative Research Centre.