

## **SUPPLY CAPABILITY OF SHEEP ON THE MITCHELL GRASS DOWNS OF NORTH AND CENTRAL WEST QUEENSLAND**

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### **SUMMARY**

While, in the past, sheep have been predominantly reared and grazed in western Queensland for wool, interest in the sheep meat industry increased when wool prices became depressed. For north west and central west Queensland producers, opportunities may exist to participate in live sheep and meat export to Asia. The capability of the Mitchell grass downs to provide sufficient numbers of export quality sheep under the variable climatic conditions while sustaining the land resources has been simulated. Sheep numbers were found to be insufficient to maintain a consistent supply for live export. However, raising marking rates and lowering mortalities effectively increased reproductive performance to a level at which a surplus for export could be sustainable. Other practices might be required for the live weight specifications to be met.

*Keywords:* sheep; supply capability; variable climate; Mitchell grass; simulation

### **INTRODUCTION**

While in the past sheep in western Queensland have been predominantly reared for wool, the possibility of exporting live sheep and frozen and chilled meat to Asia was considered when wool prices became depressed in 1991. Opportunities could exist from May to August when supplies from southern States are low and mutton prices reach cyclical highs. A computer model was developed to simulate the number and live weight of wethers and ewes grazing the Mitchell grass downs of north west Queensland and validated against historical ABS data (Australian Bureau of Statistics, 1960 to 1997) for sheep producing shires (Cloncurry, Flinders, McKinlay and Richmond) in the North West (NW) Statistical Division (Pepper *et al.* 2001). When the model was run for sequences of climatic conditions generated stochastically from distributions based on historical data which were correlated in some instances, the difficulties of sustaining a consistent supply of sheep under variable climatic conditions was highlighted. The low reproduction and survival rates presented a major problem for those shires (Rose 1972; Rose 1976). However, Cobon *et al.* (1994) has demonstrated that by adopting a management package designed to reduce the environmental and nutritional constraints, lambing percentage could be increased by over 20% above the district average, lamb losses minimised to 0-2%, and losses from marking to first shearing to 2-5% with weaner death rates of 7-21%.

In this paper, the output from the model is compared with historical ABS data for the shires of Winton, Longreach, Aramac, Ilfracombe and Barcaldine, major Mitchell grass areas, in central west (CW) Queensland. This provides further validation of the model and extends the catchment area for the sheep meat trade for opportunities in either the domestic or live export trades. The effect on the availability of young wethers, of scenarios based on increasing marking percent and reducing mortality are explored for the sheep-producing shires of NW and CW Queensland.

### **MATERIALS AND METHODS**

#### *Validation of simulation model*

Simple climatic measures, including rainfall and number of rain days in the growing season, and the number of days from the end of the previous growing season to mid-joining (Pepper *et al.* 2001), were derived from meteorological data from Toorak Sheep Field Research Station, Julia Creek (Latitude 21° 2' Longitude 141° 48') and Rosebank Research Station, Longreach (Latitude 23° 32' Longitude 144° 16'). These measures, which were used to describe seasons for NW and CW Queensland respectively, were of similar magnitude but the CW measures were slightly less variable than those for NW Queensland. The initial age structure of flocks was determined by running the model for several years with historical climatic conditions for both NW and CW. Ceilings on stock numbers were set from the ABS numbers taking into account cattle numbers. Drought management strategies such as selling a

proportion of wethers progressively down to two-tooth and selling the oldest ewes were incorporated, together with general management decisions such as ewe cast-for-age and wether turn-off age. These parameters were verified by running the model with ABS marking and mortality values and comparing the simulated numbers with the ABS numbers for 1960 to 1997. The model was then run with mortality rates, marking rates and live weight characteristics of sheep of various ages estimated from the simple climatic measures, stocking rate and reproductive status. Simulated sheep numbers were compared with the ABS numbers.

#### *Investigating the effect of management strategies*

Sequences of climatic conditions for NW and CW Queensland were generated stochastically from distributions based on historical climatic data taking into account any correlation between measures (Pepper *et al.* 2001). Management procedures outlined by Cobon *et al.* (1994) were assumed to increase marking percentage and reduce mortalities of adult sheep and weaners above that estimated from the climatic measures. Sustainable livestock capacities expressed as dry sheep equivalents were based on the areas of native and sown pasture in each of the 13 vegetation zones for the NW and 10 vegetation zones for the CW shires (Weston *et al.* 1981), and estimated to be 7.45 million for NW; 5.21 million for CW. Although stock numbers have been higher in the past than the estimated sustainable number, the ceiling on stock numbers was set at the sustainable numbers for these investigative simulations. Cattle numbers were assumed to remain static at 86,952 and 341,372, the ABS levels in 1998 for NW and CW respectively. Wethers were turned off at 3.5 years. Initial flock structure was assumed to be that at the end of the simulations using historical data but with all wethers over 2.5 years sold off. This had the effect of initially lowering the stocking rate. The model was run for three scenarios, firstly a scenario reflecting the status quo, and then scenarios with increased marking percent and decreased mortalities.

**Table 1. Input parameters that differ for CW from those for NW used in Pepper *et al.* 2001**

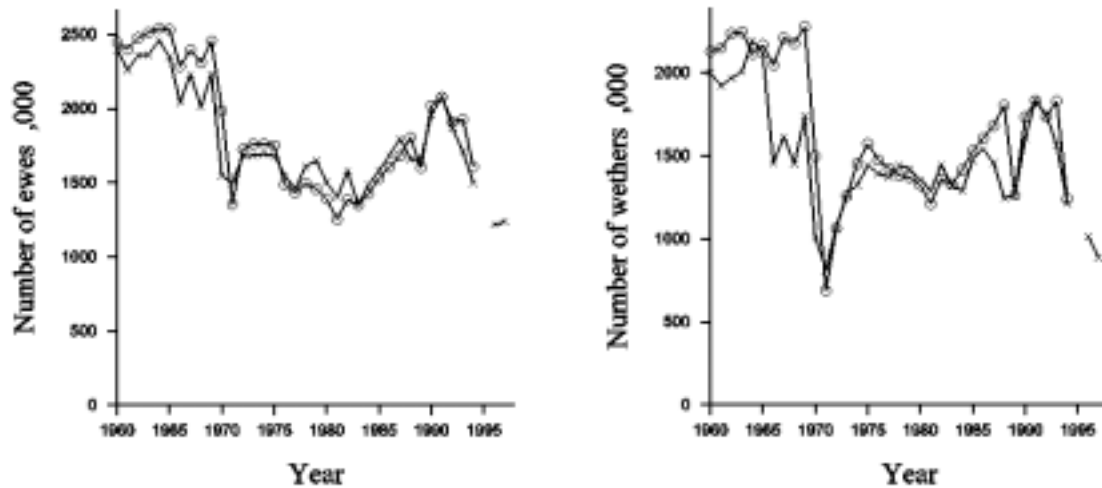
Description	Historical	Scenario 1		Scenario 2		Scenario 3	
	CW	NW	CW	NW	CW	NW	CW
Ceiling* before (000,000 DSE)	5.46	7.45	5.21	7.45	5.21	7.45	5.21
Ceiling* after 1990 (000,000 DSE)	5.88	7.45	5.21	7.45	5.21	7.45	5.21
Proportion of wethers over 1.5 years sold in 1 <sup>st</sup> year of drought	0.3	0	0	0	0	0	0
Proportion of wethers over 1.5 years sold in 2 <sup>nd</sup> year of drought	0.5	0	0	0	0	0	0
Proportion of oldest ewes sold in drought	1.0	0	1.0	0	1.0	0	1.0
Proportion of ewes joined in 1 <sup>st</sup> year of drought	0.5	1.0	0.5	1.0	0.5	1.0	0.5
Proportion of ewes joined in 2 <sup>nd</sup> year of drought	0.2	1.0	0.2	1.0	0.2	1.0	0.2
Ratio of ewes to wethers sold when overstocked	0.3	1.0	1.0	1.0	1.0	1.0	1.0
Age ewes cast-for-age	7.5	8.5	7.5	8.5	7.5	8.5	7.5
Age wethers turned off	7.5	3.5	3.5	3.5	3.5	3.5	3.5
Number of weeks in joining period	7	8	7	8	7	8	7
Increase in marking	n.a.	0%	0%	5%	5%	10%	10%
Decrease in mortality of adults	n.a.	0%	0%	1%	1%	2%	2%
Decrease in mortality of weaners	n.a.	0%	0%	2%	2%	3%	3%

\* Sustainable limit for scenarios 1, 2, 3

## RESULTS

### *Comparison of simulated and ABS numbers in CW Queensland using ABS marking and mortality values in the model*

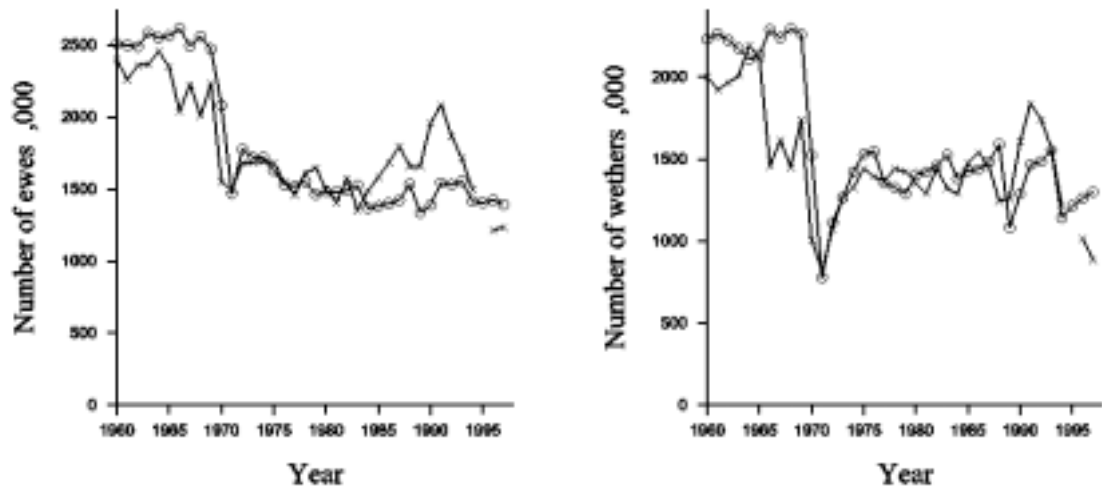
To check whether the drought and overstocking strategies were suitable, the simulated total number of ewes was compared with the ABS figures for breeding ewes and maidens plus half the lambs and hoggets. Similarly, the simulated total number of wethers was compared with the ABS figures for wethers, rams, and dry ewes plus half the lambs and hoggets. As illustrated in Figure 1 a reasonable fit was obtained although the drought of 1966 was poorly described and consequently wethers were not sold off until the 1970 drought. Drought strategies were invoked in 1970, 1971, 1989 and 1994, and overstocking strategies were invoked in the sixties and 1975, 1978, 1991 and 1992.



**Figure 1 Ewe numbers in CW (x – ABS, o – simulated); Wether numbers in CW (x – ABS, o – simulated)**

*Comparison of simulated and ABS numbers in CW Queensland using simulated marking and mortality Values in the model*

Using the marking and mortality rates predicted from empirical equations within the model, the simulated sheep numbers were compared with those from the ABS (Figure 2). The fact the model did not recognise the drought in 1966 remained a problem. Overstocking strategies were invoked in the sixties and 1977 and 1978. Parasites and predators were simulated in the run of good seasons 1973, 1974 and 1975. Simulated ewe numbers for CW did not increase at the same rate as the ABS numbers in the mid to late eighties. It is interesting that the 1987 ABS ewe numbers increased while wether numbers decreased. Simulated CW wether numbers were increasing in the nineties as ABS numbers were falling.



**Figure 2 Ewe numbers in CW (x – ABS, o – simulated); Wether numbers in CW(x – ABS, o – simulated)**

*Comparison of scenarios*

When 50 hypothetical years were simulated, droughts occurred in years 7,21,28,30,32,42,47 and 48; parasites and predators in year 46 for the NW and years 5, 39 and 46 for CW Queensland. The effect of not joining all ewes in drought years was reflected in a severe drop in wethers turned off three years later. With current marking and mortality rates as illustrated by scenario one (Figure 3) the number of young wethers turned off at 3.5 years from the Mitchell grass downs did not reach the sustainable limits (1.37 million for NW; 3.55 million for CW). However, if marking percentage could be increased and mortalities decreased by adopting the strategies of Cobon *et al.* (1994), the simulated turnoff numbers for CW and NW rapidly reached the sustainable limit even with an increase of 5% in marking and a minor decrease in mortalities.

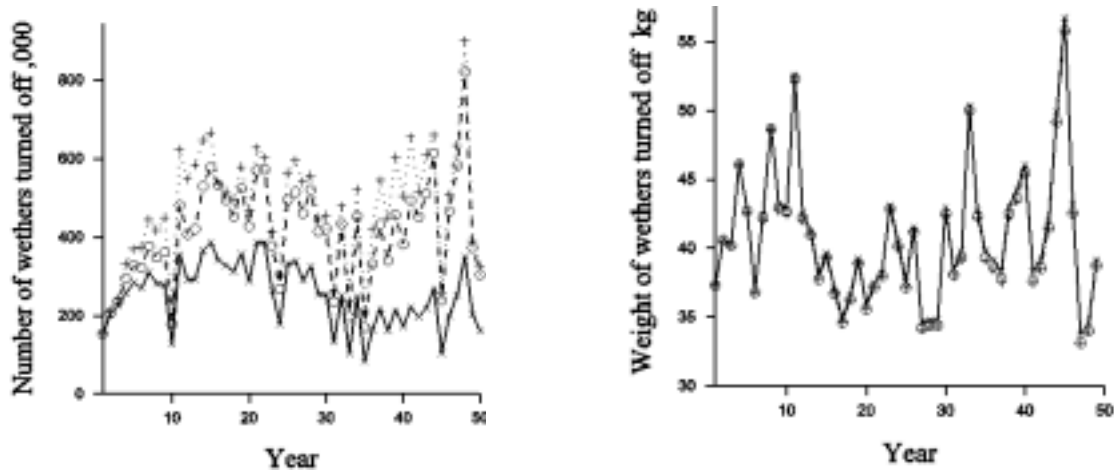


Figure 3 Wether numbers and average weights for scenarios 1 (x), 2 (o), 3 (+); NW and CW combined

## DISCUSSION

The model simulated ewe and wether numbers for CW Queensland reasonably well over 38 years although not as well as it had for NW Queensland. The differences between the ABS and simulated estimates for the 90s are thought to be due to the industry subsidised shooting of sheep following the wool price crash of 1991. Drought, poor reproduction rates, poor prospects for wool and perceived better prospects from cattle production could have contributed to the decline in sheep numbers.

The simulated numbers from the investigative scenarios (Figure 3) show that flocks are just sustainable with current marking and mortality percentages. This would mean that a live sheep trade under existing husbandry regimes is unsustainable on a consistent annual turnoff basis from these shires. While the sheep flock in NW and CW Queensland is able to provide a small surplus, the availability of young wethers for the sheep meat trade after drought years presents a problem. This denies producers consistency of supply in some years unless husbandry measures are put in place. The wether turnoff fluctuates around 200,000 per annum but is less than 100,000 in some years. If 100,000 sheep are needed for a ship consignment this means that only one ship per annum could be supplied from the shires north of the Tropic of Capricorn. While live sheep export may be denied, smaller consignments of frozen or chilled product for export may be sustainable. The simulations show the sheep flock was very susceptible to climate change. Scenario 2 showed a doubling in wether turnoff by lifting marking rates 5% and lowering ewe and weaner mortality to 1% and 2%. This suggests that investment in husbandry to increase lambing percent and reduce mortalities could reap profitable responses. It also suggests live exports may be sustainable. Figure 3 shows that the flock quickly builds over 10 years to the sustainable limit in the simulation. However, drought events deplete the flock severely in some years. Despite this, flock rebuilding is rapid and the turnoff benefits between scenarios 1 and 2 remain. Scenario 3 magnifies the benefits of improved husbandry practices. The live weight of wethers turned off varied between 34kg and 56kg in the simulation. There were little differences in weight between the scenarios. Heavier live weights are preferred for both live sheep exports and the domestic trade. The data show that live weights of wethers under current conditions would not suit the live trade in about half the years if a threshold of 40kg was adopted. Therefore the issue of how live weight might be enhanced would need to be addressed.

## REFERENCES

- AUSTRALIAN BUREAU OF STATISTICS, AGRICULTURAL INDUSTRY, QUEENSLAND, SECTION 3 – LIVESTOCK AND LIVESTOCK PRODUCTS, (1960 TO 1997).  
 COBON, D.H., CONNELLY, P.T., BAILEY, J.V. and NEWMAN, P.A. (1994). *J. Rangel.* **16**, 39-50.  
 PEPPER, P.M., DUNLOP, L.B., WESTON, E.J. and CLOONAN, D. (2001). *Proc. Intern. Cong. Modelling and Simulation, MODSIM 2001*, 1847-52.  
 ROSE, MARY (1972). *Proc. Aust. Soc. Anim. Prod.* **9**, 48-54.  
 ROSE, MARY (1976). *Proc. Aust. Soc. Anim. Prod.* **11**, 101-4.  
 WESTON, E.J., HARBISON, J., LESLIE, J.K., ROSENTHAL, K.M. and MAYER, R.J. (1981). Agric. Br. Tech. Rept. No.27, QDPI.