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SIMULATION OF PASTURE PRODUCTION IN SOUTH WESTERN QUEENSLAND

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ABSTRACT

Computer simulations of pasture production were used to estimate safe carrying capacities for a range of land systems found in south west Queensland. Simulation enabled a quantitative determination of carrying capacity as opposed to the traditional qualitative approach used by land administrators in the past. The need to adjust carrying capacities is required for long term stability of the region. Computer simulation offers one approach to determining safe carrying capacities.

INTRODUCTION

Native pastures occupy ninety percent of Queensland's area. Better management of this resource requires a knowledge of how productivity interacts with climate, grazing, fire, shrub increases and soil loss. Computer modelling offers an alternative to traditional avenues of examining these interactions and determining carrying capacity.

Traditionally, carrying capacities for the mulga lands of south western Queensland have been defined by land administrators to calculate rents for leasehold properties. Values were determined qualitatively based on experience and expectation, and once determined were difficult to adjust. While no longer required for rental assessment, carrying capacities are increasing in importance. Their use now extends to determining stocking strategies, living areas and cash flow budgeting. With increased importance, a quantified and defendable method of determining carrying capacity is needed.

The use of modelling and simulation to tackle these issues is not new. Christie and Hughes (1983) simulated primary production of the ground storey component of mulga (*Acacia aneura*) pasture at one location. They then quantitatively determined a sheep carrying capacity for a range of pasture condition classes based on these results.

However, the technique needs to accommodate the variety of land systems and condition classes found in the mulga lands. This paper describes the adoption of an existing simulation model of pasture production to a wider range of land systems. The quantitative estimation of long term carrying capacity using these simulation results is illustrated for each land system.

METHODS

i) Net primary production.
Net primary production data was collected over a fifteen month period at seven locations in south western Queensland using the technique of McKeon et al (1988). These data were used to calibrate the GRASP primary production model (McKeon *et al*. 1990). The land systems were Spinifex Heathland, Alluvial Mitchell Grass Plains, Hard Mulga, Sandplain Mulga, Open Mitchell Grass Downs, Eastern Soft Mulga and Western Soft Mulga.

ii) Simulation and carrying capacity estimation.
Long term daily climatic data from the Bureau of Meteorology Charleville was used in simulations. A probability distribution of pasture production (kg/ha) for each site was calculated from the simulation results. The pasture production occurring seven years out of ten (70% probability) was then used to estimate a "safe" carrying capacity, by adjusting stock numbers to consume only a portion of this production. For the mulga sites the portion utilised was 20% and for Mitchell grass sites 30% was utilised. Grazing trials on these land systems have previously indicated that utilising these portions of end of summer pasture production are commensurate with pasture stability. The 70% level of probability was considered to represent an acceptable level of risk.

"Safe" carrying capacity (DSE/ha) is calculated as = (Y*U)/(C*100)

where DSE = Dry Sheep Equivalents
Y = Pasture yield (kg/ha) at 70% probability
U = Level of pasture utilisation (%)
C = Annual dry matter intake per DSE (400 kg)

RESULTS

Results are presented for one location as an example of the methodology. Table 1. Other locations are represented on the poster. The pasture production for seven years out of ten (70% probability) for the Eastern Soft Mulga was 382 kg/ha. Consuming 20% of this production gave a carrying capacity of 5.3 ha/DSE.

DISCUSSION

The safe carrying capacity determined quantitatively is below that reported by Passmore (1992) of 2.4 ha/DSE for the same region. The contribution of browse to the sheep diet was not included in the determination of "safe" carrying capacities. Production from the ground story was only considered, as it is here that grazing has its most significant impact on pasture and soil stability.

Quantifiable determination of carrying capacity in this way is required if the productivity of the region is to be maintained. The safe carrying capacities need to be included in determining "safe" stocking strategies and cash flow budgeting. Over expectations of the productive capacity for the region will be avoided if this approach to carrying capacity determination is used.

Table 1. Probability distribution of annual rainfall and pasture growth from the GRASP primary productivity model for the Eastern Mulga near Charleville.

Probability	Rainfall (mm)	Pasture growth kg/ha
0%	205	170
10%	268	317
20%	333	350
30%	378	382
40%	416	492
50%	440	579
60%	483	695
70%	514	842
80%	656	998
90%	716	1270
100%	801	1503
mean	468	664

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