Use of a computer model to determine carrying capacity under variable rainfall conditions in Botswana

J. Macala, J.B. Rowe and J.V. Nolan

Animal Science, University of New England, Armidale NSW 2351 jmacala@metz.une.edu.au

The carrying capacity of extensive rangeland systems in semi–arid regions is difficult to determine due to fluctuations in available forage caused by variation in rainfall. To prevent land degradation caused by overgrazing, which cannot easily be reversed, a balance between forage supply and grazing pressure must be achieved. Stocking rate has a significant influence on animal production and on longer–term pasture condition (Hart *et al.* 1988) and determining the most appropriate rate and when to make adjustments in response to actual rainfall patterns are major challenges. Those decisions have major consequences for the profitability and sustainability of animal production from rangelands.

A computer model was developed using daily inputs of rainfall and temperature to predict seasonal pasture and cattle production in Botswana. The effect of stocking rates on animal productivity and pasture condition in a good rainfall season and during years of low rainfall was then determined. Three stocking rates per ha, low (0.07 LSU), medium (0.20 LSU) and high (0.50 LSU), were evaluated under the rainfall regimes where LSU is a Botswana Livestock Unit defined as a 450 kg steer.

Pasture production was high in a favourable rainfall season; reduction of stocking rate from high to low increased liveweight gain in steers and pasture on offer also increased, but liveweight gain per hectare decreased. During a dry season the liveweight of a steer increased with reduction in grazing pressure per hectare from high to medium; no further major increase in liveweight occurred at the low stocking rate. This was due to low pasture production caused by low rainfall. Increasing the grazing area per head during both years of low rainfall increased available pasture and therefore ground cover (Figure 1).

The use of the computer model enables the effect of stocking rate to be determined in good and poor rainfall years in Botswana, and to predict the periods during which cattle must be removed from pasture to prevent overgrazing. The model has the potential to improve decision–making regarding stocking rate and feed supplementation. To cope with variable climatic conditions, it is essential that producers be assisted to use these new decision support tools in order to predict herbage growth and feed consumption. The simulation emphasises the need for an infrastructure and appropriate incentives for producers to respond to the need to reduce stock numbers before feed shortages and overgrazing occur.

Hart, R.H., Marilyn, J.S., Test, P.S. and Smith, M.A. (1988). Cattle, vegetation, and economic responses to grazing systems and grazing pressure. *Journal of Range Management* 41, 282–286.

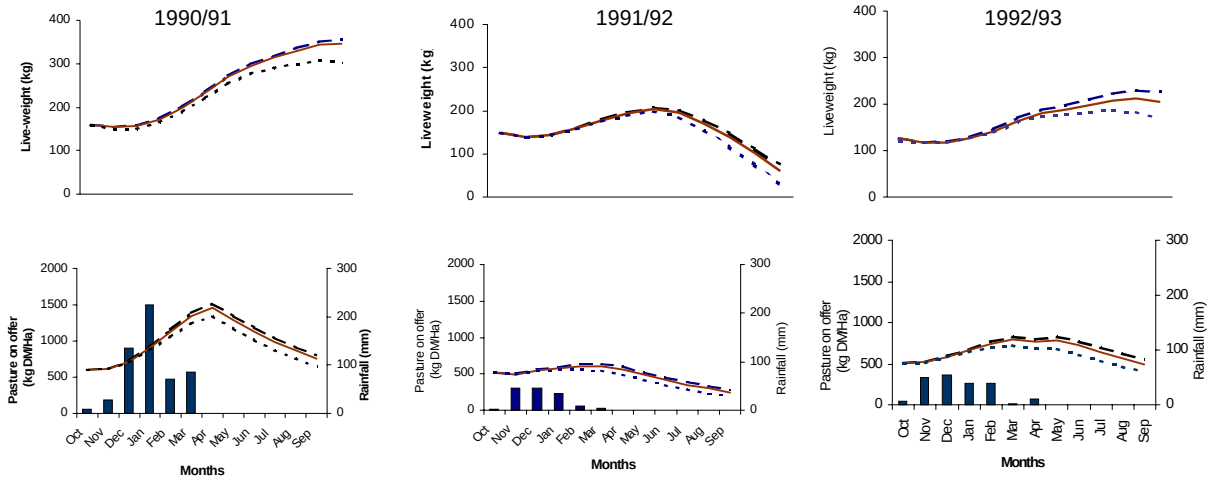

Figure 1 Prediction of liveweight in steers and available pasture with stocking rates in one good and two poor rainfall seasons. Stocking rates low (–·–·–), medium (—) and high (·····)