The Application of Farming System Models to the Problem of Sustainable Grasslands Management in Northern China and Australia

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The application of farming system models to the problem of sustainable grasslands management in northern China and Australia

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Introduction Chinese grasslands suffer considerable pressures from human and livestock populations , with more than 90% of Chinese grasslands suffering from light to heavy levels of degradation . This is reflected in a decline in the composition of desirable species , increased areas of bare ground , and soil erosion . Allied to this are declining rates of animal productivity with the adoption of high stocking rates , and low household incomes of herders and farmers dependant upon livestock products for their livelihoods . Similar problems also exist in Australian grazing systems , where the use of continuous stocking at high grazing pressures has led to degradation of pasture systems . Changes to grazing management , particularly the adoption of lower stocking rates , may boost animal productivity , achieve higher household income , and reduce grassland degradation .

Materials and methods A farming-systems linear programming model was developed for Sunan County in western Gansu Province , China . Livestock production is the main agricultural activity , and is predominantly Gansu Alpine Fine Wool sheep . The model included separate areas of summer , autumn and winter pasture , and optional lambing dates in winter , spring and summer . An important feature of the model was the specification of a range of discrete stocking rates , with individual livestock productivity declining as stocking rate increased . Consequently , production values for animal body weights , adult sheep and lamb mortality rates , and wool production were all linked to the stocking rate decision .

Results and discussions The model was solved for each possible stocking rate option as well as to determine the optimal stocking for a typical Sunan County farm . Reported here are the lamb and wool production outputs at the farm level (Figure 1) , along with a set of farm financial results (Figure 2) . This indicates that maximum wool production (the primary source of income) occurred at a stocking rate of around 2 breeding ewes ha^{-1} , whereas maximum farm lamb production occurred at around 1 .5 ewes ha^{-1} . Total farm revenue was highest at 1 .5 ewes ha^{-1} stocking rate , however this does not account for the higher feed costs associated with increased stock numbers . Once these feed costs were accounted for in the net income calculation the optimal stocking rate was determined to be 1 .25 ewes ha^{-1} .

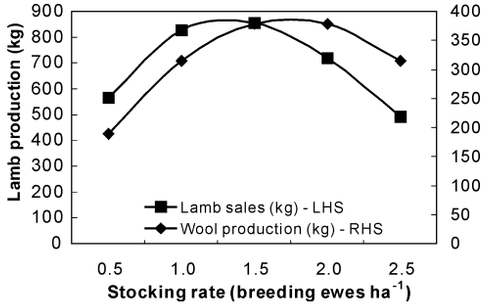

Figure 1 *Farm wool and lamb production .*

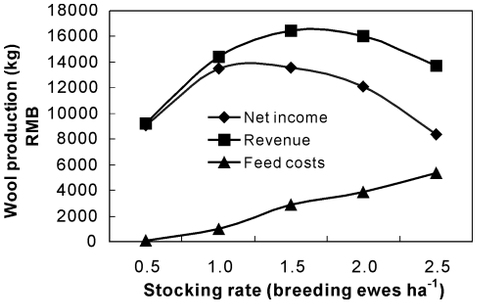

Figure 2 *Financial returns .*

Conclusions The use of a farming systems model such as presented here is an extremely valuable tool for assessing changes to farm management strategies and grassland policy options . By using a whole-farm systems approach that can incorporate the complex physical interactions that occur on most farms it is possible to measure the necessary financial trade-offs associated with different management options and government policies . Such an approach can also identify possible impediments to the adoption of new techniques that may not be apparent from a more partial analysis .