A SYSTEMS APPROACH TO RESEARCH PLANNING

FOR NORTH ISLAND HILL COUNTRY

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ABSTRACT

The achievement of increased production from North Island Hill Country (NIHC), through an increased research input, is currently receiving considerable attention in New Zealand. The task of planning future research and setting priorities for this work requires an evaluation of the current state of knowledge relating to hill country grazing systems, and an assessment of future research needs. A number of references have been made to the potential usefulness of systems modelling in research and research planning. The objectives for this study were to apply modelling to the development of research priorities on NIHC, and to evaluate modelling in this role.

A simulation model was constructed to assemble the available information on soil, pasture and sheep components of NIHC grazing systems. Evaluation of the state of knowledge on components of hill country systems was based on problems (data and conceptual) confronted during model construction. The model simulated pasture growth, senescence and decay from climate data. The sheep component was based on an energy balance using the metabolisable energy system.

Parameters in major components of the model were calibrated against data set aside at the start of the study. This was done in order to obtain the 'most valid' model because there were a range of values reported in the literature for many of the parameters. Statistical goodness-of-fit tests were used as an aid to decide on the structural acceptability of the calibrated model, and some issues facing the choice of appropriate statistical lack-of-fit test for models, were discussed in detail. Model validity was established by subjective judgement. The need for subjectivity arose mainly because of uncertainty about settings of some, or all, important exogenous variables in the data available for validation.

Experiments were carried out with the model where stocking rate, lambing day, length of flushing, winter and spring rotations, and the number of paddocks retired from grazing in early summer, were varied. The results were used to define decisions giving 'optimal' levels of production. Climate data from Ballantrae Hill Country Research Station were used. Five representative years were constructed to account for major variations in climate experienced at the site.

Early lambing and winter and spring grazing strategies which maximised spring feed supply were clearly shown as the most important decisions in maximising system profitability.

The 'optimal' system was used as a base from which to investigate possible benefits from adding feed in spring through the use of nitrogen fertiliser, and increasing ovulation rate by artificial means. Both the above were shown to be profitable, given some adjustments to management strategies. Finally, changes were made to a range of parameters influencing potential pasture and animal performance. Effecting some of these changes by physical, chemical or genetic means would be profitable, particularly where wool production was concerned.

Difficulties were confronted in conceiving a means of setting objective research priorities using the model. A number of information deficiencies were noted, but the reasonableness of using sensitivity analysis to rank the importance of each deficiency in an 'invalid' model was questioned. Further the problem of choosing between obtaining information to further improve the model, and developing improved systems suggested by the model, was noted. Subjective priorities were determined based on the need to demonstrate superior systems identified by modelling, and the apparent need for a greater understanding of particular components to enable improved systems to be devised. Advantages were apparent in using modelling as an aid to making these subjective judgements.

It was concluded that the process of developing a pre-research model to evaluate research needs had been valuable. The learning aspect of modelling was emphasised, though problems with validation occur where modelling is conducted in isolation from field research. The view was submitted that the modelling should be extended to become an integral part of a research programme.

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