Bioeconomics of pasture resource development in sheep production systems

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A thesis submitted for the degree of Doctor of Philosophy

of the University of New England

January 2008

Acknowledgements

I would like to thank my supervisors, Associate Professor Oscar Cacho (UNE), Professor James Scott (UNE) and Dr Randall Jones (NSW DPI), for all of their support, commitment and patience. Their guidance and expertise was invaluable and I feel privileged in having had the opportunity to access their skills and knowledge.

I would also like to acknowledge the Cicerone Project Board for allowing access to the data. Support was also generously provided by CSIRO Plant industry through access to the *AusFarm* software, species parameter sets and training. In particular, I would like to acknowledge Andrew Moore and Libby Salmon from CSIRO Plant Industry for their support in applying this software to the case study region.

I am also grateful for the helpful comments, suggestions and data from Dr Keith Hutchinson (UNE), Dr Andrew Alford (NSW DPI), Fiona Scott (NSW DPI) and Libuseng Mpiti-Shakhane (UNE).

Financial and extensive post-graduate support for this study was provided through the Sheep CRC and Australian Wool Innovation.

Finally and most importantly, I would like to thank my family. To my wife Kath, thank you for your encouragement, unconditional love and friendship, words cannot express my indebtedness and gratitude. To my children, Calhan, Zoe, and Connor, thank you for understanding and helping me remember what is important. Without your continued support over the past few years this would not have been possible.

Abstract

Within any grazing system managers need to decide on how to best manage the existing mosaic of pasture resources. This involves the adjustment of stocking rates and grazing management, as well as the use of inputs and existing technologies. The main technologies available to grazing managers are fertiliser, and the sowing of introduced species to improve pasture productivity, quality and persistence. These represent a series of tactical and strategic decisions that need to be made under climatic uncertainty about their degree of success in improving the persistence of desirable species, production and profits.

The process represents a complex dynamic decision problem. To address this problem a bioeconomic framework was developed that is capable of modelling the dynamic nature of pasture resource composition and production, and its response to climate and utilisation by grazing livestock. The framework integrates the sequential nature of the decision-making problems faced by sheep producers under climatic uncertainty. This is achieved by developing a paddock-level dynamic pasture resource development (DPRD) simulation model and integrating it into a seasonal stochastic dynamic programming (SDP) model. The SDP consists of four seasonal transition probability matrices which are applied sequentially to solve a recursive equation with the objective of maximising the expected net present value of the sheep enterprise in the long run.

The SDP identified optimal tactical and strategic decision rules for each season, in terms of stocking rates and pasture re-sowing as functions of the state of the pasture at the start of a season, which is defined in terms of pasture mass and botanical composition. This process was applied for three soil fertility input systems and three sheep production systems, represented as wool, wool/meat and meat production systems.

The outcomes from the process identified pasture state triggers for tactical grazing rests and management, as well as for the optimal replacement of a degraded sward. The optimal target levels for botanical composition, pasture mass and stocking rate were also derived.

Certification

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that any help received in preparing this thesis, and all sources used, have been acknowledged in this thesis.

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Acronyms and Abbreviations

DPRD	Dynamic Pasture Resource Development
DM	Dry Matter
DSE	Dry Sheep Equivalent
HRTPZ	High Rainfall Temperate Pasture Zone
SDP	Stochastic Dynamic Programming
TPM	Transition Probability Matrix