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Informing decisions of pastoral woolgrowers for country and profit

Final Report

Project reference number:	AMH 3
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Project title:	Informing decisions of pastoral woolgrowers for country and profit.
Project commencement date:	30/11/2004
Project completion date:	31/12/2005
Date of final report:	31/12/2005

Project objectives:

This project is targeted to the Managing Pastoral Country sub-program of LWW. The specific project objectives are as follows:

1. Using historical information and within six months of contract signing, develop information products that reveal environmental and animal production outcomes associated with stocking rate decisions in dry seasons.
2. To refine these products as predictive decision aids to sustainable rangeland management through collaboration with pastoralists and provide these products in attractive, readily interpreted formats within twelve months.

Project methods

Participative research and development was used to develop computer based products for wool growing pastoralists to inform decisions associated with below average seasons. Prototype products were developed and tested using lease hold and flock structure data from a progressive pastoralist within the Yalgoo Besprac woolgrower group in Western Australia and this group provided feedback on these prototype products.

The project was managed by a project team consisting of a rangelands specialist/team leader and a liaison officer assisted by a contract software developer and graphic artist. A project reference group was established to critically review outputs and suggest alternative approaches.

Various information products, which offered potential to enable decisions about stocking rate to be made in a more timely fashion, were evaluated using test data from the Yalgoo pastoral lease and data from a ten year grazing study at Boolathana in the Western Australian arid shrublands (Holm *et al.*, 2005). These products included outputs using NOAA NDVI information (Cridland *et al.*, 1999), modelled biomass predictors (Holm *et al.*, 2003) and a grazing index: DDH/100 mm rainfall (Bartle, 2003).

Carrying capacity information was derived from published range land survey information (Payne *et al.*, 1998). Daily rainfall was downloaded using the Silo data drill from the Queensland Department of Natural Resources and Mines (<http://www.nrm.qld.gov.au/silo/datadrill/index.html>). Seasonal characteristics were downloaded from *Rainman* v 4.3 produced by Department of Primary Industries Queensland.

NOAA NDVI data was provided by Western Australian Department of Land Information (<http://www.dli.wa.gov.au/corporate.nsf/web/Satellite+Image+Archive>).

Computer-based routines were prepared using Visual Basic and MS Excel 2000.

Results, interpretation and practical significance

Development of prototype information products

A time trace based on fortnightly NOAA NDVI for the lease area was identified as the most useful indicator of seasonal condition among assessed indicators. Biomass predictive indicators were primarily driven by rainfall and provided little more information than simple indicators of rainfall. Predictive biomass models were improved by including 24 month cumulative rainfall (presumably from shrubs responding to deep soil water reserves), however the improvement was insignificant. Other indicators based on cumulative rainfall (DDH/100mm rainfall), failed to reveal rainfall effectiveness such that the index either underestimated pasture response from small, but highly effective falls of rain, or overestimated pasture response from large ineffective rainfall events. Disaggregating DDH/100mm rainfall into its components of cumulative rainfall and stocking rate expressed as percent deviation from sustainable long term stocking rate was considered more informative.

Two indicators to track seasonal status were developed: 1) a direct indicator of green feed: 'Green feed indicator' being time traces of fortnightly NDVI for the averaged across the target lease area minus the minimum ever recorded average NDVI for the target lease, and 2) an indicator of green feed related to current stocking rate: 'Green feed grazing days indicator' being the 'Green feed indicator' divided by number of stock on the lease expressed as grazing days per hectare per year (expressed as DSEs).

Area-specific benchmarks were developed for each indicator as follows:

- Green feed tracking benchmark = average fortnightly (NDVI-minimum) for records since 1992.
- Green feed static benchmark = maximum average fortnightly (NDVI-minimum) for records since 1992.
- Green feed grazing days tracking benchmark = (average fortnightly (NDVI-minimum))/(long term sustainable stocking rate *365/lease area).
- Green feed grazing days static benchmark = (maximum average fortnightly (NDVI-minimum))/(long term sustainable stocking rate *365/lease area).

'Worm graphs' of each indicator together with relevant comparative benchmarks and critical decision dates are complimented by probabilities of receiving sufficient rainfall to initiate pasture growth (e.g. see Figure 1).

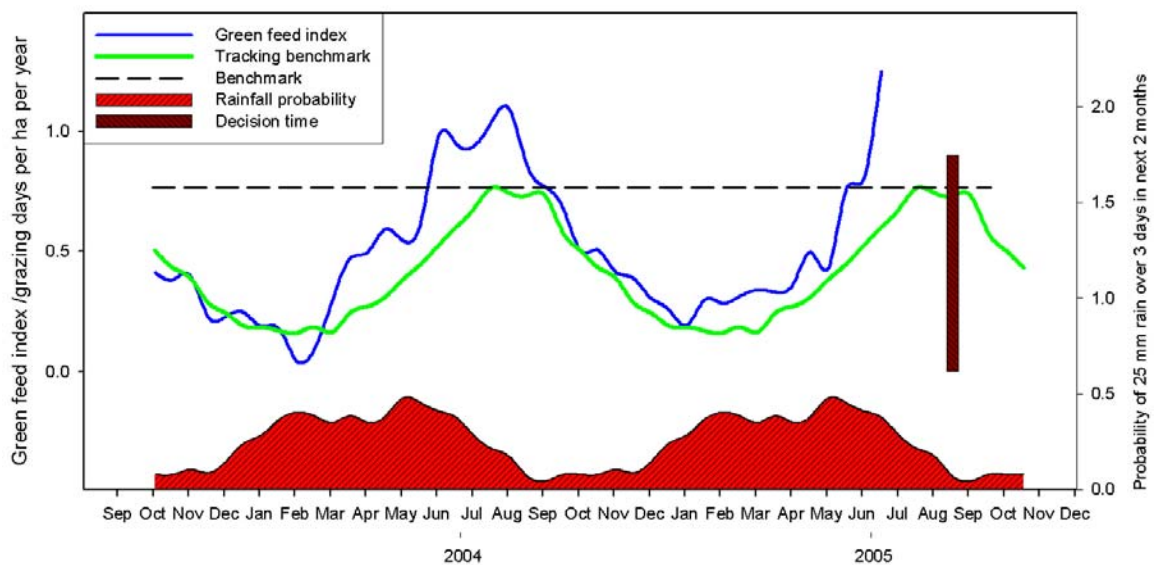


Figure 1 Example of indicator based on NOAA NDVI of seasonal condition (above average in both 2004 and 2005) for a Western Australian pastoral lease.

The two 'worm graphs' are supplemented by options to review trends over several years in a) the two green feed measures and b) monthly rainfall with a comparison of current stocking rate with long term average stocking rate (Figure 2).

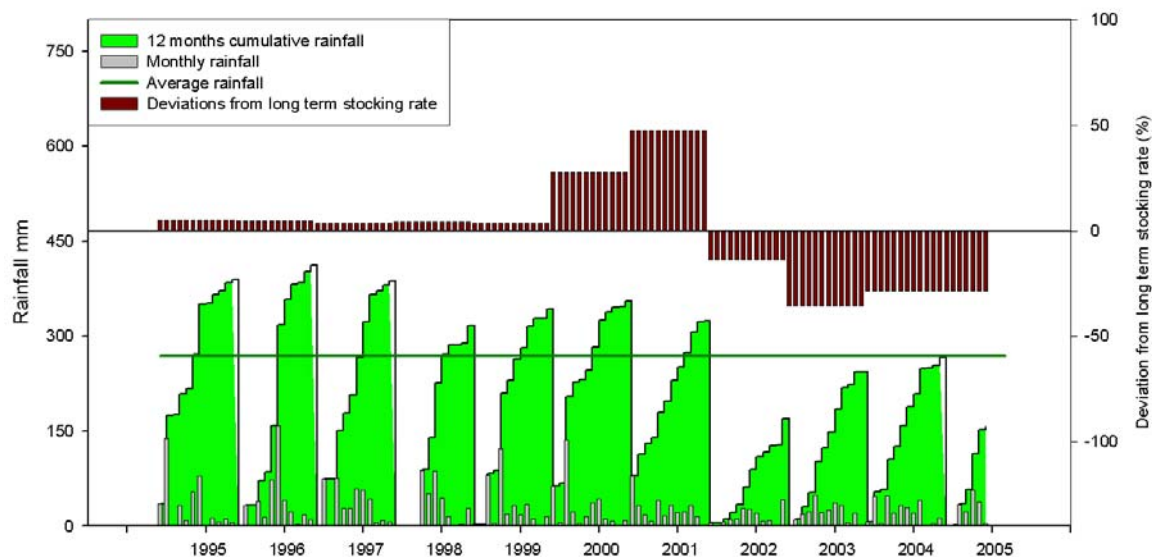


Figure 2. Example of supplementary output of cumulative rainfall and deviations in stocking rate from long term sustainable stocking rate for a Western Australian pastoral lease.

Development of decision aids

The main decision aid is a computer software program **CDSR** (Critical Decisions on Stocking Rates) supported by an **Instruction and decision support manual**.

CDSR is designed for wool growers in southern Australian pastoral lands. It helps assess the ‘susceptibility of the property to drought’ which dictates the required urgency and extent of necessary decisions when drought looms. An index (graph) of available green feed, is updated every two weeks. Current and earlier stocking rates on the property are factored into the green feed index. A comparison of the green feed index with green feed benchmarks reveals current seasonal conditions over the entire property. In the event of a ‘seasonal alert’, alternative stock reduction or management strategies are proposed aligned with the property’s susceptibility to drought.

CDSR consists of four modules:

A data entry module for details such as property size, stock numbers and rainfall.

A risk profile module for self-assessment of Susceptibility of the Property to Drought (SPD) based on:

- a) Inherent factors which include ratings for availability of perennial feed, salinity of feed and water.
- b) Variable factors which include age of stock, stock distribution and abundance of feral animals.

These risk factors are summarized and enable pastoralists to identify themselves on a risk grid where high risk indicates need for prompt, significant de-stocking in face of a poor or failed season and low risk indicates less urgent and/or less significant de-stocking.

A *seasonal analysis module* which tracks stock numbers on the property over preceding two years in relation to the evolving season in two-weekly or monthly time steps. Two outputs are provided:

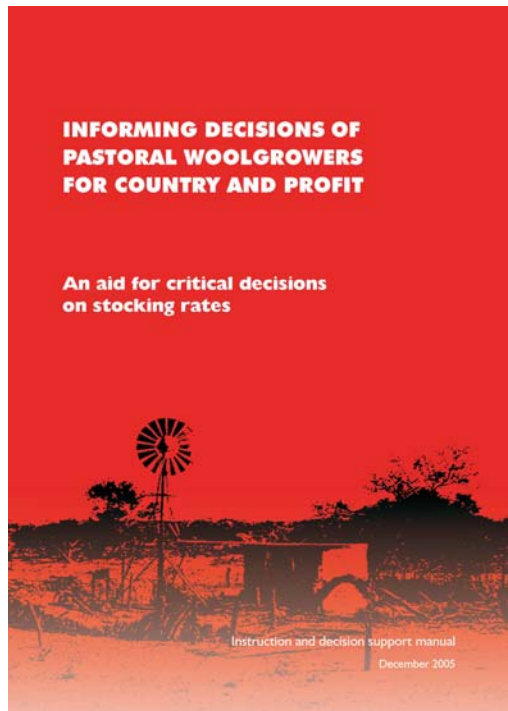
- a) A worm graph measuring amount of green feed on offer (NDVI data).
- b) A worm graph measuring amount of green feed on offer related to current stocking pressure (e.g. Figure 1.)

The seasonal analysis module also includes options to review trends over several years in a) the two green feed measures and b) monthly rainfall with a comparison of current stocking rate with long term average stocking rate (e.g. Figure 2).

An assessment module

Data from seasonal analyses provides a *seasonal alert rating* and is combined with the risk profile SPD rating. Indicative management responses are provided for each combination of SPD rating and seasonal alert status.

The **Instruction and decision support manual** is attractively presented and includes:



- a) Generic outcomes for good and poor stocking decisions over time in environmental (e.g. change in rainfall use efficiency, shrub populations) and economic terms (e.g. historical death rates during previous droughts).
- b) Historical rainfall, stocking rate information. Probabilities of seasonal outcomes (winter seasons, summer seasons and droughts).

Commercial potential, adoption and technology transfer

Two outputs (computer software **CDSR** and **Instruction and decision support manual**) have been developed to near-commercial standard and examples of these are attached. The decision aid requires pastoral clients to have internet access and support from a commercial service provider whose role is to provide near-real time NDVI data for the specific lease on demand and backup support. A commercial service provider of similar products for farm use has inspected the outputs and suggests CDSR could have commercial potential but would require a greater client catchment than the southern

pastoral region of Western Australia. Similar decision support software has had slower than expected uptake by Western Australian farmers.

Requirements for commercialisation include:

- 1) Refinement of the outputs for clients outside Western Australia.
- 2) Contractual arrangements with commercial farm software provider.
- 3) Establishment of linkages to providers of NDVI information and refinement of outputs to accommodate new generation NDVI data (MODIS satellite outputs).
- 4) Refinement of outputs to enable clients to specify paddock-scale or multiple paddock-scale information.

Publications (Attached)

Project outputs:

Informing decisions of pastoral woolgrowers for country and profit – Instruction and decision support manual. 12 pp December 2005.

Informing decisions of pastoral woolgrowers for country and profit – Technical specifications. December 2005.

Critical decisions for stocking rates (CDSR) software.

Project publications:

Holm, Alec and Egerton-Warburton, Kathryn (2005) ‘Seasonal alert’ ratings to inform management decisions for country and profit. Western Australian Department of Agriculture Southern Rangelands Pastoral Memo June 2005 pages 25-26.

References and additional information

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- Payne, A.L., Van Vreeswyk, A.M.E., Pringle, H.J.R., Leighton, K.A., & Hennig, P. (1998). *An inventory and condition survey of the Sandstone-Yalgoo- Paynes Find area, Western Australia*, Rep. No. 90. Agriculture Western Australia, South Perth.

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Abstract

The economic performance of the pastoral sheep industry is in doubt and its environmental record is being challenged. Improved use of natural resources is essential to preserve future land use options and to ensure optimum sheep productivity and profitability. The aim of this project is to assist livestock selling decisions that pastoral sheep owners make before drought bites hard. Delayed decisions often mean stock loose condition and become un-saleable. Delayed decisions force stock to overgraze and kill perennial plants. Eventually rain mostly runs off rather than supporting feed growth. Timely decisions that adjust stock numbers to available feed are most important in demonstrating environmental viability.

Computer software **CDSR** (Critical Decisions for Stocking Rates) supported by an **Instruction and decision support manual** have been designed for wool growers in southern Australian pastoral lands. CDSR helps assess the 'susceptibility of the property to drought' which dictates the required urgency and extent of necessary decisions when drought looms. An index (graph) of available green feed, (via satellite and internet) is updated every two weeks. Current and earlier stocking rates on the property are factored into the green feed index. A comparison of the green feed index with the average greenness index reveals current seasonal conditions over the entire property. In the event of a 'seasonal alert', alternative stock reduction or management strategies are proposed aligned with the property's susceptibility to drought.