NATIONAL FERAL ANIMAL CONTROL PROGRAM

BUREAU OF RURAL SCIENCES

Development of second stage of *MOUSER*, a DSS and information transfer system for mouse plague management

MOUSER VERSION 1.0

FINAL REPORT

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CSIRO
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THE UNIVERSITY OF QUEENSLAND

CARE
CENTRE FOR AGRICULTURAL & REGIONAL ECONOMICS PTY LTD

AUSTRALIA
Natural Heritage Trust
Helping Communities Helping Australia

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List of Acronyms

BRS	Bureau of Rural Sciences
CARE	Centre for Agricultural and Regional Economics
CD-ROM	Compact disk, read only memory
CPITT	Centre for Pest Information Technology and Transfer
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DSS	Decision Support System

1. Name of project

Development of second stage of *MOUSER*, a decision support system and information transfer system for mouse plague management – *MOUSER VERSION 1.0*.

2. Project aims and objectives

The primary objective of this project was to provide farmers, farmer groups and State Government Agricultural departments with tools for adopting better management practices for mouse control. This was achieved by developing an economics module and inserting it into *MOUSER* and updating and modifying the *MOUSER* CD-ROM.

3. Project location

This project was undertaken across three locations: Canberra (CSIRO Sustainable Ecosystems); Brisbane (University of Queensland, Centre for Pest Information Technology and Transfer); and Armidale (Centre for Agricultural and Regional Economics).

4. Methodology

4.1 Development of Economics Module

We conducted a review of current literature and existing knowledge to provide the best available information for inclusion in the economics module. The main sources of information came from previous and current BRS funded projects: “Best farm management practices to control mouse populations” (Brown *et al*. 1997a), and “Demonstration of best practice for mouse control in irrigated summer crops in Southern

NSW" (in progress). Additional sources were from Brown *et al*. (1997a), Brown *et al*. (1998) and Brown *et al*. (In Press).

Options for managing mouse populations were divided into two categories: routine actions, and preventative actions implemented only when mouse numbers were increasing. A list of mouse control actions was compiled and information was sought on the cost per hectare or kilometre, the effectiveness (percentage reduction) of each action and the effect on the available food supply (for example grain remaining on the ground after harvest).

The basic population model underlying the economics module was modified from the mouse population model developed by CSIRO (used to predict mouse outbreaks in the Victorian Mallee) (Pech *et al*. 1999). CARE built the economics model using Excel with input from CSIRO. The model was completed in June 2000 and was converted into a stand-alone executable file. We could not use the Excel model because it would rely on having Excel installed on the users machine and it contained macros to perform certain tasks. Dr Greg Hood (Pest Animal Control CRC) was sub-contracted to convert the Excel model into a Delphi model.

4.2 Modifications to *MOUSER* Software

Staff members of the Centre for Pest Information Technology and Transfer (CPITT) re-programmed *MOUSER* using an in-house web-based software package (WebGIST). WebGIST operates from a browser (Internet Explorer 5) that will be included on the CD. WebGIST provides a number of advantages over the prototype version of the software, including supporting html, providing easier navigation around the CD, especially the decision key, and providing "seamless" links to remote web sites. It also comes with a built-in search facility, and supports executables, such as the DSS economics package developed by CARE.

The information contained in *MOUSER* was updated. New images and text were added directly to *MOUSER* using Microsoft FrontPage. Furthermore, the Decision Key was updated and modified to incorporate the recommendations from the current BRS funded project "Demonstration of best practice for mouse control in irrigated summer crops in Southern NSW". Also, new video footage showing farm management practices and footage of wild mice was digitised. This footage was compressed and new audio tracks were added.

4.3 Project Milestones

All project milestones were completed on or before time.

Performance indicators	Anticipated milestone	Actual achievement date
Information gathered from all sources	31 December 1999	Information sent to David Thompson (CARE), October 1999
Information put together	30 June 2000	Completed June 2000
Economics module running	31 October 2000	Completed June 2000 (ahead of schedule)
Economics module put into *MOUSER*	31 November 2000	Completed November 2000
Final version running	31 December 2000	Completed December 2000

4.4 Effectiveness of Project Methodology in Achieving Milestones

The project methodologies were entirely appropriate for achieving the project milestones and outputs.

5. Results

5.1 Economics Module

The costs and effectiveness of the routine and preventative mouse control actions are summarized in Table 1. There are some gaps in the available information, so the effect of some actions is unknown. Differences in the timing of some actions can lead to different effects on mouse populations. For example, crisis management using a broadscale application of an acute rodenticide in spring can result in an 80% reduction in mouse populations, whereas an application in autumn will result in a 42-66% reduction.

Table 1. Cost and effectiveness of mouse control actions for Victorian Mallee wheatlands. Management types are classified as routine (should be conducted every year or if high mouse numbers are forecast) and crisis (when mouse plague has irrupted and damage is likely).

Action	Timing	Effect on mouse population or available food supply	Cost (AUD$)	Reference
Routine Management Practices				
Anticoagulant rodenticide in bait stations around perimeter of crop	Spring	40% reduction of mice	$5.00/km ($3.46/ha)	1
Anticoagulant rodenticide in bait stations around house and sheds [A]	Spring	Unknown	Unknown	-
Spray grasses and weeds along fencelines in early spring [B]	Spring	30% reduction of mice [C]	$0.53/ha	1, 2
Slash grasses and weeds along fencelines in early spring [B]	Spring	30% reduction of mice [C]	$0.53/ha	1, 2
Graze stubble immediately after harvest and at a high intensity	Summer	50% reduction in food	No cost if have sheep	1
Harvest as cleanly as practicable (set machinery to minimise losses)	Summer	Less food available	No cost; may take time	1
Clean up concentrated spillage of grain	Summer	Less food available	Time to do it	1
Clean up concentrated spillage of grain at sowing	Autumn	Less food available	Time to do it	1
Light cultivation after sowing to disguise seed	Autumn	Less food available	$4.29/ha	1
Sow to even depth	Autumn	Less food available	Require new machinery	1
Crisis Management Practices				
Broadscale application of acute rodenticide	Spring	80% reduction of mice	$15.00/ha	3
Broadscale application of acute rodenticide (zinc phosphide)	Autumn	42-66% reduction of mice	$15.00/ha	4
Perimeter application of acute rodenticide	Autumn	20-30% reduction of mice	Unknown	4
Perimeter application of anticoagulant bait stations at sowing	Autumn	Unknown effect on mice	$3.46 ($3.75)/ha	1
Sow as deep as agronomically possible	Autumn	Less food available	$0.35/ha	1
Sow at a higher rate	Autumn	Would enable crop to establish	Cost of additional seed	1
Consider changing crop rotation	Autumn	Unknown	Unknown	1

References:

1. Brown *et al*. (1997a).
2. Brown *et al*. (1998).
3. Clare Dunn *et al*. (Personal Communication); P. Brown (Unpublished Data)
4. Brown *et al*. (In Press)

Notes:

[A] Will not affect mouse numbers in the field. Has not been fully examined.
[B] Action must be conducted prior to seed set of grasses and weeds.
[C] A 67% reduction of mice along fencelines, equates approximately to 30% reduction over whole farm.

The main screen of the Mouse Control Simulator (economics model) is shown in Figure 1. This screen allows users to provide minimal information in order for the model to run. Information is sought on wheat options (wheat area, wheat price and variable costs), rain and mouse density estimates, and selection of mouse control options (one routine action and one crisis control action). From this screen the user can access a help screen, the model can be run (using the Run button), the defaults can be re-set, options can be accessed (see below, Figure 2), and the user can exit from the program.

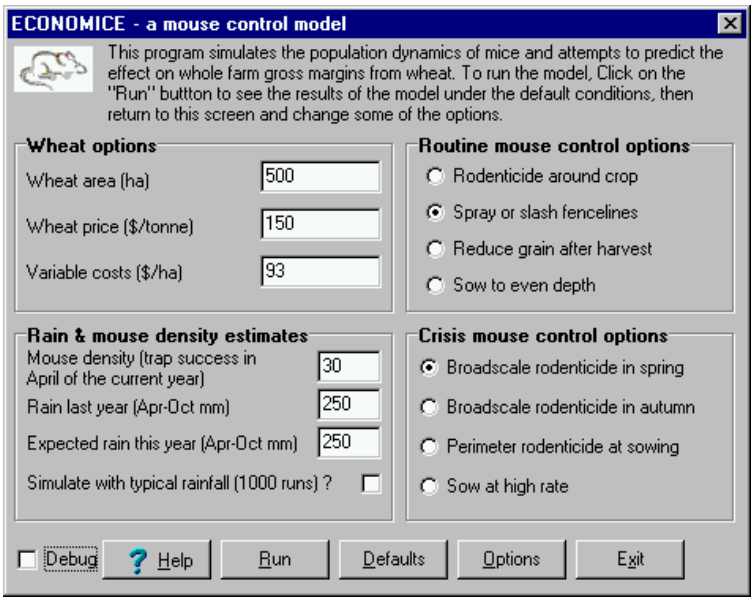

Figure 1. Main screen of the Mouse Control Simulator (economics module; EconoMice). Minimum information is required for wheat area, wheat price and variable costs and rain and mouse density estimates. The user then selects one routine action and one crisis management option.

Within the Options screen, users can change the default settings to modify the price and effectiveness of the options listed (Figure 2). Also, the user can change the relationship between mouse abundance and crop loss.

The output from the model provides a range of results. Information is provided for the whole farm gross margin, cost of control, wheat yields and mouse abundance (Figure 3).

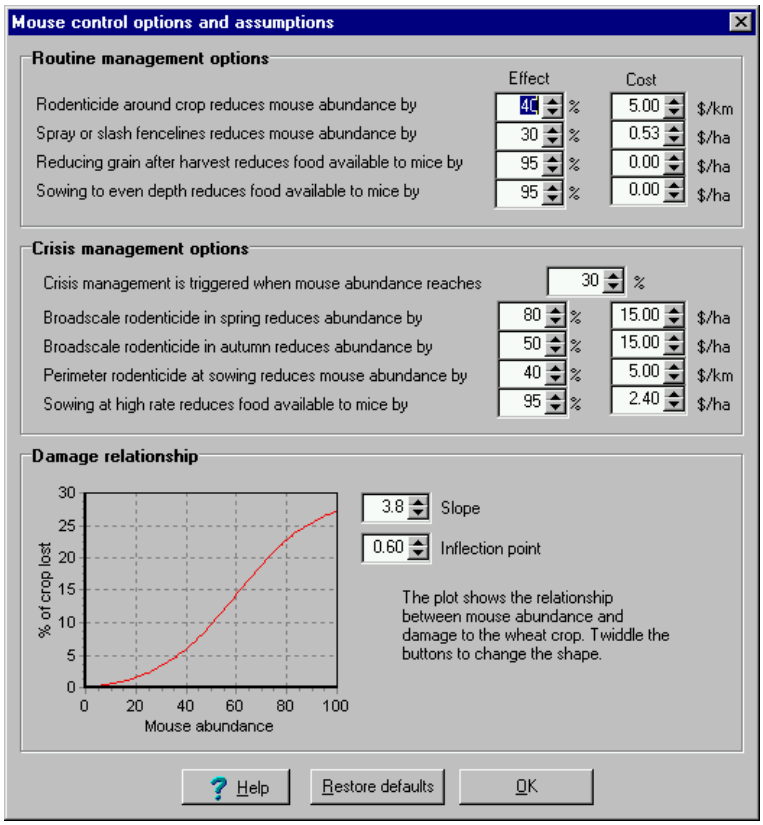

Figure 2. Details of the options screen. The effectiveness and costs of each control action can be altered, and the shape of the damage relationship can be changed.

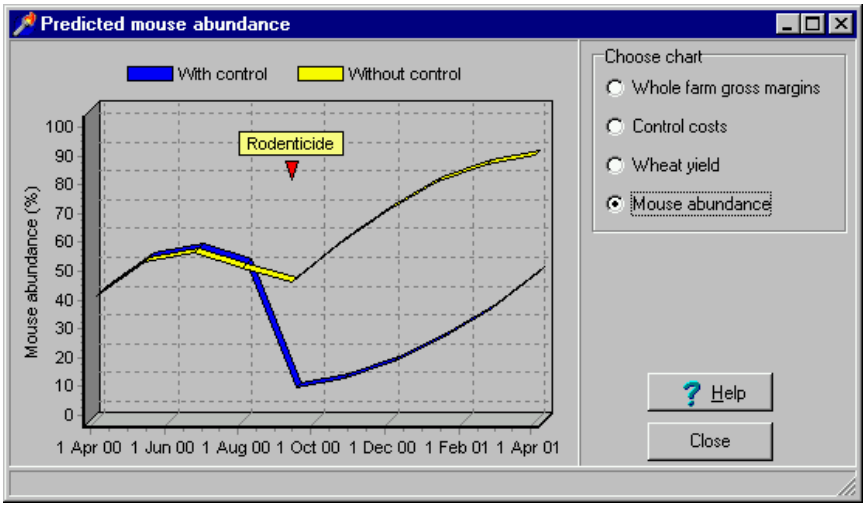

Figure 3. An example of the output screen showing response of the mouse population with and without control over the 12 month period that the model is run.

5.2 *MOUSER* Software

MOUSER was successfully upgraded to the WebGIST software and new information was added. The result is that *MOUSER* now has a new look and feel and navigation around the CD is much easier. The inclusion of a direct link to the internet will enable new information to be posted on the *MOUSER* web page of the CSIRO Rodent Research Group. The search facility of WebGIST has enhanced the usefulness of the CD-ROM.

6. Discussion of the results and implications for future management of pest damage

6.1 Economics Module

The development of an economics model for assisting with the management of mice requires (i) the use of the best available information on the costs and benefits of control actions for mice and (ii) a reliable damage-abundance function. While we acknowledge that our understanding of the damage-abundance function is based on a small data set, we have good estimates of the effectiveness of particular control actions on mouse populations (Brown *et al*. 1997a; Brown *et al*. 1998; Brown *et al*. *In Press*) and also the cost of those controls.

For the development of an economics model *MOUSER VERSION 1.0*, the information provided in Table 1 was simplified. Four routine actions (rodenticide around perimeter of crop; spray or slash fencelines; reduce grain after harvest; sow to even depth) and four crisis management actions were used (broad-scale rodenticide use in spring; broad-scale rodenticide use in autumn; perimeter baiting at sowing; sowing at a higher rate than normal). These were selected because we wanted to combine a relatively simple model with realistic sets of actions so that the end-users would be able to examine the effects of different types of control methods, in isolation or in combination.

The economics model was built using an existing mouse population model. The population model was derived using the numerical response of mice over a 15-year period in the Victorian Mallee region (Pech *et al*. 1999). Abundance of mice was related to estimates of food availability from cereal crops and grazed pasture and a density-

dependant factor representing the effects of predation, disease and intrinsic regulatory processes.

The model operates by estimating mouse densities from April in the current year to April the next year, and always runs two simulations, one with the mouse control that was specified by the user and one without mouse control options. The model requires estimates of rainfall to determine mouse densities and wheat yields, but the relationship between rainfall and mouse population dynamics is actually much more complex than is depicted in the model. A detailed explanation of an earlier version of the mouse population model can be found in Pech *et al*. (1999).

When control actions were invoked in the model, the numerical response of mice was affected. These actions have a cost, which was incorporated into the calculation of gross margins. The gross margins were determined using the farm gate price of wheat (tonnes/ha), area sown to wheat (ha), variables costs ($/ha), an estimate of the wheat yield (based on the rainfall from April to October, Pech *et al*. 1999) and the cost of mouse control. The estimate of wheat yield was dependant on the population abundance of mice at harvest. As we have demonstrated above, more data are required to strengthen this relationship.

Results of the simulations provide a comparison of control with no control over a 12-month period. Graphs are used to show the effect on the response of the mouse population, gross margins, cost of control and wheat yields. Much of the data used to generate the economics model have come from the Victorian Mallee, and so caution must be made when using the model in other agroecosystems.

The model can be run to show the impacts of mouse control in a single year, or over a range of years containing different rainfall events. This is important because rainfall has significant implications for mouse population levels, wheat yields and the net benefits from control. This feature demonstrates to users that control will not always be cost-effective and highlights the important concept of damage limitation as the goal, rather than pest eradication.

Only a few studies have examined the benefit-costs of particular control actions, generally involving the use of a rodenticide (Saunders and Robards 1983, Mutze 1993, Twigg *et al*. 1991, Singleton *et al*. 1991, Kay *et al*. 1994, Brown *et al*. 1997b), but none have examined the effects of more than one action.

6.2 Education Activities

The education/extention activities undertaken over the course of the project are detailed below. Most effort was placed on presentations to scientific audiences and to farmer field days, but there was a concerted effort to promote *MOUSER* to extension officers and farmer groups towards the end of the project. Furthermore, information about *MOUSER* was placed on the CSIRO Rodent Research Group and CPITT's web pages. This yielded some enquiries about *MOUSER* from overseas.

Scientific presentations

While developing *MOUSER VERSION 1.0*, we have taken the opportunity to present it to as wide an audience as possible to obtain feedback. Below is a list of scientific meetings and farmer field days where *MOUSER* was presented.

Brown, P. R., Yare, M. and Singleton, G. R. (1998). "Mouser: A prototype information transfer and decision support system for the management of mouse plagues." *11th Australian Vertebrate Pest Conference*, 3-8 May, Bunbury, WA.

Brown, P. R., Norton, G., and Thompson, D. (1999). "Development of an information transfer and decision support system for the management of mouse plagues." Spoken paper presented at the *Australiasian Wildlife Management Society, 12th Annual Conference*, 1-3 December, Darwin, NT.

Brown, P. R. (2000). "Update on Mouser" GRDC Cropping Expo, Parkes, 21 July 2000.

Brown, P. R., and Singleton, G. R. (2000). Impacts of rodent pests on crops in Australia - costs and damage. Invited spoken paper at *Human Conflicts with Wildlife: Economics Considerations Conference*, 1-3 August 2000, National Wildlife Research Centre, Fort Collins, Colorado, USA.

Brown, P. R., Singleton, G. R., Norton, G. A, and Thompson, D. (2001). *MOUSER (Version 1.0)*: a decision tool for managing mice. *12th Australasian Vertebrate Pest Conference*, 21-25 May, Melbourne, Victoria.

Assessment of the education strategy

A media release has been prepared and will be used to advertise and promote *MOUSER*. It will be sent to rural press and to some of the key farmer journals. A copy of the release is provided in Appendix 1.

We believe that the processes and mechanisms that were used to advertise and promote *MOUSER VERSION 1.0* were effective. We were able to inform a wide range of people about *MOUSER* and we hope that this will lead to many of them obtaining a copy and using it. Our ultimate goal is to enable managers to adopt better pest management practices by using the information contained in the CD-ROM.

6.3 Implications for Future Management of Pest Damage

The basic philosophy behind *MOUSER* is to provide extension officers, farmers and farmer groups with adequate information to develop appropriate management practices for minimising the impact of mice on farms. It is hoped that these practices will be adapted from the results of the BRS funded projects on best management practices for mouse control that have been conducted in Victoria (Mallee and Wimmera) and Southern New South Wales (Murrumbidgee Irrigation Area).

A product such as this can only lead to benefits in terms of adoption of best practice pest animal management and an increase in the awareness of the problem. To further facilitate the use of *MOUSER*, information and updates will be posted on the CSIRO Rodent Research Group's web page (http://www.cse.csiro.au/research/VFP/rodents/). Such information will include current predictions that could be used in the economics module and in the decision key.

During the development of *MOUSER* (from the prototype stage through to Version 1.0), we have received strong support and interest from industry and state government departments. The true value of *MOUSER* will be realised when state government department extension officers use it when they talk with individual farmers or groups of farmers.

6.4 References

Brown, P. R., Singleton, G. R., Dunn, S. C., O'Brien, K., Jones, D. A., and Griffiths, J. (1997a). "Best farm management practices to control mouse populations". Unpublished Report to Bureau of Resource Sciences. CSIRO Wildlife and Ecology, Canberra. pp. 58.

Brown, P. R., Singleton, G. R., Kearns, B., and Griffiths, J. (1997b). Evaluation and cost-effectiveness of strychnine for control of populations of wild house mice (*Mus domesticus*) in Victoria. *Wildlife Research* **24**, 159-172.

Brown, P. R., Singleton, G. R., Dunn, S. C., and Jones, D. A. (1998). The management of house mice in agricultural landscapes using farm management practices: An Australian perspective. Proceedings of the 18th Vertebrate Pest Conference. (R. O. Baker and A. C. Crabb Eds.). Costa Mesa, California. Davis. University of California. pp. 156-159.

Brown, P. R., Chambers, L. K., and Singleton, G. (In press). Pre-sowing control of house mice (*Mus domesticus*) using zinc phosphide - efficacy and potential non-target effects. *Wildlife Research* **28**.

Kay, B. J, Twigg, L. E., and Nicol, H. I. (1994). The strategic use of rodenticides against house mice (*Mus domesticus*) prior to crop invasion. *Wildlife Research* **21**, 11-19.

Mutze, G. J. (1993). Cost-effectiveness of poison bait trails for control of house mice in mallee cereal crops. *Wildlife Research* **20**, 445-456.

Pech, R. P., Hood, G., Singleton, G. R., Salmon, E., Forrester, R., and Brown, P. R. (1999). Models for predicting plagues of house mice (*Mus domesticus*) in Australia. In "Ecologically-based Management of Rodent Pests". (Eds. G. R. Singleton, L. A. Hinds, H. Leirs, and Z. Zhang.) pp. 81-112. (Australian Centre for International Agricultural Research: Canberra.)

Saunders, G. R. and Robards, G. E. (1983). Economic considerations of mouse-plague control in irrigated sunflower crops. *Crop Protection* **2**, 153-158.

Singleton, G. R., Twigg, L. E., Weaver, K. E., and Kay, B. J. (1991). Evaluation of bromadiolone against house mice (*Mus domesticus*) populations in irrigated soybean crops. II. Economics. *Wildlife Research* **18**, 275-284.

Twigg, L. E., Singleton, G. R., and Kay, B. J (1991). Evaluation of bromadiolone against house mice (*Mus domesticus*) populations in irrigated soybean crops. I. Efficacy of control. *Wildlife Research* **18**, 265-274.

7. Audited statement of total expenditure on the project

Attached are (i) a certified statement of receipts and expenditure for the period 1 July 1999 to 15 May 2001, (ii) a certified statement of receipts and expenditure for the period 1 January 2001 to 15 May 2001, and (iii) a consolidated financial statement for the project.

Appendices

Appendix 1 - Copy of media release to advertise and promote *MOUSER VERSION 1.0* (media release will be sent out to coincide with availability of the *MOUSER* CD-ROM).

Appendix 1 Media Release to advertise and promote Mouser Version 1.0

Media Release

Mr Nick Goldie **02 6276 6478**
Mobile **0417 299 586**
Fax **02 6276 6821**

CSIRO Media Releases are also available on the Internet: http://www.csiro.au

1 August 2001 ***Ref 01/nnn***

MANAGING MICE WITH A MOUSE

For Australian farmers plagued by mice, help is only a mouse click away.

CSIRO has released a new and user-friendly CD called *Mouser* that gives farmers access to years of scientific expertise through a home computer.

"We've been working with farmers in plague-affected areas for around 20 years," says Peter Brown of the CSIRO Rodent Group, who developed the CD.

"The mouse damage we've seen and the stories we've heard are enough to make your hair curl," he says.

The interactive CD uses a range of video footage, photos, graphics and text to provide information, science and advice on ways to monitor and manage one of the country's biggest economic pests.

"With *Mouser*, we wanted to present our scientific data to the people who need it in the most useful way possible," says Mr Brown. "We want farmers to be able to make informed decisions about mouse control using the best and most up-to-date information available.

"There's not much you can't find out about mice on the CD. From general biology through to when and how mouse plagues happen, what sort of damage mice are likely to cause and how to monitor mice on your farm and in your house," he says.

"We built a decision support key and a simulation model into the CD. These allow the user to 'roadtest' different mouse control practices to see how effective they'd be – both in terms of mouse numbers and dollars spent.

"We've designed *Mouser* to be easy to use: all you have to do is point your computer mouse and click," he says.

Originally designed for use by farmers, farmer groups and extension officers, Mr Brown has discovered that the *Mouser* prototype is being used by librarians and school teachers as a teaching aid and as a source of general information.

"We hope the CD is a resource that will appeal to a wide range of people – and that the information we've captured will be both of practical use and interesting."

The CD was developed in conjunction with the University of Queensland and the Centre for Agricultural and Regional Economics. Funding for the CD came from the Natural Heritage Trust (through the Bureau of Rural Sciences) and CSIRO. Other assistance was provided by the Pest Animal Control CRC and the Australian Centre for International Agricultural Research.

More information, images, from:

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