Building Cooperation and Collaboration in the Kangaroo Industry:
Towards a role for landholders

By Peter Ampt and Alex Baumber

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Foreword

The Barrier Ranges Sustainable Wildlife Enterprise Trial, conducted over three years from July 2006 to June 2009, is a participatory action research study that focuses on the present and future role of landholders in the kangaroo industry. Through a range of strategies involving extensive consultation, analysis, intervention and adaptive management, the study has examined key aspects of the commercial kangaroo harvest system. It has revealed a complex set of interactions between landholders, harvesters, regulators and processors in the case study area and beyond, and has implemented changes to components of the system and assessed the impact of those changes.

This research shows why landholder participation in the industry is very low at present and points to specific innovations that could increase it. Some of these innovations can be picked up by landholders immediately, some require changes to regulatory practices and others can be implemented by processors and the industry as a whole. Better integration of kangaroo harvest with land management can provide benefits to the landscape, and this research has also trialled Landscape Function Analysis as tool to help landholders make better environmental management decisions. This research can help the industry as a whole build a better value chain and access more secure and high value markets, which will provide benefits to all those involved in the industry.

This research identifies changes which could be made to the regulation of the commercial kangaroo harvest to encourage transparency and innovation; landholders and harvesters could form collaborative groups to develop quality harvest management in local areas; processors could pursue quality above compliance and the industry as a whole could seek greater visibility in actively pursuing increased domestic consumption.

This report is an addition to RIRDC’s diverse range of over 1900 research publications and it forms part of our Rangelands and Wildlife Systems R&D program, which aims to facilitate a more diverse rural sector, enhanced biodiversity and innovative industries based on non-traditional uses of the rangelands and their wildlife.

Most of RIRDC’s publications are available for viewing, free downloading or purchasing online at www.rirdc.gov.au. Purchases can also be made by phoning 1300 634 313.

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Managing Director
Rural Industries Research and Development Corporation
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## Abbreviations

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<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tr>
<td>AEMS</td>
<td>Agricultural and Environmental Management Services</td>
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<td>AM</td>
<td>Adaptive Management</td>
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<td>BaRaRoo</td>
<td>Barrier Ranges Kangaroo enterprise</td>
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<td>BARG</td>
<td>Barrier Area Rangecare Group</td>
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<td>BRSWET</td>
<td>Barrier Ranges Sustainable Wildlife Enterprise Trial</td>
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<tr>
<td>CMA</td>
<td>Catchment Management Authority</td>
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<tr>
<td>CSU</td>
<td>Conservation through Sustainable Use</td>
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<tr>
<td>DECC</td>
<td>Department of Environment and Climate Change</td>
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<tr>
<td>DPI</td>
<td>Department of Primary Industries</td>
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<tr>
<td>DSE</td>
<td>Dry Sheep Equivalent</td>
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<tr>
<td>EBC</td>
<td>Enterprise-Based Conservation</td>
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<tr>
<td>EFA</td>
<td>Ecosystem Function Analysis</td>
</tr>
<tr>
<td>FATE</td>
<td>Future of Australia’s Threatened Ecosystems</td>
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<tr>
<td>GL</td>
<td>General Licence</td>
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<tr>
<td>KMP</td>
<td>Kangaroo Management Plan</td>
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<tr>
<td>KMZ</td>
<td>Kangaroo Management Zone</td>
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<tr>
<td>LFA</td>
<td>Landscape Function Analysis</td>
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<tr>
<td>MLLE</td>
<td>Multiple Lines and Levels of Evidence</td>
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<tr>
<td>NPWS</td>
<td>National Parks and Wildlife Service</td>
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<tr>
<td>NRC</td>
<td>Natural Resources Commission</td>
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<td>PAWD</td>
<td>Pastoralists’ Association of West Darling</td>
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<td>PAR</td>
<td>Participatory Action Research</td>
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<tr>
<td>PVP</td>
<td>Property Vegetation Plan</td>
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<td>RAP</td>
<td>Rangeland Action Research</td>
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<td>RMAP</td>
<td>Rangeland Management Action Plan</td>
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<tr>
<td>RIRDC</td>
<td>Rural Industry Research and Development Corporation</td>
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<tr>
<td>SWE</td>
<td>Sustainable Wildlife Enterprise</td>
</tr>
<tr>
<td>SWOT</td>
<td>Strengths, Weaknesses, Opportunities and Threats</td>
</tr>
<tr>
<td>TGP</td>
<td>Total Grazing Pressure</td>
</tr>
<tr>
<td>TRIC</td>
<td>Tilpa Rangeland Investment Company</td>
</tr>
<tr>
<td>UNE</td>
<td>University of New England</td>
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<tr>
<td>UNSW</td>
<td>University of New South Wales</td>
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<tr>
<td>WCMA</td>
<td>Western Catchment Management Authority</td>
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</table>
## Contents

Foreword ........................................................................................................................................... iii  
Acknowledgments ................................................................................................................................. iii  
Abbreviations ......................................................................................................................................... v  
Executive Summary............................................................................................................................... x  

1. Introduction ....................................................................................................................................... 1  
   1.1 Sustainable Wildlife Enterprises .............................................................................................. 1  
   1.2 The Barrier Ranges .................................................................................................................. 2  
   1.3 Kangaroos in the rangelands .................................................................................................... 4  
   1.4 The Barrier Ranges Sustainable Wildlife Enterprise Trial ....................................................... 6  

2. Objectives ........................................................................................................................................... 7  
   2.1 Hypotheses ............................................................................................................................... 7  
   2.2 Desired outcomes of research .................................................................................................. 8  

3. Methodology ....................................................................................................................................... 9  
   3.1 Reasons for the chosen methodology and adaptive management approach .......................... 10  
   3.2 Collecting evidence and managing the trial ........................................................................... 11  
   3.3 Progress of the trial ................................................................................................................ 13  
   3.4 Components of the trial .......................................................................................................... 16  

4. Kangaroo harvest and population data ......................................................................................... 17  
   4.1 Objectives .............................................................................................................................. 17  
   4.2 Methods .................................................................................................................................. 17  
   4.3 Results .................................................................................................................................... 18  
   4.4 Discussion .............................................................................................................................. 30  

5. Adaptive management trial of General Licence ........................................................................... 33  
   5.1 Objectives .............................................................................................................................. 33  
   5.2 Methods .................................................................................................................................. 34  
   5.3 Results .................................................................................................................................... 38  
   5.4 Discussion .............................................................................................................................. 41  

6. Use of Landscape Function Analysis by landholders and the establishment of community  
   monitoring ......................................................................................................................................... 44  
   6.1 Objectives .............................................................................................................................. 45  
   6.2 Methods .................................................................................................................................. 45  
   6.3 Results .................................................................................................................................... 53  
   6.4 Discussion .............................................................................................................................. 61  

7. Survey of landholder perceptions of kangaroo issues ................................................................. 63  
   7.1 Objectives .............................................................................................................................. 63  
   7.2 Methods .................................................................................................................................. 63  
   7.3 Results .................................................................................................................................... 63  
   7.4 Discussion .............................................................................................................................. 75
8. Economic modelling and business case ................................................................. 78
  8.1 Objectives ............................................................................................................. 78
  8.2 Methods .................................................................................................................. 78
  8.3 Results ..................................................................................................................... 83
  8.4 Discussion .............................................................................................................. 96
  9.1 Objectives ............................................................................................................. 99
  9.2 Methods and results ............................................................................................ 99
  9.3 Discussion ............................................................................................................ 102
10. Discussion ................................................................................................................ 105
  10.1 Achievement of performance indicators ............................................................. 105
  10.2 Discussion to integrate Chapters 4-9 .................................................................. 108
  10.3 The complexity of the problem ........................................................................... 111
11. Implications ............................................................................................................ 115
  11.1 Implications for the kangaroo harvesting, processing and marketing system .. 115
  11.2 Implications for landholders .............................................................................. 116
  11.3 Implications for regulators ............................................................................... 117
  11.4 Implications for harvesters ............................................................................... 117
  11.5 Implications for chiller operators ...................................................................... 118
  11.6 Implications for processors .............................................................................. 118
12. Recommendations .................................................................................................. 120
  12.1 Recommendations for landholders ................................................................... 120
  12.2 Recommendations for harvesters ...................................................................... 120
  12.3 Recommendations for regulators ...................................................................... 120
  12.4 Recommendations for processors .................................................................... 121
  12.5 Recommendations for the kangaroo industry as a whole .................................. 121
Appendices ................................................................................................................... 122
  Appendix A: Interview proforma ............................................................................ 122
  Appendix B: Interview proforma ............................................................................ 124
  Appendix C: Sustainable Wildlife Enterprises Workshop ........................................ 126
Glossary ......................................................................................................................... 133
References .................................................................................................................... 134
Tables

Table 3.1: Trial hypotheses and description of evidence .......................................................... 11
Table 3.2: Strategies used to manage the trial and applied to different components ............ 12
Table 3.3: GANTT chart from initial RIRDC proposal February 2006 .................................... 14
Table 4.1: Factors affecting local kangaroo populations and shooter behaviour .................. 22
Table 4.2: Estimated red and grey kangaroo population density across trial area from September 2008 survey, with 2008 DECC estimates for each KMZ for comparison ........ 29
Table 5.1: Negotiations on adaptive management experiment .............................................. 35
Table 6.1: Key land types for LFA monitoring strategy in BRSWET area ............................... 50
Table 6.2: Comparison of LFA done by landholders and experts on transect 5 at Fowlers Gap in Nov 2006 .................................................................................................................. 56
Table 6.3: Comparing landscape organisation data between expert and learner groups on transect 2 at Mt Woowoollahra in Oct 2007 ................................................................. 57
Table 6.4: Best possible Banded saltbush/bluebush—stony site inside Emu Paddock at FG .... 59
Table 6.5: Worst available Banded saltbush/bluebush—stony site (not worst possible) outside Emu Paddock at FG ................................................................. 60
Table 6.6: Best available Sandplain—(not nearly best possible) at The Veldt ......................... 60
Table 6.7: Worst available Sandplain—(not nearly worst possible) ...................................... 61
Table 8.1: Baseline data and assumptions used in the models .............................................. 80
Table 8.2: Income parameters and assumptions for the Fowlers Gap bio-economic model .... 82
Table 8.3: Profit expected under Model A for the 19 BRSWET properties ............................ 83
Table 8.4: Annual returns for the 18 properties where the cooperative model will be viable .... 83
Table 8.5: Landholder returns from price premium payments from processor, assuming a premium for 20% of kangaroos harvested ......................................................... 84
Table 8.6: Costs, income and net returns from Model D ........................................................ 85
Table 8.7: Costs, income and net returns from Model E ...................................................... 85
Table 8.8: Comparison of models using baseline assumptions (2001-07 population and harvest levels) .................................................................................................................. 86
Table 8.9: Annual carbon credit income at different carbon prices for hypothetical conservation area on Fowlers Gap ................................................................. 88
Table 8.10: SWOT Analysis for hypothetical BaRaRoo collaborative enterprise .................... 90
Table 8.11: Key issues and recommended rules for BaRaRoo co-op ...................................... 93
Table 8.12: Possible annual revenue from premium pricing options ..................................... 94
Table 8.13: Possible Annual Costs for Business Development/Co-operative Manager .......... 95
Table 8.14: Total cost analysis for a premium-quality BaRaRoo co-op ................................. 95
Table 9.1: Key project activities that build knowledge of the kangaroo industry .................. 100
Table 10.1: Achievement of performance indicators ......................................................... 105
Figures

Figure 2.1: Hypotheses for the Barrier Ranges Sustainable Wildlife Enterprise Trial .................................................. 7
Figure 4.1: Map of September 2008 survey transects, annual DECC transects and BRSWET properties, Broken Hill and Tibooburra Kangaroo Management Zones (KMZs), NSW ................................................. 18
Figure 4.2: Total annual harvest of red and grey kangaroos for trial properties compared with the combined Broken Hill and Tibooburra KMZs 2001-07 (DECC 2009). ................................................................. 19
Figure 4.3: 2001-07 kangaroo populations for Broken Hill and Tibooburra KMZs (Payne 2008a) compared with rainfall at Broken Hill - Stephen’s Ck Reservoir (Bureau of Meteorology 2008a) ........................................ 19
Figure 4.4: Coefficient of variation (CV) for the annual harvest on each of the 19 harvested properties 2001-2007 (UNSW’s Fowlers Gap Arid Zone Research Station is excluded as it had no harvest) .......... 20
Figure 4.5: Harvest density and harvest consistency across the 20 properties 2001-2007 ........................................... 21
Figure 4.6: Harvest density for each of the 19 harvested properties (average over 2001-2007) versus temporal harvest variability for each property (CV for each property’s harvest 2001-2007) ............. 22
Figure 4.7: Most significant correlations with property harvest size and harvest variability in each of the three subgroups 2001-07 .......................................................................................................................... 23
Figure 4.8: Harvest density for the 20 trial properties and the broader region (Broken Hill and Tibooburra KMZs). .............................................................................................................................................. 25
Figure 4.9: Monthly harvest levels across the trial group May 08 – April 09 ................................................................. 26
Figure 4.10: Harvest density versus CV of monthly harvest for each trial property 2008/09 ................................. 26
Figure 4.11: Harvest v rainfall for each month of the trial within the Broken Hill, Tibooburra and White Cliffs subgroups. .................................................................................................................. 27
Figure 4.12: Properties with biggest positive and negative changes in trial year harvest compared to 2001-07 average. Only properties with >50% change on 2001-07 harvest average highlighted. ........... 28
Figure 4.13: Hypothetical locations for three chillers across the trial area designed to balance harvest consistency with accessibility for all properties. .................................................................................. 31
Figure 5.1: Harvest density for the 20 trial properties and the broader region (Broken Hill and Tibooburra KMZs). .............................................................................................................................................. 38
Figure 6.1: Landscape organisation ............................................................................................................................. 46
Figure 6.2: Soil Surface Analysis – how soil surface indicators contribute to the generation of soil surface indices. ........................................................................................................................................ 46
Figure 6.3: Distribution of key land types across BRSWET area ...................................................................................... 51
Figure 6.4: Comparison of Landscape organisation transect 5 by expert and learners at Fowlers Gap, November 2006 ........................................................................................................................................... 56
Figure 7.1: Distribution of landholding size amongst survey respondents ................................................................. 64
Figure 7.2: Age distribution of survey respondents .................................................................................................. 64
Figure 7.3: Income streams amongst survey respondents (n=144) ............................................................................. 65
Figure 7.4: Terms selected by respondents to ‘best describe kangaroos’ ................................................................. 66
Figure 7.5: Reasons selected for being interested in kangaroo management .......................................................... 67
Figure 7.6: Groups seen as liable for compensation .................................................................................................. 67
Figure 7.7: Barriers to effective control of kangaroo grazing most selected ............................................................. 69
Figure 7.8: Effectiveness of kangaroo shooting versus estimated size of influx ...................................................... 70
Figure 7.9: Potential barriers to landholders gaining income from kangaroos .......................................................... 71
Figure 7.10: Ratings for Different Models of Landholder Involvement in the Kangaroo Industry ........................................... 72
Figure 7.11: Reported participation in collaborative activities ..................................................................................... 73
Figure 7.12: Attitudes towards a change to a Queensland-style system ........................................................................ 74
Figure 8.1: Components of total profit from a hypothetical conservation area on Fowlers Gap ............................................. 87
Figure 8.2: EV analysis to determine the optimal land-use option for the case study landholder ................................ 89
Figure 8.3: Potential operating model for a landholder/harvester cooperative (Cooney 2009) ....................................... 91
Figure 8.4: BaRaRoo co-op structure developed by Peter van Herk ............................................................................. 91
Figure 8.5: BaRaRoo business implementation plan developed by Peter van Herk ..................................................... 94
Executive Summary

What the report is about

This report documents the Barrier Ranges Sustainable Wildlife Enterprise Trial undertaken by the Future of Australia’s Threatened Ecosystems (FATE) Program from UNSW between June 2006 and June 2009. FATE and several consultants worked closely with key stakeholders (members of the Barrier Area Rangecare Group, Western Catchment Management Authority, kangaroo harvesters, the Kangaroo Management Program at NSW Department of Environment and Climate Change and some kangaroo processors) in an attempt to develop a collaborative kangaroo harvesting enterprise involving landholders.

This research is important because, after three decades of commercial kangaroo harvesting, there is negligible involvement of landholders in the industry. Despite calls for a greater emphasis on conservation through sustainable use, the kangaroo industry remains separate from land management. Despite calls from experts that Australia’s rangelands are more suitable for growing kangaroos than conventional livestock and that there are significant benefits to be achieved from a shift to kangaroos, it has not occurred.

This project set out to devise, with stakeholders, a path towards a viable business based on kangaroo harvest that takes into account environmental, social, industrial and economic factors.

Who is the report targeted at?

Landholders, kangaroo harvesters, kangaroo harvest regulators, kangaroo processors and researchers interested in sustainable land management and providing opportunities to diversify rural enterprises.

Background

Sustainable use of wildlife has become widely accepted internationally as a strategy to secure conservation outcomes as well as supporting human livelihoods. To encourage sustainable use of Australia’s native wildlife, RIRDC has launched the Sustainable Wildlife Enterprises program. Kangaroo harvesting has been identified under the SWE program as a key enterprise option to be explored by landholders interested in diversifying their incomes and achieving conservation outcomes through the commercial use of native species.

Aims/objectives

The major objective of the project was to investigate whether a Sustainable Wildlife Enterprise (SWE) based on kangaroo harvesting can provide incentives to manage rangelands for biodiversity conservation and landscape rehabilitation. In order to achieve this objective, the project aims to:

1. Develop a collaborative kangaroo enterprise that provides returns to landholders.

2. Develop a collaborative approach to kangaroo management across the BARG area.

3. Integrate kangaroo management with other enterprises on the participating properties to achieve improved management of total grazing pressure.

4. Establish and undertake community monitoring of landscape function and kangaroo populations to inform adaptive management.

5. Document the process and develop a model for similar initiatives in other locations.
Methods used

An adaptive management approach was used to develop, trial, monitor and adapt a model for a collaborative kangaroo enterprise among members the Barrier Area Rangecare Group in the far west of NSW. The project consisted of several components: investigation of past harvest and population dynamics of kangaroos in the trial area; trial of a special group harvesting licence to facilitate collaboration among landholders; training of landholders in Landscape Function Analysis and progress towards a multi-property monitoring scheme; a survey of landholders across the WCMA region of NSW to gather baseline information on kangaroo management practices and landholder perspectives; economic modelling to test financial feasibility of likely enterprise scenarios and a business case for a collaborative kangaroo enterprise. These components were integrated with a thorough analysis of the kangaroo industry.

Results/key findings

The project was successful in developing a collaborative approach to kangaroo harvest management across the BARG area, developing a model for application to other areas and undertaking initial monitoring of landscape function and kangaroo populations. However, due to the short harvest trial duration, low harvest levels and difficulties negotiating with the kangaroo industry, it was not successful in obtaining returns for landholders and had limited success in integrating kangaroo management with other enterprises.

Analysis of harvest data reinforced the need for landholders to collaborate to generate practical and economic benefits from kangaroo harvest. Despite a protracted delay in gaining approval, three successive group licences were trialled successfully, providing an alternative harvest regime for consideration by the regulator. While the participants were positive about the potential of the group licence, its full potential was not assessed due to a lack of kangaroo influxes during the trial.

Landholders were successfully trained in LFA and a group monitoring system was planned and partly implemented. A web-based information sharing system for kangaroo harvest management and for monitoring landscape function was not delivered by a research partner. A business plan was developed for a collaborative kangaroo harvest enterprise. It aims to deliver a premium kangaroo product and, based on economic modelling, would be viable if a premium price could be obtained. Trial participants were unwilling to embark on the venture in the absence of a premium price and the perceived unwillingness of processors to recognise the role a local management group could play in value-adding to harvest management.

The project has identified significant potential for collaboration between landholders and harvesters and greater understanding has been gained on the factors influencing income potential of collaborative kangaroo harvesting. The research identified implications and generated recommendations for the various stakeholders involved in kangaroo harvest, regulation, processing, marketing and industry development.

The key findings of the research are:

- the commercial kangaroo harvest system is complex and resistant to change;

- there are significant risks and barriers to change in the kangaroo industry due to weaknesses in value chain and consumer misconceptions;

- while opportunities for individual landholders to participate are severely limited, there are significant opportunities for involvement of groups of landholders collaborating with each other and with harvesters and chiller operators;

- there are fundamental problems with the harvest regulation system that encourage people to work around the system and that hinder innovation;
harvesters stand to gain from collaboration with each other and with landholders;

processors are in a position to encourage innovation and stand to gain from providing incentives for groups to manage harvest locally;

a stronger focus on the development of a premium line of kangaroo meat will benefit the industry;

Further work should be done with landholders to develop self monitoring using Landscape Function Analysis.

Implications for relevant stakeholders

Landholders are capable of and interested in monitoring resource condition using Landscape Function Analysis to help guide their own management and to generate evidence of good environmental stewardship. Their data could help contribute to regional information on environmental performance with additional research.

Landholders can gain greater control of kangaroo harvest and create opportunities for gaining an economic return from kangaroos if they collaborate with neighbours and kangaroo harvesters. Harvest variability is too high on an individual property basis.

For regulators, offering a Group Licence as an alternative to a single property licence can help generate opportunities for developing kangaroo enterprises. The current regulatory system has serious flaws which lead to some non-compliance which is largely undetected and impacts on the integrity of harvest data and trace-back.

For kangaroo harvesters, being part of a co-operative group with landholders and other harvesters can generate benefits such as security of access and continuity of harvest.

Chiller operation is a critical step in the kangaroo harvest system that, if neglected, represents a significant risk to the industry.

Processors continue to dominate the industry. Great benefits could be generated for the industry as a whole if they were to recognise the potential of and provide incentives for quality local management of kangaroo harvest and chillers.

Developing a premium line of kangaroo meat and testing it in the market may be a critical step towards achieving the Kangaroo Industry’s aim of increased domestic human consumption of kangaroo manufacturing meat.

Recommendations

1. Landholders should attempt to find a kangaroo harvester with whom they can establish clear lines of communication in an effort to achieve kangaroo population management and other potential benefits (such as feral animal management) in return for security of access and harvest support.

2. Where practical, landholders should attempt to form a group, preferably of neighbouring properties, and negotiate with a reliable harvester or harvesters by offering harvest support and access rights to the whole group in exchange for desired harvester behaviour such as a commitment to harvest when necessary and the management of feral animals. This can be achieved under the current Occupiers and Trappers Licences but there are advantages to using a group General Licence.

3. Landholder groups in areas where kangaroo populations are high and for whom effective kangaroo management is a high priority should use the information generated by this trial to develop workable kangaroo management strategies in collaboration with harvesters and processors. In particular, they should determine whether the production of a premium line is possible and work
towards establishing a co-operative which provides incentives for provision of quality in return for a premium price.

4. Landholders and landholder groups interested in generating evidence of environmental stewardship and seeking objective means of assessing the impact of management practices on resource condition should consider implementing a system based on Landscape Function Analysis.

5. Harvesters should consider approaching landholder groups and other landholders to collaborate on harvest management in their area. This project has demonstrated clear benefits from collaboration and cooperation across properties and between harvesters. Harvesters can take a leading role in this.

6. Property specific tags should be phased out. This is because they are not sufficiently flexible to allow for the habits of kangaroos and the livelihoods of harvesters and they are not necessary to ensure zone quotas are upheld. In states where they occur, tag-swapping is practiced which compromises harvest data and trace-back reliability. Whilst it is illegal, tag-swapping is difficult to detect and therefore ineffectively enforced.

7. If property specific tags are retained, penalties for using them on another property should be replaced by a requirement for such use to be reported. This would require minimal changes to the existing system, would remove the perverse incentive to falsify harvest returns, would provide more reliable harvest data and would improve the accuracy of trace-back.

8. If property specific tags are retained, a group licence similar to the one tested in this trial should be made available to groups that provide coordination and administration of harvest.

9. The system of Fauna Dealers Licences should be reviewed to remove the barrier for a local kangaroo harvest management co-operative or corporation to develop a business independent of existing processors.

10. The NSW KMP should include more detail on social, cultural and economic objectives.

11. The adaptive management provisions in the NSW KMP should be streamlined and broadened to provide a clearer path for researchers to design and implement adaptive management trials.

12. Investigation should be undertaken into the possibility of generating a line of kangaroo meat from the existing value chain that is of sufficient quality and consistency to demand a higher price from the domestic restaurant, food service, gourmet and specialist retail market. Consideration should be given to the contribution of size, age, species, field processing, chilling, transport and location to the achievement of a market-appropriate quality differential.

13. The kangaroo industry should develop and implement incentives for landholder groups, harvesters and chiller operators to meet and exceed compliance to develop quality rather than incentives solely based on quantity.

14. The possibility of providing a processing service to harvest management groups should be investigated that allows them to have their animals processed for a fee while retaining ownership through to the retailer.

15. A task force should be set up that aims to develop a national kangaroo harvest regulation system that removes differences between states, is based on ecologically sustainable development and allows for devolution of management to local groups that can demonstrate their ability to successfully manage the harvest. Consideration should be given to a system of tradable tags.

16. The industry should support the development of a system driven by quality rather than quantity. This will involve supporting research into the measures needed to generate differentiated products,
assess the potential volume of those products and develop the markets for those products. This research suggests that achieving a quality driven system could involve providing incentives to local business / landholder / harvester groups to provide quality harvest and chiller management.

17. The industry should explore innovative ways of increasing the visibility of kangaroo meat and awareness of its positive market attributes.

18. The industry should develop closer ties with landholders and landholder groups and seek to work more closely on mutually beneficial areas such as integrating commercial kangaroo harvest with good land management. Through this the industry can utilise the promotional benefits of landholder involvement and support for the industry, which links closely with consumer attitudes looking farmer ‘management’ of kangaroo production. One possible mechanism is to support the establishment of a National Kangaroo Grower and Harvester Association.
1. Introduction

1.1 Sustainable Wildlife Enterprises

Sustainable use of wildlife has become widely accepted in recent years as a strategy to secure conservation outcomes at the same time as supporting human livelihoods (CITES 1992; IUCN 2000; CBD 2004). Use of wild resources, it is argued, can generate incentives for conservation of wild species and ecosystems, and these incentives can counteract the powerful drivers currently operating for conversion of biodiverse natural landscapes to intensive production (Webb 2002; Hutton and Leader-Williams 2003; CBD 2004). In Australia, many writers have highlighted the potential benefits of sustainable use of wild fauna and flora and called for its wider adoption (Grigg, Hale et al. 1995; Wilson 1995; Senate RARATR Committee 1998; Lunney and Dickman 2002; Webb 2002; Archer and Beale 2004).

To encourage sustainable use of Australia’s native wildlife, the Rural Industry Research and Development Corporations (RIRDC) Rangelands and Wildlife Subprogram have launched the Sustainable Wildlife Enterprises program. The initiative seeks to trial new ways of managing native species to provide profitable and sustainable income generating options for landholders. A Strategic Plan for Trialling the Sustainable Wildlife Enterprises (SWE Plan) concept has been produced and published by RIRDC in 2005 through its Rangelands and Wildlife Research Program and with the support of the National Landcare Program. The SWE Plan sets out guidelines for conservation-based enterprises as an incentive to restore native on-farm habitat. The trials will seek to determine whether alternative production systems enable the value of wildlife resources to operate as an incentive to protect and maintain habitat and to enhance biodiversity on private lands, to increase the resilience and long term sustainability of the agricultural sector in rangelands, to reduce the costs of land rehabilitation and to strengthen the viability of rural communities.

Emu on Fowlers Gap

The Future of Australia’s Threatened Ecosystems Program (FATE), a small research group based at UNSW, is working on conservation through sustainable use (CSU) and common property strategies to improve natural resource management. The FATE Program’s objective is to investigate whether CSU approaches involving the commercial use of Australia’s native species could enhance the long-term conservation of Australian biodiversity and increase the resilience and economic viability of rural and regional Australia. The FATE approach is fundamentally consistent with the work being undertaken.
by the Rangeland and Wildlife Systems under the Sustainable Wildlife Enterprises (SWE) Strategic Plan.

Both the FATE Program and the SWE Program have identified kangaroo harvesting as a key enterprise option to be explored by landholders interested in diversifying their incomes and achieving conservation outcomes through the commercial use of native species. Australian scientists have repeatedly called for landholders in the Australian rangelands to manage and earn income from the kangaroos on their land, and move away from sole reliance on non-native stock species (Grigg 1989; Grigg 1995; Ampt and Baumber 2006). Potential benefits include more effective management of total grazing pressure, reducing stocking densities, reduced land degradation, incentives for habitat and vegetation retention and rehabilitation, and diversified income streams for landholders (Grigg 1989; Grigg 1995; Ampt and Baumber 2006). A further benefit of increased reliance on kangaroo production is the trivial greenhouse gas emissions they produce, compared to the very large methane emissions involved in sheep and cattle production (Diesendorf 2007). In spite of almost two decades of calls for increased landholder involvement in the commercial kangaroo industry, they have gained little traction. Today landholders remain almost completely uninvolved in kangaroo management, and kangaroo use generates minimal or nil benefits for habitat conservation among the landholders who manage land. There are multiple reasons why this hasn’t happened, one of them being that little attention has been paid to the question of exactly how landholders could be involved and gain economic benefits.

This report presents the results of the Barrier Ranges Sustainable Wildlife Enterprise Trial (BRSWET) conducted by the FATE program as part of the larger program funded by RIRDC to develop Sustainable Wildlife Industries (SWEs) in the rangelands. The Trial integrates kangaroo management with good land management for the benefit of the rangelands and rangeland communities. To understand the origins of the project it is necessary to have some feel for its context, so we begin with a detailed historical backdrop of the barrier ranges and its kangaroos leading to the Barrier Ranges Sustainable Wildlife Enterprise Trial.

1.2 The Barrier Ranges

The Barrier Ranges area, north of Broken Hill in Western NSW, is a microcosm of much of Australia’s semi-arid rangelands. It has an average rainfall of between 200-300mm per year (of moderate to high variability) and is covered with native vegetation such as bluebush, saltbush, grasslands, and sparse woodlands of Mulga (an Acacia) and other small trees. It is crossed by ephemeral streams vegetated with river red gum (Eucalyptus) and associated species. Geomorphically, it consists of alluvial and rolling plains, lowlands, hills and tablelands interspersed with dune fields and sand plains. Prior to colonial occupation, Wiljakali, Malyankapa and Pandjikali people lived in the area.

Explorer Charles Sturt named the Barrier Ranges in 1841 and pastoralists began settling the area in the 1850s, using the Darling River as their main trade route. The vast shrublands were quickly stocked with sheep over the following decades. The devastating droughts in the 1890s resulted in massive stock losses and land degradation. The area is now under the jurisdiction of the NSW Department of Lands, having been divided into Western Lands Leases overseen by the Western Lands Commissioner.

During the 20th Century, pastoralism continued with a proliferation of bores sunk to extend the areas available to grazing. Crises such as rabbits and droughts occurred, leading to massive soil loss and local extinctions of many species, including small native mammals. This has impacted on the structure and function of the remaining native vegetation and the subsequent productivity of the land for grazing purposes. For the past eight to ten years the area has remained in the grip of drought with only minor reprieves.
Presently, the Barrier Ranges is settled by grazier families on Western Lands Leases who are under considerable pressure on multiple fronts. Traditional enterprises (such as wool growing) are returning marginal incomes. Some landholders are acquiring additional leases to achieve an economically viable area, taking on large areas of land. This leads to extreme labour demands, so traditional enterprises such as wool growing become less feasible, as infrastructure is difficult to maintain under these circumstances with fencing and stock water requiring ongoing attention. Pressure to generate off-farm income is driving some families to separate during the week with partners living in the nearest large town to work and be close to schools. Many families have off-farm investments in property and shares and include ancillary businesses. In some cases this means that generating income from the pastoral enterprise is no longer critical.

In addition to wool growing, there is interest in meat sheep breeds and many landholders make a significant income from trapping and selling feral goats. For some families, these enterprises have displaced wool growing because of the increased global demand for sheep and goat meat and because the labour demands are much less than for wool growing.

Since 1990 federal money has been available under a number of schemes for landholders to carry out conservation-orientated works on their properties. These include the historic decade of Landcare (1990-2000) the associated Natural Heritage Trust program, regionalisation and the current ‘Caring for our Country’ initiative. Regionalisation of natural resource management led to the establishment of the Western Catchment Management Authority (WCMA), a key intermediary between individual farmers and federal funding. Like all regional bodies, the WCMA has developed catchment targets for land and vegetation (ground cover greater than or equal to 40% to prevent soil erosion) and biodiversity (ecological communities of high conservation values adequately protected and 25% of other ecological communities managed for conservation within 25 years).

The State’s *Native Vegetation Act 2003* and Regulations have put conditions on management that restrict landholders’ rights to clear and modify native vegetation. One of the biggest impacts of this in the Barrier Ranges is to require landholders to prepare a Property Vegetation Plan (PVP) before being able to manage the encroachment of invasive native scrub: a contentious issue because while
proliferation of native shrub can be classified as native vegetation under the Native Vegetation Act, landholders generally view it as being over-run by woody weeds. Some landholders are also involved in the NSW State Government’s Enterprise-based Conservation Scheme. This scheme pays them per ha to reduce their stock numbers and/or manage for a minimum ground cover target.

In response to these pressures and to the availability of the federal money, the Barrier Area Rangecare Group (BARG) was established by interested landholders in 2002. It is an active, incorporated Landcare group of landholder families with a wide range of ages, property sizes and backgrounds. Through BARG, they collaborate on weed and feral animal control, grazing management and other aspects of rangeland health. BARG members have been successful in gaining access to Western Catchment Management Authority (CMA) funding for a range of activities including goat trapping, invasive native scrub control and improved stock water management. They are clearly committed to maintaining their pastoral, outback station lifestyle despite the pressures described above. As a result they are keen to develop diversified income streams.

Feral goats on Fowlers Gap Station

1.3 Kangaroos in the rangelands

The vast arid landscape of the Barrier Ranges also supports varying populations of four different species of large kangaroos; Reds, Western Greys, Eastern Greys and Wallaroos. Numbers vary according to the seasons, but these species have been very successful despite the dramatic changes in the landscape since Europeans arrived. Pastoralists traditionally view these kangaroos as pests because, apart from shooting the occasional kangaroo for pet food, they obtain no direct material benefit from them and perceive them as a potential threat to the profitability of their enterprise. During good seasons kangaroo numbers increase, then as the landscape dries they can move large distances seeking feed in the paths of storms and in wash out areas where there is green vegetation. They occasionally descend on properties in large numbers at these times. At other times they are ever present in the landscape. Many landholders are convinced that kangaroos cost them many thousands of dollars through competition with domestic stock and the damage they do to infrastructure.
In Queensland in the 19th century, kangaroos were officially considered vermin and bounties were paid. At the same time their commercial potential was being discovered, with a growing skin trade in the late 1800s and into the 1900s. Kangaroo meat was also used for pet food, and with the collapse of the rabbit industry after the introduction of myxomatosis in the 1950s, it became more valuable. Over the next few decades legislation was introduced into most states to control the harvest. By the 1970s all states had legislation that offered protection to kangaroos as native animals but issued licences to cull kangaroos either for damage mitigation or for commercial use. An industry grew around the cull, supplying skins to tanneries and lean meat to both pet food manufacturers and to a growing market for human consumption overseas and in Australia. Many of the pioneers of the industry are still in business. They have worked hard to develop domestic and export markets for kangaroo meat, promoting it as a healthy alternative to traditional red meats.

**Kangaroos on Fowlers Gap Station**

The Barrier Ranges are in the Tibooburra and Broken Hill commercial kangaroo management zones under the management of the NSW Kangaroo Management Program in the NSW Department of Environment and Climate Change (DECC). The goal of this program is to:

> Maintain viable populations of kangaroos throughout their ranges in accordance with the principles of ecologically sustainable development (Department of Environment and Conservation NSW 2006)

Each year the DECC commissions a population survey which estimates the populations of the 4 commercial species of kangaroo and sets a quota for harvest which is usually about 15% of the estimated population. Landholders can apply for an ‘Occupier’s Licence’ to harm kangaroos on their properties. The licence involves purchasing royalty tags from the Kangaroo Management Program of DECC and specifies a ‘Licensed Trapper’ who will undertake the harvest. The trapper fixes a royalty tag to each harvested kangaroo and offers them for sale to a registered fauna dealer.
Several studies have been done recently about the commercial kangaroo industry (Chapman 2003; Thomsen and Davies 2007) that came to the following shared conclusions:

- It is rare for landholders to derive direct income from kangaroo harvest.
- Landholders perceive that regulatory regimes are a key disincentive to their participation in the industry.
- Despite many landholders regarding kangaroos as a potential resource, they provide access for harvest because they derive indirect benefit due to reduction in kangaroo numbers.

1.4 The Barrier Ranges Sustainable Wildlife Enterprise Trial

The problem at the centre of this project is declining sustainability of pastoralism in the rangelands and the perceived lack of alternative enterprises. Linked to this is public pressure to manage land for enhanced environmental outcomes. FATE is interested in whether landholder returns from kangaroos can simultaneously improve the viability of rangeland enterprises and create incentives to conserve rangeland habitat. Such conservation outcomes may result from diversifying away from sheep (with a commensurate reduction in grazing pressure) and/or by more effective control of kangaroo grazing pressure through the commercial harvest.

FATE first became involved with BARG in March 2005 when the FATE program manager attended a meeting and discussed the issues around kangaroos in the rangelands. The positive response from the meeting stimulated a preliminary funding proposal which was accepted by the Rural Industries Research and Development Corporation (RIRDC) in October 2005.

FATE then assembled a team and attended a BARG meeting in November 2005, at which a core group of ten BARG landholders expressed interest in participating in a trial to learn about better ways of managing kangaroos for multiple benefits. In the meeting it was clear from the landholders that the stimulus for their involvement was the belief that:

- kangaroos made a significant impact on total grazing pressure, especially in dry times when landholders reported influxes of kangaroos onto drought reserve paddocks, flood out areas and in the path of storms where ‘green pick’ was evident
- the existing quota setting and tag allocation system was not flexible enough to respond quickly to influxes of kangaroos
- the existing industry was preventing economic returns to landholders from kangaroos harvested from their property.

A full proposal for the Barrier Ranges Sustainable Wildlife Enterprise Trial was submitted by FATE to RIRDC in January 2006 which was funded from July 2006 until June 2009.
2. Objectives

The major objective of the project was to investigate whether a Sustainable Wildlife Enterprise (SWE) based on kangaroo harvesting can provide incentives to manage rangelands for biodiversity conservation and landscape rehabilitation. In order to achieve this objective, the project aims to:

1. Develop a collaborative kangaroo enterprise that provides returns to landholders.
2. Develop a collaborative approach to kangaroo management across the BARG area.
3. Integrate kangaroo management with other enterprises on the participating properties to achieve improved management of total grazing pressure.
4. Establish and undertake community monitoring of landscape function and kangaroo populations to inform adaptive management.
5. Document the process and develop a model for similar initiatives in other locations.

2.1 Hypotheses

These strategies follow an adaptive management framework by which a model for a collaborative kangaroo enterprise is developed, trialled, monitored and adapted over the three year life of the project. The trial tests the following hypotheses:

1. More flexible licensing arrangements can lead to greater collaboration between landholders.
2. Greater collaboration can lead to economic opportunities for landholders in the kangaroo industry.
3. Greater collaboration can lead to more strategic control over kangaroo grazing pressure.
4. Economic returns from kangaroos can drive incentives for conservation.

The interrelation between these hypotheses is illustrated in Figure 2.1.

Figure 2.1 Hypotheses for the Barrier Ranges Sustainable Wildlife Enterprise Trial

1. More flexible harvesting arrangements can lead to greater collaboration
2. Greater flexibility and collaboration can lead to economic opportunities
3. Greater collaboration can lead to more flexible management of total grazing pressure
4. Economic returns from kangaroos can provide incentives for conservation
5. Improved management for conservation AND economic return can flow from the project
2.2 Desired outcomes of research

1. Improved understanding of the feasibility of collaborative landholder involvement in kangaroo harvesting and its potential benefits for rangeland management.

2. Development of a model for kangaroo harvesting initiatives based on the experience of the BARG members, flexible enough to be adapted to the different economic, social and environmental factors operating in different locations.

3. Increased landholder involvement in kangaroo harvesting across Australia’s rangelands and increased acceptance of sustainable kangaroo harvesting as a viable land-use option.
3. Methodology

This section outlines the methodologies used to guide the project as a whole. Chapters 4-9 all deal with different components of the project and have their own methodologies which relate just to that component. At the conclusion of each of Chapters 4-9 there is a short summary of what that chapter contributes to the whole project.

The research methodology for the overall project is best described as participatory action research (PAR). This involves working with the people whom the research is supposed to benefit with behaviour change as a key outcome. It usually goes through several stages:

- understanding the context;
- engaging stakeholders;
- working with stakeholders to design an intervention;
- implementing the intervention;
- evaluating the intervention;

Ultimate success is measured by continuation of the intervention in some form after the ‘project’ ends.

The management approach used can be described as active and integrative adaptive management which is used to guide the intervention. Adaptive management recognises that in complex situations the solution to problems and the best path to improving problem situations are rarely evident or uncontested at the outset. Often information comes to light through the problem solving process that makes altering the path or even re-defining the problem necessary. Adaptive management sets out to collect evidence along the way that can inform the process and encourage flexibility in incorporating new knowledge. There are several alternative models (Stankey, clark et al. 2005):

- Incremental – reactive, muddling through, no purposeful direction.
- Passive – sequential learning, frame a single best approach along a linear path.
- **Active** – designed to provide feedback on which approach is best, parallel learning.
- Participation-limited – focuses on the interface between scientists and managers, leaving out the public - expert-driven by command and control.
- **Integrative** – public engaging as peers building working relationships with managers and scientists, social learning.

In this project we endeavoured to use active and integrative adaptive management which is strongly compatible with participatory action research.
3.1 Reasons for the chosen methodology and adaptive management approach

We had three key reasons for using PAR and adaptive management in this project:

1. The situation was highly complex: the problem is complex, with various and conflicting values, multiple objectives, and entrenched histories.

2. There was structural support for the use of adaptive management: The RIRDC Program under which we sought funding suggested that adaptive management was a key strategy in developing sustainable wildlife enterprises and the Kangaroo Management Plan also had provision for adaptive management trials. As researchers we had strong motivation to drive the process and had secure support from UNSW for our work.

3. There was good potential for participation: FATE could see clear applicability for adaptive management cycles to be built into the research process. Despite our open admission that we were not sure how far the project would go, we had a willing group of landholders committed enough to sign up to the project and to join a Steering Committee. Several harvesters volunteered to join the Steering Committee out of their loyalty to the landholders involved and to have a stake in the process. We knew that this support was dependent on progress, and that the research team would be doing most of the work. However it was imperative to gain support for each step and provide feedback and opportunities to influence the directions that we took.

The following points summarise key components in the adaptive management cycle that we needed to include in the process when appropriate:

Learn

- The group needed critical information and understanding of key components of the complex systems relevant to kangaroo management.
- We needed to canvass the views and suggestions of the group.
- We needed to negotiate key steps with other parties on behalf of the group without knowing in advance what the outcome would be.
- We needed to provide continual informal access to us to allow opportunities for dialogue.
- We needed to identify gaps in knowledge as they became apparent and seek to fill the gaps.

Describe

- We needed to be able to describe and model key parts of the process and provide opportunities for the group to contribute to the models.
- We needed to provide experts to build and conduct economic and business models for possible strategies.

Predict

- In deciding on the next steps we needed the benefit of the group’s and outsider’s experience on how our actions would impact others.
- We needed to develop scenarios for an outcome that satisfied the group’s motivation and diminished their scepticism.
• We clearly needed action before we could know the next steps. This was particularly true when it came to testing a different regulatory framework.

• The FATE Program was committed to participatory action research.

### 3.2 Collecting evidence and managing the trial

Each of the trial hypotheses outlined in Chapter 2 (Figure 2.1) required learning, describing, predicting and doing stages with specific feedback before proceeding to the next stage. We adopted a multiple lines and levels of evidence (MLLE) approach. A summary of the types of evidence we have used for each hypothesis is summarised in Table 3.1 below. Strategies we employed to manage the trial are summarised in Table 3.2 below.

**Table 3.1 Trial hypotheses and description of evidence.**

<table>
<thead>
<tr>
<th>Trial hypothesis</th>
<th>Description of evidence</th>
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<tbody>
<tr>
<td>More flexible harvesting arrangements can lead to greater collaboration</td>
<td>• Meeting agendas and minutes</td>
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<td></td>
<td>• Trial progress as documented in newsletters</td>
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<td></td>
<td>• Documented feedback from participants</td>
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<td></td>
<td>• Western Division Landholder Survey</td>
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<tr>
<td>Greater flexibility and collaboration can lead to economic opportunities.</td>
<td>• Documented discussion of economic opportunities.</td>
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<td></td>
<td>• Development of an enterprise plan.</td>
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<td></td>
<td>• Development of a business plan.</td>
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<td></td>
<td>• Establishment of business entity.</td>
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<td></td>
<td>• Success of business entity.</td>
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<td></td>
<td>• Documented feedback from participants</td>
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<tr>
<td></td>
<td>• Adoption of business model by other groups.</td>
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<tr>
<td>Greater collaboration can lead to more flexible management of total grazing pressure.</td>
<td>• Western Division Landholder Survey.</td>
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<tr>
<td></td>
<td>• Document the process of tag distribution.</td>
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<td></td>
<td>• Describe any influx events and how the trial responded</td>
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<tr>
<td></td>
<td>• Contrast trial response with status quo or previous influx events.</td>
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<td></td>
<td>• Documented feedback from participants</td>
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<tr>
<td>Economic returns from kangaroos can provide incentives for conservation.</td>
<td>• Success of business entity.</td>
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<td></td>
<td>• Documented feedback from participants</td>
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<td></td>
<td>• Impact of trial on BARG and other landholders.</td>
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<td></td>
<td>• Date from monitoring using Landscape Function Analysis</td>
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<tr>
<td>Improved management for conservation AND economic return can flow from the project.</td>
<td>• Adoption of business model by other groups.</td>
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<td></td>
<td>• Document examples of collaborative kangaroo enterprise being successfully incorporated into sustainable management</td>
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<td>Key Strategy</td>
<td>Key events/ dates/ frequency</td>
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<td>-------------------------------------------------</td>
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<tr>
<td>Employ locally-based Research Assistant</td>
<td>Half-time from July 2006 until June 2009</td>
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<tr>
<td>Steering Committee</td>
<td>Established Oct 06, met 14 times either face-to-face or teleconference</td>
</tr>
<tr>
<td>Regular newsletters</td>
<td>23 produced between Sept 2006 and June 2009</td>
</tr>
<tr>
<td>Attendance at BARG meetings</td>
<td>8 meetings between March 2005 and June 2009</td>
</tr>
<tr>
<td>Involvement of Harvesters</td>
<td>Initial Shooters’ meeting August 2006, Steering Committee membership, General Licence participation.</td>
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<td>Involvement of Processors</td>
<td>Various formal and informal contacts.</td>
</tr>
<tr>
<td>Involvement of regulators</td>
<td>Ongoing from July 2005 until June 2009 and beyond</td>
</tr>
<tr>
<td>Linkages with other landholder groups</td>
<td>Various formal and informal contacts</td>
</tr>
<tr>
<td>Broken Hill Workshop</td>
<td>Feb 2008, 50 participants</td>
</tr>
</tbody>
</table>
| Use of consultants and other outside expertise  | David Tongway, Richard Stayner, Peter van Herk, Margaret Chapman, Catherine Allan, Steve McLeod and Tony Pople | Landscape Function Analysis  
Economic modelling  
Business Case Development  
Landholder Survey  
Adaptive Management  
Kangaroo population survey |
3.3 Progress of the trial

We were committed from the outset to ensuring that the trial itself should be focused on processes that enable the stakeholders to adaptively manage their resources for multiple benefits. We were also committed to use the adaptive management provision in the Kangaroo Management Plan (KMP). It was clear early in the project that there was considerable uncertainty about the likely outcomes of different stages of the process and how they would impact on future directions. As a result, there was no point in being linear and prescriptive in planning the project. As a consequence, we made a deliberate decision that our project management would be adaptive. To keep us on track, we involved a recognised adaptive management expert practitioner (Catherine Allan) to oversee the progress of the trial.

What followed was a serious commitment by the FATE team to adaptively manage the group of participating landholders (and kangaroo harvesters) through a series of stages. The FATE team wanted to understand how landholders could add value to kangaroo industry, why landholders weren’t involved, and what it would take to get them involved. Learning was involved by all parties, and at the outset it was unclear how different players would react as new information came to light.

In this process FATE played the role of agent provocateur, stimulating dialogue by bringing people together regularly and joining BARG events –we kept turning up. We knew that to shift the system, thinking had to move beyond the status quo and this wouldn’t happen quickly or without sustained and regular effort. In the spirit of researching with people, we were very open about the approach we were taking and were clear about not being certain at the outset about where the project would go. We were emphatic about the need for us to gain feedback from them, and they expressed a willingness to embark on the journey and keep up with what happened.

Our approach meant that we were working simultaneously on several aspects of the study in parallel. Initially, the most dominant aspect was the adaptive management trial of the General Licence which, due to protracted delays, impacted on other aspects of the project. As we gathered information on other aspects, changes to the original plan were necessary. Table 3.3 shows where our initial plans were altered as a result.

A critical component was to employ a local research officer who was the face of the project and the voice at the other end of the phone, providing an accessible avenue for expressing views about the project that might not have come out at more formal meetings. The research officer was critical in managing stakeholder expectations, reinforcing our chosen strategies and directions and following people up about commitments. We produced a regular newsletter and maintained good group management practice – agendas, minutes, housekeeping.
Table 3.3  GANTT chart from initial RIRDC proposal February 2006. Original timelines hatched or marked with an asterisk (MS = Milestone).

Updates as of 1 June 2009 in grey.

<table>
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<td>Jun - Jul</td>
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<td>Stage 1</td>
<td>Initial planning workshop involving key stakeholders.</td>
<td>*</td>
<td>MS</td>
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<tr>
<td></td>
<td>Development of collaborative harvesting trial for 2007 based on outcomes of workshop. – delayed by negotiations with DECC</td>
<td>*</td>
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<td></td>
<td>Establish business structure for collaborative enterprise and position in supply chain. – development of co-op model and business case</td>
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<td></td>
<td>Train landholders in LFA and kangaroo monitoring, establish monitoring sites and commence monitoring. – took longer than expected due to difficulties with weather and getting landholders together</td>
<td>*</td>
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<tr>
<td>Stage 2</td>
<td>Implement adaptive management harvesting trial under approved 2007 quota. – commenced over 1 year later than planned</td>
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<td></td>
<td>Mid-year review of 2007 adaptive management trial, involving stakeholder workshop. – major review workshop held in Feb 08</td>
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Table 3.3 – continued  GANTT chart from initial RIRDC proposal February 2006. Original timelines hatched or marked with an asterisk (MS = Milestone).

Updates as of 1 June 2009 in grey.

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<td>Jul - Sep</td>
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<td>Apr - Jun</td>
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<tr>
<td><strong>Stage 3</strong></td>
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<td>MS</td>
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<tr>
<td>Develop revised collaborative harvesting trial for 2008 based on outcomes of review workshop.</td>
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<tr>
<td>Implement revised adaptive management trial under approved 2008 quota. – started in May 08 rather than January</td>
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<tr>
<td>Mid-year review of 2008 adaptive management trial involving stakeholder workshop.</td>
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<tr>
<td>Depending on outcome of review workshop, develop revised collaborative harvesting trial for 2009.</td>
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<td>Apply for further funding (also dependent on review).</td>
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<tr>
<td><strong>Stage 4</strong></td>
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<tr>
<td>Commence 2009 collaborative harvest if desired.</td>
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<tr>
<td>Evaluation of 2007 and 2008 trials, involving workshop. – interviews with participants instead of workshop, due to difficulties getting people together</td>
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<tr>
<td>Preparation of final report and submission to RIRDC.</td>
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<tr>
<td>Presentations to conferences, field days, landholders, NRM bodies and industry groups.</td>
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</table>
3.4 Components of the trial

As kangaroos were the key wildlife enterprise, it was essential that we develop and share an understanding of the past harvest and population dynamics of kangaroos in the area, as well as to record thoroughly the impact of the changes to kangaroo harvest management as they were implemented. This is the focus of Chapter 4. A key conclusion of this work was that it was critical for landholders to act collectively to generate any returns or to influence kangaroo harvest on their properties. This led us to work towards the changes in the regulatory regime that are the focus of Chapter 5, in particular the collaborative General Licences that ran from May 2008 to June 2009.

Throughout the first year, the researchers elucidated a vision for the system managed for higher standing biomass, higher biodiversity, increased groundcover, improved landscape function, all of which are consistent with good natural resource management, and for which management of total grazing pressure is essential. Overall it was aiming towards a strategy for generating income from a landscape managed for resilience. To bring landholders into this process in a practical way, we undertook to train as many landholders as possible in Landscape Function Analysis (Tongway and Hindley 2004) and through that training to encourage them to incorporate landscape function information into the decision-making process. This component is dealt with in Chapter 6.

In order to understand how the BARG related to the broader population of Western Division, South Australian and Queensland landholders with regard to kangaroo management, we undertook a survey which is the focus of Chapter 7. As one of our key objectives was to determine whether, following the completion of the project, the landholder and harvester group could continue the work, we contracted economic modellers and a business consultant to undertake economic modelling of likely enterprise scenarios and to develop a business case for a potential SWE, which we called BaRaRoo (Barrier Ranges Roo). In a separate SWE project, a model for a co-operative for kangaroo harvest management (Cooney 2008) was developed. This is dealt with in Chapter 8.

In parallel, FATE embarked on a project to better understand consumers’ beliefs, attitudes and behaviours around the choice and consumption of kangaroo meat. It was through this project that FATE directly engaged processors. The report produced from this project (Ampt and Owen 2008) became a key component of the thinking in 2008 at the Broken Hill Workshop organised as part of the trial. This aspect is the focus of Chapter 9.

Chapters 4 to 9 each have their own methodologies and a brief summary of the contribution that the chapter contributes to the whole project. These are picked up in the implications and recommendations Chapters 10 and 11.
4. Kangaroo harvest and population data

4.1 Objectives

Past harvest and population data for the Barrier Ranges area was analysed and compared to data for the BRSWET group licence harvest in 2008/09 according to the following objectives:

- identify spatial and temporal harvest trends across the trial area;
- better understand what factors are most significant in influencing harvest patterns (e.g. kangaroo populations, property accessibility, shooter dynamics);
- determine if the group harvest trial (2008/09) had a discernible impact on harvest patterns;
- identify harvest management options that could improve harvest efficiency or reduce harvest uncertainty across the trial area.

4.2 Methods

Past kangaroo harvest statistics for the period 2001-2007 were compiled for the 20 properties (16 landholders) participating in the Barrier Ranges Sustainable Wildlife Enterprise Trial (BRSWET). These statistics covered the three main harvested species: the Red Kangaroo (*Macropus rufus*), Eastern Grey Kangaroo (*M. giganteus*) and Western Grey Kangaroo (*M. fuliginosus*). Harvest data was supplied by the NSW Department of Environment and Climate Change (DECC) from its database of Occupier’s Licences (issued to landholders) and harvest returns (submitted by shooters). The 20 properties included one non-harvest refuge, UNSW’s Fowlers Gap Arid Zone Research Station.

The 2001-2007 kangaroo harvest data was analysed to determine spatial and temporal patterns. Mean annual harvest and variation was calculated for each property. A number of factors were analysed to determine correlations with harvest size and temporal variability, including rainfall, shooter dynamics, kangaroo species breakdown and distance to major geographic features such as towns, roads and national parks. Kangaroo harvest data was also compiled for the twelve months of the BRSWET General Licence period (1 May 2008-30 April 2009; further details in Chapter 5) and compared with the 2001-2007 harvest data.

Kangaroo population data was not available at the property scale for direct comparison with harvest statistics. However, data at the regional (Kangaroo Management Zone) scale was available for the years 2001-2008 from DECC’s annual aerial surveys and data at the BRSWET group scale was obtained in September 2008 through a separate fixed-wing aerial survey funded by RIRDC (Pople, McLeod et al. 2009). DECC’s surveys are undertaken in June/July each year using methods outlined by Payne (2008b). The September 2008 survey was approximately five times more spatially intensive than the DECC surveys but employed the same standard methodology, such as 100m wide transects, standard flying speed and height and correction factors from Cairns and Gilroy (2001) to account for kangaroos missed by observers. Due to the differing seasons between the two surveys, different temperature correction factors from Cairns and Gilroy (2001) were used.

Figure 4.1 shows the BRWSET properties used for harvest data analysis, along with survey transects flown in the September 2008 survey and in DECC’s annual surveys.
4.3 Results

4.3.1 Analysis of pre-trial harvest data 2001-2007

Figure 4.2 shows 2001-07 harvest totals for the 20 BRSWET properties, ranging from 23 211 (in 2002) down to 7312 (in 2007). The 2001-07 average was 13 012 red and grey kangaroos per year. The temporal variability pattern across the BRSWET properties was broadly similar to that for the Broken Hill and Tibooburra KMZs combined (DECC 2009). A small number of wallaroos harvested in 2001 and 2002 are excluded.
Overall, for 2001-07, the 20 BRWSET properties made up 6.17% of the total harvest from the two KMZs, slightly more than the proportion of the total land area of the KMZs that they accounted for (6.08%). Red kangaroos made up 83% of the harvest across the BRWSET properties (66-94% on individual properties). In comparison, reds made up 70% of the BH KMZ harvest and 88% of the Tibooburra KMZ harvest for 2001-07.

Figure 4.3 shows rainfall at Broken Hill and red and grey kangaroo populations across the Broken Hill and Tibooburra KMZs for comparison with the 2001-07 harvest data.

While rangeland kangaroo populations are broadly determined by rainfall, and harvest levels are broadly determined by populations (Olsen and Low 2006), a number of other factors play a role (Jonzén, Pople et al. 2005). Time lags are to be expected, with McCarthy (1996) finding that regional-scale red kangaroo population changes in South Australia were most closely related to the previous year’s rainfall. This lag effect is evident in the 2001-07 data, with the big population fall in 2003 coming in response to low rainfall levels in the preceding two years (rather than the rainfall in 2003 itself which was actually above average). Harvest levels can also show lag effects due to kangaroos congregating in drought and being easier to harvest, thus pushing up harvest levels while populations are in decline. This is reflected in the fact that regional harvest levels actually increased from 2001 to 2002, and again from 2005 to 2006, despite population and rainfall being in decline.
As much as harvest levels fluctuated across the group as a whole, analysis shows that variability was considerably higher for individual properties, with some recording coefficients of variation (CV) in annual harvest as high as 200% (Figure 4.4).

**Figure 4.4 Coefficient of variation (CV) for the annual harvest on each of the 19 harvested properties 2001-2007 (UNSW’s Fowlers Gap Arid Zone Research Station is excluded as it had no harvest). Columns at the right show CV for the 19 properties’ combined annual harvests (TRIAL PROPS), CV for the Tibooburra KMZ’s annual harvests (TIB KMZ), CV for the Broken Hill KMZ’s annual harvests (BH KMZ) and CV for the annual harvests across both KMZs (TIB+BH KMZs).**

Managing such high levels of temporal harvest variability creates risks for landholders, both in terms of their ability to control kangaroo grazing pressure and in terms of making investments in a kangaroo enterprise. As seen in Figure 4.4, the level of harvest variability was lower for the group as a whole than it was for the majority of individual properties. This indicates that most landholders (17 out of 19) could reduce their exposure to the risks of harvest variability by acting as a group. Notably, analysis did not show that simply adding more and more properties would continue to reduce variability, as the CV was slightly higher at the scale of a Kangaroo Management Zone (KMZ) than it was for just the 19 properties combined (i.e. ~60 000–90 000 km² versus ~9000 km²).

The spatial distribution of the kangaroo harvest over the period 2001-2007 was also highly variable (Figure 4.5). Harvest density across the properties’ combined area of 8850 km² averaged 1.47 kangaroos/km²/year, but for individual properties, the average harvest density ranged from a low of 0.11 kangaroos/km²/year (excluding Fowlers Gap which averaged zero) to a high of 2.94 kangaroos/km²/year.
A zone of high harvest density (>2 kangaroos/km²/year) is found in the centre-north of the trial area, along the Silver City Highway. However, notable outliers also occur in the southeast and southwest of the group. A zone of high harvest consistency (CV<50%) is concentrated in the central area. Figure 4.6 shows that there is a broad correlation ($R^2=0.5$) between harvest density and harvest consistency on individual properties (i.e. those with higher harvests tended to also have lower variability).
Figure 4.6 Harvest density for each of the 19 harvested properties (average over 2001-2007) versus temporal harvest variability for each property (CV for each property’s harvest 2001-2007).

As the only population data available for 2001-2007 is at the regional scale, property-scale comparisons between harvest and population were not possible. However, by dividing the properties into three regional subgroups (based on proximity to Broken Hill, Tibooburra or White Cliffs), certain factors were identified that may be influential on harvest levels. Within each regional subgroup, property-scale harvest density (kangaroos harvested/km²/year) and harvest variability (CV of annual harvest) were plotted against several factors (Table 4.1).

Table 4.1 Factors affecting local kangaroo populations and shooter behaviour

<table>
<thead>
<tr>
<th>Factors affecting local kangaroo populations</th>
<th>Factors affecting shooter behaviour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance of property (straight-line) from nearest national park</td>
<td>Distance of property by road from nearest town (Broken Hill, Tibooburra or White Cliffs)</td>
</tr>
<tr>
<td>Distance of property (straight-line) from dog fence (NSW/SA border)</td>
<td>Distance of property by road from the Silver City Highway (major regional road)</td>
</tr>
<tr>
<td>Percentage of red kangaroos in the property’s total harvest</td>
<td>Percentage of property’s harvest taken by primary shooter</td>
</tr>
</tbody>
</table>

Figure 4.7 highlights the most significant correlations for each subgroup. The Broken Hill subgroup consists of nine properties, Tibooburra consists of seven and White Cliffs of four.
The three subgroups had broadly similar rainfall and harvest patterns with some minor differences. The Tibooburra subgroup showed the biggest drop in harvest levels from 2002 to 2003, but was also the quickest to rebound to harvest growth (in 2004). The White Cliffs subgroup had achieved the greatest harvest rebound by 2006, despite missing out on the 2005 rainfall bump recorded at Broken Hill and Tibooburra.

Distances from the nearest town, highway, national park and the dog fence showed different relationships with property-scale harvest size and variability in each subgroup. Around Broken Hill, harvest levels were positively correlated with distance from the nearest national park (Mutawintji), which clashes somewhat with anecdotal evidence presented by some trial members that being near national parks increases kangaroo grazing levels (and hence the need to harvest). However, for the Tibooburra subgroup, properties closer to Sturt National Park did tend to have higher harvest
variability, which supports anecdotal evidence of red kangaroos migrating out of the park in a highly variable manner during drought years.

Distance from the dog fence running along the NSW/SA border was one of the more significant factors around Broken Hill (higher harvest closer to the fence) and White Cliffs (more stable harvest closer to the fence). At White Cliffs, this result is difficult to interpret due to the greater distances from the fence (all properties over 100 km) and the small sample size (only four properties). Around Broken Hill, it may be evidence of a ‘funnelling’ effect of kangaroos moving along the fenceline (anecdotally reported by members of the trial group).

Around White Cliffs, properties further from town tended to show larger and more stable harvests. For the Tibooburra subgroup, properties also showed greater harvest stability the further they were from town. While these results need to be interpreted with caution given the small sample sizes, it would not appear that being more distant from the nearest town posed any major barriers to attracting and retaining a stable shooter during this period. Around Tibooburra, distance from the Silver City Highway was related to lower harvest levels. However, this could be due to either shooter factors (e.g. access difficulties) or kangaroo population factors (e.g. areas away from the highway may be more rugged and/or less productive). The dominance of a property’s primary shooter (i.e. % of harvest taken by them) was not a good predictor of either harvest size or variability in any of the subgroups over the 2001-07 period.

When looking at all properties together, the proportion of red kangaroos in the harvest showed the strongest correlations with both harvest size and harvest variability of any of the factors explored. Overall, properties with a higher proportion of red kangaroos in the harvest tended to have a lower harvest size (R²=0.12) and greater harvest variability (R²=0.16). This effect was most significant for the Broken Hill subgroup. The lower harvest size may be related to the fact that red kangaroos are more dominant in the north of the area (i.e. in the Tibooburra KMZ) and this area saw a sharper decline than the southern area (i.e. Broken Hill KMZ) in both kangaroo populations and harvest levels between 2001 and 2007 (Payne 2008a). The relationship between a higher proportion of red kangaroos and greater overall harvest variability may be due to the fact that red kangaroos migrate further and aggregate more during droughts (Pople, Phinn et al. 2007).

4.3.2 Data analysis for trial year

For the trial year (1 May 2008-30 April 2009), the total harvest across the participating properties was 9485 kangaroos. This was relatively low compared to the 2001-2007 harvest average of 13 012 but was higher than the 2007 harvest of 7312. Red kangaroos made up 86% of the harvest, slightly higher than the 83% they made up from 2001 to 2007.

As shown in Figure 4.8, the harvest density for the trial properties during the trial year (1.07 kangaroos harvested/km²/year) was slightly higher than harvest density recorded for 2008/09 across the wider Broken Hill and Tibooburra KMZs (1.01 kangaroos harvested/km²/year). Furthermore, the trial area showed a trend of increasing harvest density from 2007 to 2008/09 while the broader region showed a declining trend.
The total group harvest was highly variable across the 12-month trial period, peaking at 1685 kangaroos/month in July 2008 and dropping to a low of zero in January 2009 (Figure 4.9). The zero figure for January 2009 was due there being a one-month gap between General Licences at that time (March 2009 had the lowest harvest while a General Licence was in place with 57 kangaroos). The CV for monthly harvest across the total group was 82%, with variability higher at the subgroup scale (Broken Hill subgroup CV 114%, Tibooburra 179% and White Cliffs 136%) and at the property scale (several properties had a CV over 200%).

As with the 2001-07 annual harvest data there was a broad correlation between high harvest and high consistency (i.e. low variability) amongst individual properties during the 2008/09 trial (Figure 4.10).

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Figure 4.9 Monthly harvest levels across the trial group May 08 – April 09.

Figure 4.10 Harvest density versus CV of monthly harvest for each trial property 2008/09. CVs could only be calculated for 16 properties (as others recorded less than two harvest months).

There was a pronounced drop in harvest levels during the hotter months (November-March). Anecdotal evidence from trial participants suggests that this was caused by a combination of factors affecting shooter effort and success, including difficulty finding kangaroos, longer days (shorter nights for harvesting), holidays for harvesters/landholders and processor shutdowns. The zero harvest in January 2009 occurred due to a lapse between group licences and practical difficulties getting the next licence in place during the holiday season (interest in harvesting was low at this time regardless).

Rainfall and harvest showed a mixed relationship throughout the trial year. Overall, there was a weak negative correlation between monthly rainfall and monthly harvest levels in each subgroup (Figure 4.11). This appears to be mainly due to the impact of periods of high rainfall (>20mm/month) depressing harvest levels due to difficulties in getting access to harvest areas (anecdotally reported by harvesters). At lower monthly rainfall levels, the relationship between rainfall and harvest disappears.
It is also notable that these high rainfall events were often much more pronounced in some regions than others (e.g. the June 2008 event at Broken Hill and the November 2008 event at White Cliffs).

**Figure 4.11 Harvest v rainfall for each month of the trial within the Broken Hill, Tibooburra and White Cliffs subgroups.**

There were also no discernible patterns between rainfall and harvest at the regional scale over the full trial year (May 2008-April 2009). In the Tibooburra subgroup, rainfall for the trial year was down 20 mm on the 2001-07 average and harvests were lower than the 2001-07 average by 48%. In the Broken Hill subgroup, harvests were also down (46% below 2001-07 average), but rainfall was actually 40mm higher than the 2001-07 average. In White Cliffs, rainfall was on par (within 3mm of 2001-07 average) and so was the harvest (within 3% of 2001-07 average).

Figure 4.12 highlights the properties with the biggest changes in the trial year compared to the 2001-07 period (more than 50% above or below their 2001-07 average). There are clusters of properties in the centre and the north of the group which recorded harvests well below their 2001-07 average, while the properties recording big increases were scattered.
The population survey undertaken across the trial area in September 2008 produced a total red and grey kangaroo population density estimate of 11.01 kangaroos/km² (Table 4.2). If this density is assumed to apply to the entire 8,850 km² of the trial area, the total 2008 population of red and grey kangaroos would be 97,473 and the trial year harvest of 9,485 would represent 9.7% of this population. The harvest percentage for red kangaroos would be 9.3% of the population (well below the 17% figure used by DECC to set annual red kangaroo harvest quotas for each KMZ) and for greys it would be 14.4% (close to the 15% figure used by DECC to set annual grey kangaroo harvest quotas for each KMZ).2

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2 Eastern and western grey kangaroos are combined for the purposes of this analysis as they cannot be distinguished from the air.
Table 4.2  Estimated red and grey kangaroo population density across trial area from September 2008 survey, with 2008 DECC estimates for each KMZ for comparison. Sep08 data based on 100m wide transects, using bioregional and temperature correction factors from Cairns and Gilroy (2001). Standard errors include measurement error and bioregional correction factor error.

<table>
<thead>
<tr>
<th></th>
<th>Sep08 Density Estimate +/- standard error (/km²)</th>
<th>Population Estimate for 8,850km² Trial Area</th>
<th>Harvest rate for 2008/09 (Harvest/Pop’n)</th>
<th>DECC Density Estimate for BH KMZ, 2008 (/km²)</th>
<th>DECC Density Estimate for TIB KMZ, 2008 (/km²)</th>
<th>DECC 08 Estimate Across BH+TIB KMZs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reds</td>
<td>10.00 ± 3.90</td>
<td>88,532 ± 34,527</td>
<td>9.3%</td>
<td>13.10 ± 1.44</td>
<td>11.06 ± 1.25</td>
<td>12.33 ± 1.91</td>
</tr>
<tr>
<td>Greys</td>
<td>1.01 ± 0.44</td>
<td>8,942 ± 3895</td>
<td>14.4%</td>
<td>4.84 ± 0.74</td>
<td>1.70 ± 0.68</td>
<td>3.65 ± 1.01</td>
</tr>
<tr>
<td>Total</td>
<td>11.01 ± 3.92</td>
<td>97,473 ± 34,746</td>
<td>9.7%</td>
<td>17.94 ± 1.62</td>
<td>12.75 ± 1.43</td>
<td>15.99 ± 2.16</td>
</tr>
</tbody>
</table>

The combined density figure for red and grey kangaroos obtained in the September 2008 survey is 31% lower than that estimated by DECC for the combined Broken Hill and Tibooburra KMZs in June/July 2008. Excluding the possibility that kangaroo populations changed substantially between June and September, this appears to indicate that the trial area has substantially lower kangaroo densities than the overall KMZs in which it is found. This result is somewhat surprising given that the trial group has consistently shown a higher harvest rate (in terms of kangaroos harvested per km²) than the combined KMZs and a broad correlation is generally found between kangaroo populations and harvest levels across the Australian rangelands (Olsen and Low 2006). However, a number of other factors need to taken into account, such as the level of error in the surveys, consideration of harvest refuges and factors affecting harvest effort and success.

Firstly, when the survey errors indicated in Table 4.2 are taken in account, DECC’s KMZ population densities and those of the BRWSWET area survey are not significantly different from one another. Secondly, the harvest statistics that suggest the BRWSWET area has a higher harvest rate than the broader KMZs (Figure 4.8) may be somewhat misleading. 96% of the BRWSWET study area is available for harvest (Fowlers Gap being the other 4%), which is a substantially higher proportion than for the broader KMZs. Overall, around 5% of the area of the Tibooburra and Broken Hill KMZs is National Park/Reserve and landholder survey results (see Chapter 7) indicate that around 10% of properties may also be harvest refuges where commercial harvesting of kangaroos does not occur. Thus, the average harvest density across the KMZs will be dragged down by these non-harvest areas meaning that, even if population densities were the same between the KMZs and the BRWSWET study area, a lower harvest density would be expected to appear in the KMZ data. There are also a number of possible reasons why the BRWSWET properties might harvest at higher-than-average levels even if they do have lower-than-average population densities. These reasons include the properties’ proximity to the Silver City Highway (access for shooters and chiller collectors) and to the dog fence (funnelling effect discussed in relation to Figure 4.7).

One interesting aspect of the harvest during the year of the general licence was that one property had its highest ever harvest – more than any other property during the year and higher than any yearly harvest on any of the participating properties for the past seven years. After consultation with the landholder and harvester on that property, it was clear that it was the biggest difference was that the harvester was living on the property for months at a time so the number of harvest days was greater than ever before. According to the landholder, there might have been slightly more kangaroos than in previous years. It is reasonable to conclude from this that greater harvest in this case was due to increased harvest intensity, and thus that harvester availability and effort can be a critical determinant of harvest level.
4.4 Discussion

This data analysis highlights the high levels of temporal variability in the kangaroo harvest in the Barrier Ranges and the critical business risk this poses to landholders. No landholders were actually running a kangaroo enterprise during the analysis period, but such risks pose a clear barrier to investment. This is a point clearly identified by landholders in the trial, who have expressed concerns about investing in or relying upon a kangaroo resource that can very easily disappear or “clear out on you” (ABC TV 2008). However, the analysis also shows that, when working as a group, landholders can substantially reduce the harvest variability business risk to which they are exposed. In many ways, such a risk-mitigation strategy is analogous to the way that kangaroo shooters attempt to secure a wide-ranging harvest ‘territory’ and processors spread their chillers across a large area.³

The 2001-07 data analysis shows that working as a group has the potential to reduce variability in annual harvest levels, while the data from the 2008/09 group trial shows that this also holds true in relation to monthly harvest rates (i.e. CV for monthly harvest was lower at the group scale than the subgroup or property scale). Furthermore, a group of this size would also have a greater capacity to maintain supply in the face of high rainfall events that can depress harvest levels, as these events often affect some parts of a region but not others. Such a group may also have appeal for processors, who could be able to secure access to a larger and more consistent supply of product by entering into cooperative agreements with the landholders and harvesters.

Spatial harvest variability was also high in the data analysed. This has important implications for a collaborative kangaroo enterprise. Properties with consistently high harvest levels are likely to have a much greater stake in any collaborative venture than properties with low harvest levels. These spatial patterns would also impact on the placement of any chillers operated jointly by the group. As shown in Figure 4.13 below, chillers placed at the northern, eastern and south western edges of the central area of high harvest and high consistency would be able to benefit from this area’s consistent supply, as well as providing access for harvesters working on the less consistent properties further from the centre.

Ephemeral creek line after rain, Eastern Barrier Ranges - kangaroos may descend on areas like this in large numbers.

³ Thomsen and Davies (2007) report that shooters in South Australia, to minimise the risk of a poor harvest, often seek exclusive access to more land than they can realistically shoot. Such a strategy minimises risks to the shooter, but at the expense of landholders (unable to deal with high kangaroo numbers), younger shooters (unable to obtain territory) and the industry as a whole (fails to take full available quota).
In the absence of property-scale kangaroo population data, spatial harvest trends could only be partially explained. However, it would appear that factors such as the percentage of red kangaroos in the harvest and proximity to national parks and the dog fence play some role in determining the size and variability of the kangaroo harvest on a property. These factors are expressed differently in different subregions. Distance from town does not appear to be a major barrier to attracting a reliable harvester.

With only one year of group harvesting being undertaken as part of BRSWET, it is difficult to draw definitive conclusions about the effect of the group licence on harvesting activities. However, given that the group harvest in 2008/09 showed an increase on 2007 levels while the overall harvest for the Broken Hill and Tibooburra KMZs showed a decline, it would appear that the group licence was not a barrier to effective harvesting for the landholders and harvesters who participated. It may have had a positive impact. This is discussed further in Chapter 5.

The September 2008 population survey produced a somewhat surprising result, with density estimates for the BRSWET area that were much lower than DECC’s estimates for the broader KMZs. While a number of possible explanations for this outcome have already been discussed, it also highlights an important issue for a group of landholders seeking to collaboratively manage their kangaroo harvest. Group harvest quotas are likely to differ significantly depending on whether they are based on a local estimate of kangaroo populations, past harvest levels or the proportion of the KMZ area that the group makes up. If the September 2008 population estimates were used to set a 2009 group quota for BRSWET, such a quota would be relatively low and the group may find itself coming close to meeting it, even with a harvest that is below past levels (and even if ample quota is still available across the KMZs as a whole). The potential ramifications of each group quota option would need to be considered carefully.
A summary of the key points from the discussion follows:

- The 2001-07 harvest in the BRSWET area followed broad patterns for the Broken Hill and Tibooburra KMZs, with higher harvests in 2001 and 2002 followed by years of lower harvest induced by drought. The BRSWET area showed a slightly above-average harvest level for 2001-07 compared to the broader KMZs.

- The 2008/09 harvest trial year saw an increased harvest in the BRSWET area compared with 2007 levels (although it was still down on the 2001-07 average). This compares with a harvest decrease in the broader KMZs over a similar time period. This is an indication that the trial was not a barrier to effective harvest and may have even increased harvest effectiveness.

- Temporal harvest variability is very high in this region. However, group-scale variability is lower than that which most individual properties are exposed to, providing a strong argument for collaboration in managing a kangaroo enterprise and responding to kangaroo influxes.

- Spatial harvest variability is also very high, with contributing factors potentially including distance from national parks, the dog fence and main roads. Properties with a higher proportion of red kangaroos tended to have lower and more variable harvests for 2001-07. These factors influence the potential placement of chillers and division of income from any collaborative enterprise.

- Local population monitoring in 2008 suggests that the area has a lower-than-average population density compared to the Broken Hill and Tibooburra KMZs overall, despite its slightly higher-than-average harvest rate. Differences in seasonal conditions and spatial extent and large error values make comparisons difficult. More monitoring is required for definitive conclusions. However, this does highlight that harvest quotas based on local monitoring could be more problematic than quotas based on past harvest rates or proportion of KMZ area.
5. Adaptive management trial of General Licence

A key element of the Barrier Ranges Sustainable Wildlife Enterprise Trial (BRSWET) was to undertake an adaptive management experiment involving a special group harvesting licence that could facilitate collaboration. This trial fell under Aim 5 (‘facilitate adaptive management and research’) of the NSW Commercial Kangaroo Harvest Management Plan (Department of Environment and Conservation (NSW) 2006 p28). Following extended negotiations, a final plan for this adaptive management experiment was accepted by DECC and harvesting was undertaken from May 2008 to June 2009 under three collaborative General Licences issued under s120 of the NSW National Parks and Wildlife Act 1974. Harvest data for 1 May 2008-30 April 2009 was available for this report.

5.1 Objectives

The final adaptive management trial plan submitted to DECC identified the following objectives:

1. To test whether more flexible approaches to licensing and use of harvest tags can lead to greater collaboration between neighbouring properties.
2. To test whether greater landholder collaboration across property boundaries can provide a tool for more effective management of total grazing pressure.
3. To test whether more flexible licensing arrangements and greater collaboration between properties can lead to economic returns for landholders by establishing a valued role for them in the kangaroo industry.
4. To test whether economic returns for landholders from kangaroo harvesting can create incentives to manage land for conservation.

Objective 1 is the main focus of this chapter. It is based on the notion that the sharing of harvest tags amongst a number of properties and shooters could offer mutual benefits and lead to greater collaboration.

Objective 2 recognises that kangaroos can cause significant grazing pressure at certain times and in certain locations and that managing these impacts strategically may be improved with cross-property cooperation. Measuring the success of this objective was dependent on the success of the licensing trial, as only once collaboration had occurred could it be assessed for its role in managing grazing pressure. The role of the licensing trial in facilitating such collaboration is covered in this chapter, while other aspects of collaboration are discussed in other chapters, including insights from the analysis of harvest and population data (Chapter 4), collaboration on landscape monitoring using Landscape Function Analysis (Chapter 6) and landholder attitudes toward collaboration (Chapter 7).

Objective 3 is based on a recognition that the current licensing regime gives kangaroo processors (holders of Fauna Dealer’s Licences) the greatest amount of flexibility in generating economic returns and landholders (holders of Occupier’s Licences) the least. Processors can choose where and from whom they wish to purchase kangaroos and shooters (holders of Trapper’s Licences) can choose which properties they will harvest on, giving both capacity to respond to spatial variations in kangaroo populations and harvest levels. Landholders, as demonstrated through the harvest data analysis in Chapter 4, can experience extremely high levels of harvest variability at the property-scale and do not have the option of shifting their geographic location. Cross-property collaboration may provide an option for increasing harvest stability and reducing the business risks resulting from high harvest variability. Other economic benefits could also result from increased bargaining power with processors and more efficient and cost-effective harvest management. Results obtained through the licensing trial are discussed here, while other results are presented in Chapter 8 (economic analyses and business case).
Objective 4 recognises that, in addition to greater control over total grazing pressure, there are other ways in which kangaroo harvesting could potentially lead to improved conservation outcomes. Anecdotal evidence suggests that kangaroo populations often increase when areas are destocked to allow regeneration and, while this is currently a disincentive to remove stock, it could become an incentive if landholders can obtain an economic return from an increased kangaroo harvest. Such returns could lead to increases in the destocking of land, including under formal arrangements such as the Western CMA’s Enterprise-Based Conservation (EBC) scheme, where landholders are paid a stewardship payment to manage part of their land for conservation.

The testing of this objective was largely dependent on the trial group obtaining economic returns from their kangaroo harvest. This was not possible given the short duration of the General Licence harvest trial (12 months) and the harvest conditions during this period. Thus, most results for this objective are theoretical and are covered in Chapter 7 (landholder survey) and Chapter 8 (economic analysis and business case).

5.2 Methods

5.2.1 Development of adaptive management experiment

The major steps involved in negotiating an adaptive management experiment with DECC are outlined in Table 5.1. FATE began the process seeking a period of robust and engaged discussion with DECC before settling on a mutually-agreed plan that sought answers to management questions on behalf of the researchers and the regulators. However, the overall process stretched out to well over two years due to disagreements about legal issues, the applicability of Conservation through Sustainable Use (CSU) to abundant species such as kangaroos and the kinds of scientific data necessary for an adaptive management experiment with such a strong focus on socio-economic issues. These problems were compounded by a lack of detail in the Kangaroo Management Plan (KMP) on requirements for adaptive management experiments, a lack of engagement by DECC with the initial development process and subsequent delays for legal advice and consultation with stakeholders.
### Table 5.1 Negotiations on adaptive management experiment

<table>
<thead>
<tr>
<th>Date</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 2005</td>
<td>FATE discussed with DECC possible adaptive management scenarios for members of the Barrier Area Rangecare Group (BARG).</td>
</tr>
<tr>
<td>September 2005-February 2006</td>
<td>DECC agreed to provide in-kind support for preliminary and full BRSWET proposals submitted to RIRDC</td>
</tr>
<tr>
<td>February 2006</td>
<td>FATE asked DECC about issuing a collective Occupier’s Licence.</td>
</tr>
<tr>
<td>March-May 2006</td>
<td>FATE obtained permission from 25 BARG properties to access their past kangaroo harvest data and requested data from DECC.</td>
</tr>
<tr>
<td>July 2006</td>
<td>BRSWET commenced with RIRDC-funding. FATE met with DECC to discuss possibilities for AM trial and query on group Occupier’s Licence.</td>
</tr>
<tr>
<td>August 2006</td>
<td>FATE submitted draft adaptive management plan to DECC, with supporting legal advice on the issuing of a group Occupier’s Licence.</td>
</tr>
<tr>
<td>August 2006</td>
<td>DECC informed FATE that its legal advice indicated it could not issue a group Occupier’s licence. DECC declined to provide legal advice.</td>
</tr>
<tr>
<td>September 2006</td>
<td>FATE responded, proposing a group General Licence instead.</td>
</tr>
<tr>
<td>October 2006</td>
<td>DECC agreed to explore use of General Licence, but raised concerns about the trial’s scientific methods and ability to ensure compliance.</td>
</tr>
<tr>
<td>February 2007</td>
<td>FATE consulted landholders and shooters and submitted revised plan. FATE presented plan in person to the NSW Kangaroo Management Advisory Committee.</td>
</tr>
<tr>
<td>June 2007</td>
<td>DECC consulted with Kangaroo Management Advisory Committee and informed FATE that they wouldn’t approve the trial due to concerns about methodology, applicability of CSU for kangaroos and lack of stakeholder support (notably from the Pastoralists of West Darling - PAWD).</td>
</tr>
<tr>
<td>July 2007</td>
<td>FATE responded to DECC, raising concerns about DECC’s assessment and providing a revised letter of support from PAWD, who felt their initial response was misunderstood.</td>
</tr>
<tr>
<td>August 2007</td>
<td>UNSW Dean of Science wrote to NSW Minister reiterating concerns.</td>
</tr>
<tr>
<td>October 2007</td>
<td>DECC met with FATE and expressed support for trial.</td>
</tr>
<tr>
<td>November 2007</td>
<td>FATE submitted revised adaptive management trial plan to DECC</td>
</tr>
<tr>
<td>December 2007-March 2008</td>
<td>Logistical details were finalised. FATE finalised list of landholders and shooters. DECC obtained further legal advice.</td>
</tr>
<tr>
<td>April 2008</td>
<td>General Licence application and final adaptive management plan approved by DECC for commencement on 1 May 2008.</td>
</tr>
</tbody>
</table>

### 5.2.2 Group licensing

Under the adaptive management trial, General Licences (GLs) were issued under Section 120 of the *National Parks and Wildlife Act 1974* (NPW Act) to allow the commercial harvesting of kangaroos on 20 properties owned by 16 landholders (15 landholders on GL3). These General Licences covered the periods May-August 2008 (GL 1), September-December 2008 (GL 2) and February-June 2009 (GL 3). Harvest statistics for this report were compiled up to the end of April 2009. The conditions on the General Licences were analogous to those on a Commercial Occupier’s Licence (e.g. compliance with Code of Practice, use of harvest tags, requirement to submit harvest returns), with minor variations in wording to reflect the multiple-property nature of the General Licences. Any trappers wishing to harvest on the properties covered by a General Licence had to be listed prior to its commencement, with a total of 17 trappers participating in the trial (16 in GL1, 17 in GL2, 12 in GL3).
DECC assigned portions of their regional harvest quotas to the BRSWET group for 2008 and 2009. These were based on the proportion of the total area of the Broken Hill and Tibooburra Kangaroo Management Zones (KMZs) that the BRWSET properties made up (6.14%) and the proportion of the harvest year that the General Licence covered (four months initially). This quota-allocation process was designed to have no impact on the regional sustainability of kangaroos, as KMZ harvest levels would not be affected.

The quota requested for the period May-December 2008 was based on the area of the properties compared to the entire Broken Hill and Tibooburra KMZs and was for 15 300 animals, being: 12 750 red kangaroos, 1150 eastern grey kangaroos and 1400 western grey kangaroos. For GL 1, the group initially requested that a total 4-month quota of 6400 red kangaroos, 600 eastern grey kangaroos and 700 western grey kangaroos be ‘pencilled-in’ for the group to provide security in harvest planning. A rough allocation of harvest tags to shooters was agreed to by the BRSWET steering committee for GL 1 based on the past harvest levels on the properties each shooter usually covered. Eight thousand (8000) tags were issued under this initial licence, covering roughly 52% of this quota. Based on returns for the months of May, June and July, 3975 of kangaroos were harvested over this three-month period (3469 reds, 237 eastern greys and 269 western greys).

Based on these harvest figures, the second General Licence requested for a maximum harvest number of 4000 kangaroos to be harmed (3500 reds, 240 eastern greys and 260 western greys) in the period 1 September-31 December 2008.

The ‘pencilled-in’ quota for GL3 was for 6091 red kangaroos and 1592 grey kangaroos (total 7583 animals) to be harmed in the period 1 January to 30 April 2009. When the licence was issued, it was agreed with DECC to be for the period 1 January 2009 to 30 June 2009, as the trial was ending on 30 June 2009. The actual number of tags issued for this 3rd General Licence was 4000 (with an option to purchase more up to the ‘pencilled in’ quota figure). These tags were all issued by mid-June 2009.

However, neither the total quota nor the allocation of tags to shooters was seriously tested under any of the General Licences due to poor harvest conditions in 2008 and 2009.

5.2.3 Issuing of tags and record-keeping

Tags were purchased in bulk by UNSW at the commencement of each licence, and then on-sold to trappers at cost. DECC agreed to allow unused tags to be ‘rolled-over’ from GL1 into GL2 (although not into GL3 as this was a separate harvest year). Only tags which remained in FATE’s pool of unallocated tags could be rolled-over. Tags that had already been distributed to trappers could not be rolled-over and had to be returned to DECC for a refund (which was a special concession as refunds are not usually permitted). Trappers could use their allocated tags on any property listed on the General Licence for which they had permission from the landholder (signing up to the General Licence did not oblige a landholder to allow any trapper onto their property). Tags could not be swapped between trappers and DECC had to be kept informed of who held which tag at all times.

KMP developed a spreadsheet to keep track of which tags had been allocated to each shooter and FATE developed a separate spreadsheet to record payment details (trapper’s name, account details, number of tags purchased and how tags were paid for). Upon purchasing of tags, trappers were issued with a hand-written receipt and paper trapper return forms for them to keep records of where and when tags were used. An invoice from the UNSW finance system was then prepared to enable the money from tag sales to be banked and recouped by the FATE program. This was then sent to the RIRDC-funded FATE Local Research Officer who was based at Western CMA offices in Broken Hill, who passed on this ‘official’ invoice to the trapper.

For General Licences 1 (May-August 08) and 2 (September-December 08), tags were distributed by the FATE Local Research Officer in Broken Hill. However, due to problems arising from the part-time nature of this position, it was decided to contract out the selling of tags to a local business for General Licence 3 (January-April 09). The contractors were ‘Competent Appointment Services’ (CAS), a business services and employment agency that were open normal business hours, providing some certainty about when tags were able to be purchased.
In the initial stages of General Licence 1, KMP staff developed the tag spreadsheet, visited Broken Hill to train the FATE Local Research Officer in its use and worked closely with the Local Research Officer on any teething problems. Some interaction occurred between FATE and KMP once the system was up and running, generally to request data and try to sort out discrepancies between trapper returns and chiller returns. For General Licence 3, the CAS staff received some initial training, a manual and ongoing support from FATE staff in both Broken Hill and Sydney.

The KMP required record-keeping both when tags were issued and by trappers to reconcile tags shot monthly. When tags were issued the data collected was:

- tag numbers
- quota of reds, eastern greys and western greys to be shot.

This data was entered by FATE into the spreadsheet developed by KMP for tracking tags, and was then used by KMP to match with data collected from tagged animals in chillers.

Trappers were required to keep records of:

- which property the tags were used on
- the species, weight and gender of the animals trapped
- the number of the chiller where the animals were deposited.

The data for these returns needed to be filled into the returns each night trapping occurred and kept until the end of the month. At the end of each month, trappers had to complete a return providing information about demographics of animals trapped at each property and chillers shot to. This information had to be submitted on two forms: one by property and again as a ‘group return’. These records were then sent to the FATE research officer for collation and forwarding to the KMP at the end of each month.

‘Trapper books’ were introduced in GL 3 to ease this process. These were bound books, with triplicate copies, that trappers used to record: the date, permit number, trapper licence number, property name; and numbers, weights and demographics of animals shot.

These requirements were essentially a compromise between the desire of the BRSWET participants for more flexibility in the issuing of tags and the requirements of KMP for accountability in the tag-issuing chain. FATE would have initially liked greater flexibility in tag-issuing, including the ability for trappers to swap tags amongst themselves (with paperwork) and roll any unused tags into the next licence period (or alternatively have licences longer than four months at a time). KMP’s priorities were to ensure that they knew who was in possession of particular tags at all times so that they could ensure compliance with the Code of Practice and other licence conditions and trace kangaroo carcasses at processing works back to individual shooters and properties.

5.2.3 Contact with participants before and during the trial

A steering committee was set up in 2007 consisting of four landholders, three shooters, three FATE staff, a Western CMA representative and a representative of the Fowlers Gap research station. FATE remained in close communication with intending and eventual participants in the trial through personal contact with the local Research Officer, newsletters, steering committee meetings and BARG meetings. An agenda and minutes were completed for all meetings and the Research Officer documented all informal contact. In the final stages of the trial the research officer conducted telephone interviews with all available participants which included specific questions about the General Licence trial.

Interviews were conducted by phone during June 2009. Attempts were made to interview all landholder and Harvester participants. Three landholders and three harvesters were interviewed. The interview pro-forma is in Appendix A. In addition, numerous phone calls between landholders,
harvesters and researchers took place during the trial, from which very valuable information was
gathered informally.

5.2.4 Other methods

In addition to the use of a General Licence, the adaptive management plan submitted to DECC
outlined a number of other management actions. These are covered in other chapters of this report,
including Chapter 4 (analysis of harvest data), Chapter 6 (use of LFA), Chapter 7 (landholder survey)
and Chapter 8 (economic analyses).

5.3 Results

5.3.1 Collaborative harvest under General Licences May 2008 - April 2009

As discussed in Chapter 4, the total harvest over the trial harvest period (1 May 2008 - 30 April 2009)
was 9485 kangaroos. This was relatively low compared to the 2001-2007 harvest average of 13 012
but was higher than the 2007 harvest of 7312. As shown in Figure 5.1, the harvest density for the trial
properties during the trial year (1.07 kangaroos harvested/km²/year) was slightly higher than the 2008
harvest density across the wider Broken Hill and Tibooburra KMZs (1.03 kangaroos
harvested/km²/year) within which the trial properties fell. Furthermore, the trial area showed a trend of
increasing harvest density from 2007 to 2008/09 while the broader region showed a declining trend.

Figure 5.1 Harvest density for the 20 trial properties and the broader region (Broken Hill and
Tibooburra KMZs). Comparison for 2008/09 covers slightly different harvest periods.

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4 2008/09 harvest data for the trial group covers the 12-month period 1 May 08 – 30 April 2008. 2008/09 harvest
data for the Broken Hill and Tibooburra KMZs covers the 15-month period 1 January 2008-31 March 2009,
converted to a 12-month average by multiplying by 12/15.
The adaptive management plan submitted to DECC identified one key performance indicator relating to the obtaining of a General Licence, as follows:

<table>
<thead>
<tr>
<th>Performance Indicator</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1.1 Success in obtaining a joint General Licence and the number of landholders choosing to participate.</td>
<td>Three general licences were successfully obtained. Participation level was high, with 15-16 landholders and 12-17 trappers listed on each. Harvest levels for the trial were also high relative to regional levels.</td>
</tr>
</tbody>
</table>

5.3.2 Administration of General Licences and harvest tags

**Tag-issuing**

Trappers generally found it easier to purchase tags on the General Licence trial than for a normal single-property licence, due to tags being available from Broken Hill rather than Dubbo. The part-time availability of tags for GLs 1 and 2 was overcome in GL 3, when CAS was contracted to distribute tags. During the period of the trial there were several changes to the way single property tags were issued so comparison is difficult. The General Licence system compares favourably with tag issue from Dubbo and the tags purchase before the 15th day of each month. It is comparable with the current system which is tag issue from Broken Hill all month. It can take well over a week for this mail to reach the more remote areas of western NSW: another reason why the single-property system makes it difficult to respond to influxes of animals in a timely manner.

The distribution and selling of tags though, was administratively cumbersome, as there was much ‘paperwork’ (both paper and electronic) and many people involved in this process, including trappers, FATE research assistant, FATE project officer, and tag distributors (currently contracted). In future this could be streamlined by simplifying the process and involving less people in the tag distribution process: preferably just one person located in Broken Hill, distributing tags, reconciling all the paperwork and doing the invoices.

The FATE Local Research Officer in Broken Hill was only funded as a part-time position, and so it did occur under GLs 1 and 2 that trappers came to purchase tags on days when she was not in the office. Sometimes other CMA staff ‘sold’ the tags; and on a small number of occasions nobody was available and trappers were unable to purchase tags at all. Trappers may have travelled long distances to town to get the tags and not been able to purchase them, and issues like these did cause some to become disgruntled with the system. Some difficulties arose when the research assistant was not available and others were delegated to issue tags. These issues were resolved before General Licence 3 commenced, but not before record discrepancies became an issue for both FATE and KMP.

Contracting out the issuing of tags to CAS resulted in more reliable access of shooters to tags, but CAS required constant support from FATE staff to ensure all aspects of transactions were properly completed. This was probably due to CAS being insufficiently familiar or engaged with the rest of the General Licence program to make sensible decisions during transactions.

For General Licence 3, contracting out the issuing of tags cost around 75% of the value of the tags purchased, and around 100% of the value of the tags actually issued until the end of April 2009.

**Invoicing**

Once some teething problems had been overcome, issuing invoices through the UNSW finance system worked well. The invoices were then forwarded to the Broken Hill tag issuing person to be marked as ‘paid’ (if the tags had been paid for when they were collected), then forwarded to the trapper. It was the responsibility of the tag issuer to hold and bank the money from the tag ‘sales’, as they were in the best position to know which tags had been paid for, and also because money from sales of tags could not be banked to UNSW without an invoice number.
This system could definitely be improved upon, and some trappers became disgruntled when sent invoices that had inadvertently not been stamped ‘paid’. A system where the trappers were able to receive an ‘official’ invoice at time of purchasing tags, indicating what monies were paid or owing, would be better. This could be achieved by either: UNSW allowing the tag issuer access to its financials system, or KMP selling the tags directly to the trappers, or via another intermediary that could access DECC financial system (not UNSW). Either way, time spent on issuing invoices and opportunity for administrative error would be greatly reduced. These may not seem good ideas from an auditing perspective, but most systems can restrict system access to the component the user requires.

**Record keeping**

Some of the trappers thought that the paperwork required was too onerous, and this discouraged them from being part of the trial. The more similar the paperwork is to that for the single-property system, the easier it will be for trappers to fulfil paperwork requirements.

Many trappers expressed their dissatisfaction with the way the system operated at times. They considered the paperwork too onerous, and felt they were reporting the same data several times. Record keeping for trappers needs to be made as simple as possible and take into consideration that the level of literacy and numeracy skills of some trappers might be quite low.

The difficulty of fulfilling the record keeping for some trappers also impacted upon the ability of FATE staff to provide accurate and timely monthly summaries to KMP. However, as the trial has progressed, and trapper books have been introduced, this improved greatly.

**Interaction between FATE and KMP**

More interaction and discussion between FATE and KMP regarding administrative systems and record keeping might have helped avoid some of the issues mentioned here, particularly during key times of change in the trial such the issuing of new General Licences and changes to staff and admin processes. While the need for collecting of the data and maintaining a chain of accountability for tags is well understood, the feeling at FATE was that the KMP’s administrative requirements were inflexible, and might have been able to be improved with some discussion and cooperation. The KMP project officer had been given very little time for the project, as it was a very small portion of their duties, and this may have impacted on their capacity to liaise with FATE and develop more workable procedures and processes.

**5.3.3 Feedback on trial from participants**

Participants expressed significant frustration with the protracted delay in gaining approval for the General Licence but, despite this, attendance at Steering Committee meetings remained high and interest was maintained through until late 2008 (see Chapter 9 for further details).

The following two performance indicators from the adaptive management plan relate to the administration of harvest tags:

<table>
<thead>
<tr>
<th>Performance Indicator</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1.2 Landholder and shooter satisfaction with the methods of distributing tags and access rights amongst shooters.</td>
<td>1/3 landholders and 2/3 harvesters said tags were more readily available under this system and this was supported by responses to this question at Steering Committee meetings.</td>
</tr>
<tr>
<td>5.1.3 Number of transactions required for shooters to obtain tags throughout the year and the time taken between landholder/shooter identifying need for harvest and obtaining necessary tags necessary.</td>
<td>Apart from occasional problems this occurred efficiently. In the trial year (May 08-Apr 09), there were 5.3 tag transactions required per 1000 roos harvested. This compares with 3.8 transactions per 1000 roos for 2001-07 across the BRSWET properties.</td>
</tr>
</tbody>
</table>
It was hypothesised that the trial might have resulted in a lower administrative load overall if trappers sought fewer batches of tags because they could use them across several properties. The higher number of tag transactions under the trial indicates that this did not occur. However, this result does not necessarily mean that the trial caused administrative loads to increase unnecessarily. The higher number of transactions per 1000 kangaroos harvested may have had more to do with the fact that shooters could generally get tags more easily and thus may have sought them in smaller and more regular batches. The low harvest level relative to the 2001-07 average would also have contributed to trappers seeking smaller batches of tags.

It proved impractical to measure the exact time that a need for harvest was identified by a landholder or trapper. Also, such data is not collected under the normal DECC system for comparison.

Some delays in obtaining tags were encountered due to the part-time nature of the local coordinator position but this was rarely, if ever, a problem for harvesters.

The following performance indicator from the adaptive management plan relates to the post-trial feedback from participants:

<table>
<thead>
<tr>
<th>Performance Indicator</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1.4 Desire to continue with group licensing arrangements following the end of the initial trial at the end of 2008.</td>
<td>All respondents said they would sign up to the General Licence if it were continued by FATE and were supportive of keeping it running without FATE if suitable arrangements could be made. Several harvesters expressed regret when the general licence was not renewed after 30 June 2009.</td>
</tr>
</tbody>
</table>

5.4 Discussion

5.4.1 Licensing arrangements

As a result of the trial, an avenue has been developed in NSW for the use of a General Licence that enables a group of landholders and trappers to collaboratively manage kangaroo harvest tags across property boundaries. This is outside of the normal system of Occupiers’ Licences. As far as the landholders and trappers were concerned, harvesting continued in much the same way as before, with trappers working on the properties they were used to working on and following much the same harvest planning and communication strategies with the landholders with whom they had an existing relationship. This was a deliberate strategy negotiated within the steering committee to alleviate anxiety about possible unwanted consequences of the group licence regime. It is clear from this strategy that ‘business as usual’ was possible under the alternative group licence strategy.

Participants noted that benefits included greater access to tags and greater autonomy in deciding how tags would be allocated. During the trial, the group increased its harvest while the broader region was experiencing a harvest decline. This may have been a direct consequence of the alternative licence arrangements. The short duration of the trial (one year as opposed to the two years initially planned), relatively poor harvest conditions and the deliberate strategy of keeping arrangements as much like ‘business as usual’ as possible meant that it was unrealistic to expect a significant amount of change in trapper and/or landholder behaviour.

There was only one reported instance of a large kangaroo influx on a district property during the trial period. Researchers were not informed of this until after the trial period had ended. The harvester was able to harvest heavily and satisfactorily minimise the impact of the influx by tag swapping - using tags issued for other properties outside of the trial. While this practice is illegal, it is apparently widely practiced.

Chapter 9 deals further with landholder and trapper views of the trial and how they impact on broader industry issues.
A number of the administrative difficulties encountered during the trial, such as unavailability of administrative staff and record-keeping errors could be put down to ‘teething’ problems. However, due to the short duration, there was not much opportunity to settle into processes and systems beyond this teething phase. Many administrative issues and additional costs related to the double-handling of processes such as the submission of trapper returns and invoicing for tag payments. Such double-handling was inevitable given the novel nature of many of the trial processes and the fact that existing DECC systems and databases had been set up for single-property arrangements under an Occupiers’ Licence framework. Such processes would need to be reformed and better integrated if a group harvesting system operating under a General Licence was to become a permanent component of kangaroo harvest management in NSW.

Problems also arose due to a combination of the bureaucratic processes at an institution such as UNSW and the distance of UNSW’s administrative base from the trial location. Future group harvest administration would benefit from being closer to the harvest site and from a simplified corporate structure. There is a strong case for the devolution of appropriate responsibility to the group with simplified reporting and auditing processes within the limits of the legislation.

Over the longer-term, it may be expected that a group licensing system could reduce the DECC workload for licence and tag administration. Indeed, under the 2008/09 trial, DECC had to directly handle only three General Licence transactions rather than 50 individual tag transactions which would have otherwise fallen under Occupiers’ Licences. However, any savings here would have been outweighed by the additional DECC resources dedicated to getting the trial off the ground (e.g. development of new database, sorting out teething problems) and doubling-handling of harvest returns.

Chapter 8 (economic modelling and business case) further explores administrative costs and possible corporate structures for future collaborative harvesting arrangements.

### 5.4.2 Adaptive management under the KMP

A key issue for FATE in the development of the trial was a lack of clarity from DECC about the process for development and approval of adaptive management experiments. This makes it difficult for stakeholders other than DECC to engage in adaptive management (e.g. landholders, harvesters, processors or researchers such as FATE). Our experience with DECC’s adaptive management processes turned out to be costly, time consuming and contained a strong bias in favour of maintaining business as usual.

There is also a strong bias in the KMP towards facilitating adaptive management experiments in areas such as kangaroo ecology, population estimation and harvest modelling rather than social or economic aspects of the kangaroo harvest. This is reflected in the fact that two of the key goals of this trial - to improve control of kangaroo grazing pressure and to carve out a sustainable economic role for landholders - are not stated goals of the KMP. This is not to say that control of kangaroo grazing pressure and the distribution of economic returns are not of concern to DECC. Indeed, DECC undertakes a number of specific management actions in these areas, including:

- the release of ‘special quota’ when zone quotas are exhausted but grazing pressure persists (designed to assist landholders in their goal of controlling kangaroo grazing pressure)
- limiting the number of licensed processors in order to ensure their economic sustainability (a longstanding policy that is not stated in the KMP itself)
- a moratorium on new trapper licences recently introduced for much the same reason as the limit on processor licences.

The reasons why goals such as management of grazing pressure and economic viability are omitted from the KMP are partly political. There has been a deliberate shift in rhetoric away from ‘pest control’ to ‘sustainable use’ in Australian kangaroo management and there is also a need for DECC to portray itself as a manager of protected kangaroo species that is not influenced by the economic goals
of industry participants. However, the lack of explicit goals in these areas makes it very difficult to argue the case for adaptive management proposals such as BRSWET and means that there is very little data available on factors such as the efficacy of the commercial kangaroo harvest in reducing total grazing pressure or the success of licensing policies in delivering desired socio-economic outcomes.

As an example, despite having no stated goals on the economic participation of landholders in the kangaroo industry, no policy prescriptions to enable participation and no monitoring of participation, DECC dismissed our initial proposal in August 2006 by stating that it “does not consider that the failure of most landholders to participate in the commercial kangaroo industry beyond providing access for licensed trappers is due to legislative or policy impediments”. This set the tone for the protracted negotiations that followed and, based on the results of the landholder survey presented in Chapter 7, clearly contradicts what many landholders think about legislative and policy barriers to their participation in the industry.

A summary of the discussion follows:

- The trial showed that a group of landholders and shooters can successfully manage the allocation of harvest tags amongst themselves. This was apparent in the fact that the group expressed a desire to continue if funding for administrative costs could be obtained.

- The group also increased their harvest on 2007 levels while the rest of the region was in decline overall. This shows that group licensing was not a burden on the ability of shooters to harvest and may have been a benefit.

- Quotas were not threatened in 2008/09 and it is unknown how well the allocation of tags would hold up under such a circumstance. For example, conflict might arise if tags were running out and several harvesters were vying for the remaining tags.

- The administrative burden of the trial was high. However, much of this relates to the teething problems inevitable for any new system and the double-handling caused by DECC retaining control over processes and not fully devolving responsibility to the group. A longer trial would be needed with progressively more responsibility devolved over time to get a complete picture of administrative loads.

Our experience with DECC and the adaptive management provisions of the KMP indicates that:

- Adaptive management should involve the clear statement of all goals that drive policy. Without clear statement of goals, it is often very difficult to argue the case for adaptive management proposals such as BRSWET. Very little data is likely to be available for comparison and objectives of the research team are likely to clash with unstated goals of regulators and other stakeholders. Such impacts result in a heavy bias towards maintaining the status quo.

- Plans espousing adaptive management need to state clearly what factors can be experimented with (e.g. population monitoring, quota-setting, socio-economic considerations) and by whom (regulators only, ecological researchers, socio-economic researchers). Without such guidance, very few experiments will get off the ground.

- Adaptive management should be viewed holistically, not as simply the implementation of experiments that are unconnected from the rest of management. Adaptive management means that all management actions should be seen as experiments, not just those that deviate from the status quo. The manner in which the KMP approaches adaptive management at present creates a strong bias towards maintaining business-as-usual.
6. Use of Landscape Function Analysis by landholders and the establishment of community monitoring

A key component of this project is to determine whether the integration of kangaroo management into domestic stock and land management activities can generate landscape-scale environmental benefits. Measuring the impact of management activities in the rangelands is problematic due to the extreme climatic and geographic variability and the dramatic impact of weather events on environmental condition. Except in situations where there has been obvious management failure, extensive research and long-term monitoring has been inconclusive in linking management activities with land condition in the rangelands (Stafford Smith, Morton et al. 2000).

As a consequence, we did not expect any measurable changes in environmental outcomes during this trial. We didn’t expect to detect noticeable changes that could be attributed to different kangaroo strategies due to the short duration of the trial. We weren’t expecting measurable change in landscape function during the course of the project nor were we testing different kangaroo management regimes against each other for their effect on landscape function. As stated in the previous chapter we adopted a deliberate strategy of trying to keep key aspects of management constant to allay anxiety about possible adverse effects of our intervention.

Despite these difficulties, the team was keen to at least begin the process of engaging landholders with environmental monitoring that was also relevant to production. Following an exploration of possible monitoring methodologies, Landscape Function Analysis (LFA) was chosen for this study because LFA:

- is based on underlying landscape properties not the specifics of particular locations
- is simple and straightforward enough to be done without detailed and specific knowledge and skills and yet is scientifically rigorous
- has a numerical component for incorporation onto databases and GIS systems
- links directly with NRM targets and links on ground management with those targets
- is applicable to land under a range of management strategies from cropping to conservation and all types in between.

In addition, we judged that there was a strong likelihood that LFA:

- could be done by landholders as part of their normal routine and would mean something to their day-to-day management
- could provide a common language that is shared across regions and industries and between conservation and production
- is cost effective enough to allow many sites to be monitored frequently
- could complement other more detailed assessments that are more localised.

It became the key component of the fourth objective for this project: to ‘establish and undertake community monitoring of landscape function (and kangaroo populations) to inform adaptive
management’. Please note that localised community monitoring of kangaroo populations under the trial is dealt with in Chapter 4.

Interactive adaptive management would involve landholders aiming towards maintaining or improving land condition using LFA as a monitoring tool. Information generated by LFA can determine the dynamic range of function of a targeted land type and show, through periodic monitoring, how land is responding to management treatments which can be active or passive in nature. Whilst individual landholders could undertake this process, incorporating it into a Landcare group strategy would generate additional benefits. A range of management strategies undertaken in a district could be monitored in parallel and over time to generate social learning. This is consistent with farming systems research advocating work at the interface between biophysical systems and social management systems (Keating and McCown 2001).

The WCMA provided additional funding on top of that supplied by RIRDC to support this component of the project.

6.1 Objectives

The key objective of this component of the project is to establish and undertake community monitoring of landscape function to inform adaptive management. We divided this objective into the following components:

- learning LFA and applying it to an individual property
- group monitoring using LFA.

This is the first attempt, of which we are aware, to systematically train landholders in LFA, to evaluate the effectiveness of the training, to assess the usefulness of LFA to landholders and to attempt to incorporate LFA into a group monitoring system.

6.2 Methods

6.2.1 Landscape Function Analysis

Landscape Function Analysis (LFA) is a rigorously developed method based on a clearly articulated conceptual framework that is backed up with decades of meticulous analytical research. It can be used to assess and monitor how an area of land (defined as a ‘hill slope’ in the methodology, meaning an area of land that will either have a defined slope, however gentle, or a directional environmental driver such as slope or prevailing wind direction) is functioning as a biogeochemical system and the extent to which it is self-regenerating (Tongway and Hindley 2004). It is extensively used in mine reclamation and in rangeland monitoring, particularly in WA (Watson, Richardson et al. 2006; Watson, Novelty et al. 2007). If used in a time sequence and in context, LFA can show the extent to which a landscape is retaining and using its vital resources. LFA is a central part of a broader method, Ecosystem Function Analysis (EFA) which incorporates further assessments to more fully characterise the functional performance of plants and animals.

LFA involves collecting data on a downslope (or down wind) transect. The transect is divided into sections according to whether it is accumulating resources (called a patch) or losing resources (called an interpatch). The pattern of different sections (patches and interpatches) is called landscape organisation (Figure 6.1). Each section is then analysed according to its soil surface characteristics by using 1m sampling sites in each section, and applying 11 Soil Surface Indicators (SSIs) to each sampling site. This process is called soil surface analysis (Figure 6.2). All data (site description, landscape organisation and soil surface analysis) are entered into a purpose built software package to generate information that characterises the site and calculates indices for stability, water infiltration.

45
and nutrient cycling. It generates the information immediately so that interpretation of the results can begin on the day of monitoring.

**Figure 6.1 Landscape organisation**

Geomorphic entities such as flats and slopes may also be patches and interpatches, respectively.

**Figure 6.2 Soil Surface Analysis – how soil surface indicators contribute to the generation of soil surface indices.**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Emergent soil surface Indices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Soil Cover</td>
<td>STABILITY</td>
</tr>
<tr>
<td>2. Basal cover of perennial grass</td>
<td>INfiltration</td>
</tr>
<tr>
<td>3a. Litter cover</td>
<td>NUTRIENT CYCLING</td>
</tr>
<tr>
<td>3b. Litter cover, origin and degree of decomposition</td>
<td></td>
</tr>
<tr>
<td>4. Cryptogam cover</td>
<td></td>
</tr>
<tr>
<td>5. Crust broken-ness</td>
<td></td>
</tr>
<tr>
<td>6. Erosion type &amp; Severity</td>
<td></td>
</tr>
<tr>
<td>7. Deposited materials</td>
<td></td>
</tr>
<tr>
<td>8. Microtopography</td>
<td></td>
</tr>
<tr>
<td>9. Surface resistance to disturb.</td>
<td></td>
</tr>
<tr>
<td>10. Slake test</td>
<td></td>
</tr>
<tr>
<td>11. Soil texture</td>
<td></td>
</tr>
</tbody>
</table>

Indices are scaled 0-100

**6.2.2 Learning LFA and applying it to an individual property**

This research involved an adaptive learning cycle incorporating the development and trialling of an on-site training package, an evaluation of its use leading to modification, its use in the modified form...
by new groups, then the opportunity for further modifications. The evaluation incorporated comparing
the use of LFA by novices to its use by an expert and follow-up interviews with those trained.

During 2006 a two-day on-site LFA training package was developed. It was trialled at Fowlers Gap
Arid Zone Research Station in November 2006 to a group comprising landholders from the Barrier
Area Rangecare Group (BARG), WCMA personnel and representatives from the Natural Resources
Commission (NRC). The training culminated in participants undertaking an LFA without assistance on
two transects that had been previously analysed by an LFA expert. These data were then compared and
the results fed back to the groups at the conclusion of the training. It became clear that learners were
using a range of approaches to landscape organisation reflecting significant misconceptions. As a
result some groups generated LFA indices that were different to the expert, while for other groups
results were consistent with the expert.

**David Tongway conducting LFA training, Fowlers Gap, November 2006**

In response to the trial the training package was modified to place more emphasis on the landscape
organisation phase of the procedure. The modified training package was then used with another group
of BARG landholders, DPI research staff and a landholder from another area at a second Barrier
Ranges property (Mt Woowoollahra Station) in October 2007. This time participants were more
consistent in describing landscape organisation, but the soil surface analysis component was rushed
due to shortening of the course due to logistical difficulties.
After each LFA training session, feedback about the opinions and observations of participants was obtained by discussing the following topics with each group:

- the success of the training course
- personal responses to LFA as a methodology for use by landholders
- whether LFA should form the basis for a community monitoring system.

A third training course took place at Wanaaring in June 2008 with local landholders as well as people from Western Australia who came specifically to learn LFA. The training course, scheduled over two days, had to be shortened to two half days due to rain preventing access to the isolated location. This limited the extent to which this training course could provide clear evidence supporting the reliability of LFA data generated by landholders.

During 2008, multiple attempts were made to arrange follow up visits to landholders trained in LFA. For a range of reasons no visits took place. Instead, semi-structured interviews are yet to be conducted with landholders following their being trained in LFA. The interviews will be undertaken by phone or in person. A protocol for the interviews was developed to guide the interviewer and ensure all desired areas were covered (see detailed proforma in Appendix B). When these interviews have been completed the results will be published.

The broad purpose of the landholder interviews was to explore their experience of the LFA training in their personal context. The questions to which answers were sought were:

- How do landholders read their land? What are the markers for them of land under stress on which they might make decisions, for example, to reduce stock or move stock on or de-stock?
- What land management tools do they have at their disposal. Are they adequate?
- How did they respond to training in LFA? Did it make sense to them? Were they able to integrate it with what they already know and do? Do they now use anything from the training formally or informally?
- How did they react to training in LFA? What aspects worked? What aspects did they find difficult? What parts of the training were unclear?
• Are they interested in using LFA for group monitoring?

### 6.2.3 Group monitoring using LFA

Whilst LFA training was being planned and undertaken, a parallel effort was made to define the parameters for a community-based LFA monitoring program in the BARG area. This involved selecting a set of key land types (KLTs) for the area and determining locations within each key land type for the monitoring of representative sites which landholders could use as a reference point for sites they monitor on their own properties.

A number of methods were used for selecting key land types through a consultative process involving BARG landholders, FATE, Western CMA, David Tongway and David Eldridge (NSW DNR and UNSW). Discussions at a BARG meeting in 2006 identified 11 different terms for land types that were in common usage amongst landholders in the area (Flood Country, Alluvial Plain, Banded Saltbush, Saltbush/Bluebush, Sand hills, Sand plains, Mulga rises, Mulga Woodland, Gibber Plain, Sandstone Hills, Mitchell Grass Country). These terms were based on a combination of geomorphology and vegetation type. It was recognised that the list was not exhaustive and that there would be substantial overlap between the terms, but it provided a broad framework for how landholders categorised their landscapes, how many different categories were present in the area and the terms that were in common usage.

A number of existing land mapping datasets were consulted to determine a set of key land types that would meet a number of aims, as follows:

- Categories should be based on a combination of geomorphology and vegetation type.
- The number of categories and terms used should reflect landholder perceptions.
- The number of categories should be manageable (considering that at least three reference sites were likely to be needed within each key land type).
- KLTs should be consistent with categorisations used in other monitoring programs, especially the Rangelands Assessment Program (RAP) coordinated by the NSW Department of Natural Resources.

The RAP Rangetypes and the NSW Landsystems data that they are based on were identified as the most likely options, especially given that RAP sites were already being monitored in the trial area. Other possibilities were considered and rejected, including the Major Vegetation Sub-categories used in NVIS data (too many categories and didn’t reflect position in landscape enough), Regolith data (too broad and didn’t factor in vegetation enough) and Soil Conservation Service categories (not consistent with RAP/Landsystems data).

The RAP Rangetype categories themselves were considered to be too broad for the required purpose, as there were only four RAP Rangetypes in the trial area and two of these dominated (Sandplain and Bluebush). However, the digital landsystems dataset that underlies the RAP categories further divides the NSW Western Division into 251 separate landsystems, grouped into 20 range types and nine physiographic categories. It was determined that the best categorisation would be achieved by using the nine physiographic categories in combination with the four RAP rangetypes. Theoretically, this could result in 36 categories (9x4), but in practice many categories did not occur in the trial area and the “Ranges” physiographic category was excluded as being too steep for practical use in an LFA monitoring strategy.

The end result was a set of six key land types that were dominant in the trial area (see Table 6.1 and Figure 6.3), providing a manageable number of categories for community monitoring based on both geomorphology and vegetation that reflected landholder terms and categories and were consistent with the existing RAP categorisation.
Table 6.1  Key land types for LFA monitoring strategy in BRSWET area.

<table>
<thead>
<tr>
<th>Physiographic Category</th>
<th>Rangetype (RAP and other names)</th>
<th>Key Land Type Code</th>
<th>Approx Percentage of Area covered by category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dunefields/Sandplains</td>
<td>Sandplain</td>
<td>SP_sp</td>
<td>40%</td>
</tr>
<tr>
<td>Alluvial Plains</td>
<td>Sandplain</td>
<td>AP_sp</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>Bluebush</td>
<td>AP_bb</td>
<td>7%</td>
</tr>
<tr>
<td>Rolling Downs and Lowland</td>
<td>Bluebush</td>
<td>RD_bb</td>
<td>17%</td>
</tr>
<tr>
<td>Hill and Footslopes/Tablelands</td>
<td>Bluebush</td>
<td>HF_bb</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>Saltbush</td>
<td>HF_sb</td>
<td>2%</td>
</tr>
</tbody>
</table>

Note: most of the remaining trial area was classed as “Ranges” and excluded from the monitoring strategy. Other Physiographic/Rangetype combinations were negligible in their extent across the trial area.

Plains and Foothills Landscape, Fowlers Gap
Figure 6.3  Distribution of key land types across BRSWET area.
6.2.4 Planning for reference sites

Through discussions between the FATE Program, David Tongway and landholders participating in LFA training, a basic group monitoring strategy was devised based on centralised monitoring of reference sites in each key land type, which involved landholders undertaking their own monitoring and comparing their results to the relevant reference sites. It was determined that three reference sites would be ideal for each key land type – one representing a site in good condition, one in medium condition and one in poor condition. Monitoring of these reference sites would be undertaken by FATE (at least initially) every Spring and Autumn, with results distributed to participating landholders for comparison with sites they may wish to monitor on their own properties.

The initial Spring monitoring round could be combined with landholder interviews that involve presenting a monitoring package to each landholder. The package could contain the LFA manual, results for each reference site monitored and a map of their property showing where each of the key land types occurred. Training and assistance with initial monitoring could also be provided.

To monitor three reference sites within each of the six key land types, a total of eighteen sites would be needed. A greater number than this may actually need to be visited in order to find sites in good, medium and poor condition, however, it may be possible to locate transects in different condition very close together to save time (e.g. two sites on either side of a fenceline or in the same paddock but different distances from water). Two to three days in the field may be required to complete this monitoring of reference sites and ideally, LFA data from these reference sites would be processed before being discussed with landholders.

David Tongway describing impact of vegetation on sandhills

Prior to the trial we had engaged Agricultural and Environmental Management Services (AEMS) to jointly develop a web-based tool to incorporate LFA into land management systems. AEMS prepared an LFA template for their online property management system and intended to adapt it to hold and manage the kinds of cross-property reference data produced by this community monitoring program. AEMS personnel were involved in field work conducting LFAs in the Barrier Ranges but were unable to deliver on the web-based tool. We were able to accumulate some of the data needed but difficulties with gaining access to properties and availability of landholders at critical times prevented us from implementing the multi-property system.

Our next task was to conduct LFAs on each of these categories on sites that provided a range of conditions from severely degraded to ‘as good as you can get’. This enabled us to establish the dynamic range of LFA values for each land category which could then provide a benchmark from...
which individual landholders could compare the state of their own land of the same land category. We undertook these LFAs both as a small research group and during LFA training sessions (November 2007 and August 2008) on the Barrier Ranges.

6.3 Results

6.3.1 Learning LFA and applying it to an individual property

Participation

A total of nine BARG landholders representing six properties were trained in two training courses (November 2006 at Fowlers Gap and August 2007 at Mt Woowoolahra). This was fewer than was anticipated. Enrolment for the first training course was very strong (22), necessitating our rejection of some landholders due to limited places. Subsequently, more than half failed to show for the course, but by then it was too late to replace them. Bookings for the second training course originally scheduled for March 2007 were strong (12), but it had to be postponed due to a severe storm on the day which prevented access to the venue. The earliest we were able to reschedule was August 2007, when fewer landholders were available.

Feedback from participants

Participant responses immediately after the training courses were very encouraging. They reported enjoying the course as a practical, hands-on experience. Several described how the course opened their eyes to how landscapes function rather than just assessing condition, which is generally limited to information on pasture species.

Participants in the first course described landscape organisation as the most difficult part whereas this was not a problem in the modified course offered to the second group. There were comments about how confidence grew through the course as they were encouraged to participate rather than just watch. Several practical suggestions were made at each of the first two courses that were used to further refine the method and the course.

When asked about the relevance of LFA, participants were very positive. One described it as:

‘better compared to some other methods (tactical grazing) as it provides a deeper and more ‘whole’ understanding of how soil, vegetation and landscape function.’

It was described as very relevant and several instances were described where knowledge of landscape function would be of benefit. Two participants reported that, following training, they were already looking at their land differently, indicating that they were already making informal use of the principles behind LFA without actually doing a formal transect.

Following the second course there was strong support for setting up a multi-property monitoring system using LFA. There was unanimous support for the view that such a system would generate considerable benefits and would be self-sustaining after an initial training and set-up period.
Attempts by the researchers to visit landholders trained in LFA to further evaluate the impact of the training and to implement the multi-property monitoring system were unsuccessful. The reasons for this were either:

- times set aside by researchers to achieve this were not suitable to landholders;
- landholders were in a period of personal or occupational crisis (Chapter 10, Section 10.1).

**Comparison of LFA done by landholders and experts**

During the three training courses, data were collected to allow comparisons between the LFAs done by landholders who were just learning and those done by the recognised expert in LFA, David Tongway. Some of these data (broadly representative of all of the data) are presented below in Table 6.2 and Figure 6.4. These data allowed the researchers to assess where learners differed from the expert so as to improve the training to bring learners closer to the expert in subsequent training sessions.
During the first training course, it became clear that learners had generated misconceptions about landscape organisation which came out during discussion in the final stages of the course and impacted on their data. This is demonstrated in Figure 6.4 where the expert identified four different zones, Group B identified three zones and Group E identified two zones along the same transect. Learners also hadn’t sampled sufficiently often (as shown in red). However, despite these differences, overall LFA assessments were similar between the expert and the two learner groups as shown in Table 6.2. This is an indication of the robustness of the LFA methodology.

During the second training course, more emphasis was placed on the landscape organisation stage and, as a result, learners’ classifications were close to those of the expert. In Table 6.3 landscape organisation data are presented from the same transect done by the expert and two landholder groups, and apart from some additional zones and some differences in zone names, all three are essentially the same. This was similar for a second transect. Unfortunately the second training course was cut short due to access and weather problems so the soil surface analysis component did not receive sufficient emphasis and the consistency of the final LFA data was patchy.
Figure 6.4 Comparison of Landscape organisation transect 5 by expert and learners at Fowlers Gap, November 2006.

Table 6.2 Comparison of LFA done by landholders and experts on transect 5 at Fowlers Gap in Nov 2006.
<table>
<thead>
<tr>
<th>MtWW: Master</th>
<th>MtWW: Group A</th>
<th>MtWW: Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transect: 2</td>
<td>Transect: 2</td>
<td>Transect: 2</td>
</tr>
<tr>
<td>Distance (m)</td>
<td>Distance (m)</td>
<td>Distance (m)</td>
</tr>
<tr>
<td>Patch width (cm)</td>
<td>Patch width (cm)</td>
<td>Patch width (cm)</td>
</tr>
<tr>
<td>Patch/Interpatch Identity</td>
<td>Patch/Interpatch Identity</td>
<td>Patch/Interpatch Identity</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1.55</td>
<td>1.55</td>
<td>mound slope</td>
</tr>
<tr>
<td>Sandy slope</td>
<td>Sandy slope</td>
<td>Sandy slope</td>
</tr>
<tr>
<td>3.25</td>
<td>3.25</td>
<td>bare soil</td>
</tr>
<tr>
<td>bare soil</td>
<td>bare soil</td>
<td>bare soil</td>
</tr>
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<td>3.72</td>
<td>3.72</td>
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<td>shrub hummock</td>
<td>shrub hummock</td>
<td>shrub hummock</td>
</tr>
<tr>
<td>8.61</td>
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</tr>
<tr>
<td>bs</td>
<td>bs</td>
<td>bs</td>
</tr>
<tr>
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<td>10.6</td>
<td>sm</td>
</tr>
<tr>
<td>sh</td>
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</tr>
<tr>
<td>12.55</td>
<td>12.55</td>
<td>bs</td>
</tr>
<tr>
<td>bs</td>
<td>bs</td>
<td>shrub mound</td>
</tr>
<tr>
<td>15.28</td>
<td>15.28</td>
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</tr>
<tr>
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<tr>
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</tbody>
</table>
6.3.2 Results of group monitoring using LFA

There was strong support from landholders trained in LFA for the establishment of a multi-property monitoring system using LFA. In anticipation of this response, FATE had prepared the following monitoring program description which was presented to the groups following the training course.

**BARG Landscape Monitoring and Assessment Program:**

‘The Barrier Area Rangecare Group is a proactive, social community group aiming to achieve long term sustainable landscape management by implementing recognised and innovative land management strategies.’

Reasons for monitoring:

- Provide an additional tool for landholders to use to read their land and understand how it is responding to seasonal and management changes.
- Provide landholders with benchmarks for important landscape types against which they can compare the condition of their land.
- Provide evidence over time of changes in landscape condition and landholders’ level of land stewardship.
- Provide reliable and rigorous information on which individual landholders and BARG as a whole can base management and strategic decisions such as domestic stocking rates, control of invasive native scrub, control of introduced pests and kangaroo harvesting strategies.
- Develop a model that, if successful, can be used in other locations both in WCMA and other areas to provide CMAs with reliable and timely information on resource condition.

Field data collection and analysis:

- Landscape Function Analysis (LFA) will be used as the basis of data collection and analysis. Through LFA, indices for soil stability, water infiltration and nutrient cycling can be generated through a well designed methodology.
- Important land types will be defined using broad RAP (Rangeland Assessment Program) land types refined to be meaningful across the BARG properties. Three Key Land Types will be selected that best represent the landscape and the objectives of the landholders.
- Reference Sites will be located on participating properties; at least two for each of the three Key Land Types.
- Landholders will learn LFA. Data will be collected on whether they have learnt to conduct the LFA consistently during the training.
- Landholders will establish sites on their properties which correspond as closely as possible to one or more of the Key Land Types and will undertake to monitor regularly (a minimum of twice yearly).
- Critical locations that have higher levels of growth and thus higher potential herbivore populations (eg ‘wash-out’ areas or areas that have received water from a localized storm) could be identified and monitored as additional sites.
- Each landholder can enter their data onto data sheets. They (or the team) can transfer the data onto the LFA software program to generate the 3 indices. The team can add the data to the GIS.

Turning data into information:
• When new data comes in, the team will enter the data onto the LFA software, do the calculations and provide feedback to the landholder about how to interpret it.

• The team will develop information via print and the website that will help landholders to understand what their data means using the LFA framework. For example, it might show whether measured values mean that the landscape is functioning well in relation to the Reference Sites and other sites on other properties.

• The team will record and maintain the data, maintaining a balance between confidentiality and making an appropriate level of information available to help make sense of data from individual properties. The team will have access to all data but landholders will be able to de-identify themselves from the data that is viewed by others. The data will appear in GIS format with access to layers managed in accord with the wishes of the landholders and researchers.

Turning information into action plans:

• The reliable and rigorous information generated from the data can provide evidence on which individual landholders and BARG as a whole can base management and strategic decisions such as domestic stocking rates, control of invasive native scrub, control of introduced pests and kangaroo harvesting strategies.

• It will enable BARG to demonstrate any movement towards improved environmental stewardship based on sound and systematic evidence.

Landholders agreed in principle to base a subsequent monitoring system on this. This project has provided the starting point for this group and others to develop a monitoring system. We also have collected some of the data necessary to establish a monitoring program in the Barrier Ranges on two of the Key Land types, Sandplains; and rolling plains and foothills. Some of these data are presented below in Table 6.4 – 6.7.

Table 6.4 Best possible Banded saltbush/bluebush—stony site inside Emu Paddock at FG.

<table>
<thead>
<tr>
<th>Zone</th>
<th>% of transect</th>
<th>Stability</th>
<th>Infiltration</th>
<th>Nutrient cycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stony interpatch</td>
<td>40</td>
<td>65</td>
<td>23</td>
<td>16</td>
</tr>
<tr>
<td>Shrub band</td>
<td>60</td>
<td>69</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Best Overall</td>
<td>67</td>
<td>27</td>
<td>24</td>
<td></td>
</tr>
</tbody>
</table>
Table 6.5  Worst available Banded saltbush/bluebush—stony site (not worst possible) outside Emu Paddock at FG.

<table>
<thead>
<tr>
<th>Zone</th>
<th>% of transect</th>
<th>Stability</th>
<th>Infiltration</th>
<th>Nutrient cycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stony interpatch</td>
<td>75</td>
<td>55</td>
<td>19</td>
<td>10</td>
</tr>
<tr>
<td>Shrub mound</td>
<td>20</td>
<td>60</td>
<td>31</td>
<td>26</td>
</tr>
<tr>
<td>Alluvium</td>
<td>5</td>
<td>45</td>
<td>16</td>
<td>9</td>
</tr>
<tr>
<td>Best Overall</td>
<td>56</td>
<td>56</td>
<td>22</td>
<td>13</td>
</tr>
</tbody>
</table>

Table 6.6  Best available Sandplain—(not nearly best possible) at The Veldt.

<table>
<thead>
<tr>
<th>Zone</th>
<th>% of transect</th>
<th>Stability</th>
<th>Infiltration</th>
<th>Nutrient cycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandy dune</td>
<td>45.5</td>
<td>36</td>
<td>32</td>
<td>8</td>
</tr>
<tr>
<td>Shrub patch</td>
<td>25.5</td>
<td>41</td>
<td>37</td>
<td>15</td>
</tr>
<tr>
<td>Gilgai</td>
<td>29</td>
<td>45</td>
<td>20</td>
<td>16</td>
</tr>
<tr>
<td>Best Overall</td>
<td>40</td>
<td>30</td>
<td>30</td>
<td>12</td>
</tr>
</tbody>
</table>
Table 6.7 Worst available Sandplain— (not nearly worst possible).

<table>
<thead>
<tr>
<th>Zone</th>
<th>% of transect</th>
<th>Stability</th>
<th>Infiltration</th>
<th>Nutrient cycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand plain</td>
<td>79</td>
<td>36</td>
<td>21</td>
<td>8</td>
</tr>
<tr>
<td>Shrub mound</td>
<td>21</td>
<td>38</td>
<td>31</td>
<td>12</td>
</tr>
<tr>
<td>Best Overall</td>
<td>36</td>
<td>24</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

6.4 Discussion

Whilst circumstances intervened that prevented the research plan from being thoroughly followed, it is clear that the LFA course improved as a result of the learning cycle and that novices using the modified package can generate data very similar to the expert after a two-day training course. In addition, landholders responded very positively to LFA, expressing a desire to incorporate it into their day-to-day management as well as work together with other land managers to develop group monitoring using LFA. It is already clear that:

- Landholders are capable of learning LFA in a two-day training course.
- Landholders readily understood the concepts behind LFA and were able to integrate them into their existing knowledge and understanding of the landscape.
- Landholders perceived LFA to be useful in that it enhanced their understanding of the landscape and provided an additional tool to help inform their management.

Even if LFA is not conducted formally following training, LFA lends itself to informal appraisal by landholders once the principles are understood.

A two-day training course is the ideal for landholders to learn the basics of LFA and to be able to begin using it informally on their property. Follow up contact of at least one day is needed to develop a more formal on-farm LFA monitoring system that is tailored to an individual property. In order to develop a multi-property monitoring system, all members of the group would need to go through this process. The next step would be to work together with expert help to choose key land types and set up benchmark transects across sites to establish best and worst LFA values for each key land type in the area covered by the group. It would then only require one member of the group to collate this information and make it available to the others. They could then conduct their own LFA measurements and compare them to previous measurements on the same site and with the group benchmarks.

For LFA to be used as a basis for broader scale resource condition monitoring that contributes to a wider dataset, further evaluated training courses are needed to generate sufficient data on which to conduct statistical analysis to measure the significance of differences between novices and the expert conducting LFA. Follow-up interviews are still required to assess aspects of the training in and use of LFA. It is also conceivable that landholders themselves could become LFA data collectors for wider use of LFA by regional bodies. Illustrated local region manuals or ‘glovebox guides’ could be developed to maintain and reinforce the principles.

Three performance indicators relating to LFA were identified in the Adaptive Management trial plan submitted to DECC in March 2008 (see Chapter 5). Key findings against these performance indicators are as follows:
Performance Indicator | Key Finding
--- | ---
Number of landholders in the group trained in LFA and number of landholders undertaking LFA transects on their properties. | Nine landholders representing six properties were trained in LFA. A number have reported applying LFA principles on their properties, but not the formal undertaking of LFA transects.

Success in setting up representative LFA sites for each major rangetype which are monitored at least once annually. | Key range types across the BRSWET area were identified and an outline of a group monitoring program was developed. Benchmark data was obtained for representative sites on some range types.

Degree to which landholders are prepared to share data on other aspects of total grazing pressure through cross-property GIS. | AEMS did not deliver on the proposed cross-property GIS. Future data-sharing would be dependent on the adoption of a group monitoring strategy.

Key points from the discussion follow:

- Sufficient work was done through this project to establish that LFA is a suitable methodology for landholders to use to monitor land condition.

- Exposure to LFA training encouraged landholders to aspire to a multi-property monitoring system to allow them to measure themselves up against local benchmarks to inform their adaptive management. This would open the way to their collecting evidence of stewardship.

- Establishment of a co-operative SWE could therefore involve an environmental management system that incorporated community monitoring using LFA to work towards sustainable land management independent of enterprise.

- More work needs to be done on developing LFA training packages, evaluating them and developing a system for linking community monitoring with agency monitoring before landholder LFA can be incorporated into broader resource condition datasets.
7. Survey of landholder perceptions of kangaroo issues

7.1 Objectives

A survey was undertaken of landholders across the Western Catchment Management Authority’s (WCMA) region of NSW between March and June 2008. The main objectives of the survey were:

- to obtain baseline information about landholders’ management of kangaroos against which the outcomes of BRSWET could be assessed
- to identify key differences and similarities between the BRSWET group and other landholders
- to determine future directions for landholder involvement in kangaroo management in western NSW.

7.2 Methods

A 1999 survey undertaken in southwest Queensland (Chapman 2003) was used as a starting point for the survey methodology. Margaret Chapman, of the University of Queensland’s School of Natural and Rural Systems Management provided a copy of the 1999 survey and collaborated with FATE to extensively modify the questions. Key issues of interest for BRSWET were incorporated and questions that were not considered effective in 1999 were amended. The final survey covered basic data such as property size, age and income streams, attitudes towards kangaroos, measures employed to control total grazing pressure, perceived effectiveness of the kangaroo industry, attitudes towards different kangaroo enterprise models and attitudes towards collaboration with neighbours. The 28 survey questions included a mixture of response types, requiring respondents to select one or more responses from a list, to rank possible options in order of preference or to provide comments.

WCMA provided access to their landholder database and the survey was mailed to 419 landholders in the WCMA area in March 2008. A pre-paid return envelope was included and reminder letters were sent in June 2008. The Pastoralists’ Association of West Darling (PAWD), the peak representative body for pastoralists in the region, also provided support for the mail-out.

The mailing list included 23 Barrier Ranges landholders who had been exposed to BRSWET. These 23 envelopes were specially marked so that their responses could be viewed as a subset of the total. This subset included landholders participating in the BRSWET group licence, as well as others who had only been exposed to elements of the trial’s planning and development.

The response rate overall was 35% (145 responses out of 419), with 61% for the Barrier Ranges subgroup (14 responses from 23 sent). Not all questions were completed on each survey, meaning that the sample size was reduced for many questions. Results were compiled and analysed between June 2008 and February 2009 and were then discussed with trial participants in June 2009.

7.3 Results

7.3.1 Baseline data

The average landholding size amongst survey respondents (n=145) was 28 000 ha (Fig. 7.1). The average amongst the Barrier Ranges subgroup (n=14) was higher at 53 000 ha, reflecting the fact that the area has lower average rainfall, is more rugged, does not contain any major towns and does not border the Darling River.
Barrier Ranges respondents were also younger on average (Fig. 7.2), with only 36% aged 50 or over (n=14) compared to 61% overall (n=145). This reflects anecdotal evidence that the area features a concentration of younger landholders.

Figure 7.2 Age distribution of survey respondents.

7.3.2 Income streams

Sheep grazing was the most significant income source for respondents, followed by cattle grazing and goats (Fig. 7.3). No respondents said that kangaroos were a major income source, although 6% (n=144) said they were minor (also 6% for the Barrier Ranges subgroup; n=14). The only major difference amongst the Barrier Ranges subgroup was that sheep were somewhat more dominant (100% major income source v 78% overall).
In terms of commercial kangaroo management, 89% of respondents \((n=145)\) said that they allowed commercial shooters to harvest on their properties, but only 12 landholders \((8\%)\) reported more active participation, consisting of:

- eight who harvested commercially themselves (two of these also had chillers)
- two who owned or operated chillers but did not harvest personally
- one who received a payment from their shooter
- one who identified commercial value in kangaroos for tourism.

While landholder income from kangaroos was clearly low, there was some inconsistency between the answers given to different questions. Twelve landholders reported participation in the activities listed above, but only five reported that they or a family member earned income from these activities. Both of these figures differ from the number of respondents \((8)\) who listed kangaroos as a minor income source (see Fig. 7.3 above).

### 7.3.3 Attitudes toward kangaroos

When asked to choose which term they felt best described kangaroos (from a list provided), the most popular response was ‘can be a problem at times’, followed by ‘pest’ and ‘potential resource’ (Fig. 7.4). One-third of respondents misinterpreted the question and selected multiple responses. Therefore, two series of data are shown in Figure 7.4; one based on those who chose one answer only and one based on those who selected multiple answers. Both data series show very similar patterns, with the only major difference being the order of ‘potential resource’ or ‘pest’ as second or third. The Barrier Ranges subgroup \((n=14)\) also showed these broad patterns, with ‘can be a problem’ clearly ranking first.
These results challenge the common assumption that landholders view kangaroos primarily as ‘pests’ and support the findings of Thomsen and Davies (2007) in South Australia. In their interviews with 21 landholders, Thomsen and Davies (2007) also found that ‘a problem at times’ (or ‘a nuisance at times’) was the most common description of kangaroos. However, we would not yet conclude as Thomsen and Davies (2007) did in South Australia that ‘landholders view kangaroos as a resource, not a pest’ (Thomson and Davies 2007, p. xii), given that the ‘pest’ and ‘potential resource’ descriptions were ranked so closely in this NSW survey.

The nuanced way in which respondents viewed kangaroos was further highlighted by how they ranked their reasons for being interested in kangaroo management (Fig. 7.5). The statement that kangaroo management ‘provides an opportunity to better manage total grazing pressure’ was ranked first by 39% of respondents (n=113), almost equal to ‘provides a source of income when livestock prices are low’ at 37%. Thus, the two top-ranking responses came from opposite ends of the pest versus resource spectrum.

Interestingly, a disproportionately high number of landholders in the Barrier Ranges subgroup selected grazing pressure management as their number one reason for being interested in kangaroos (71%; n=14). While better management of grazing pressure has been an identified goal of this group since the commencement of the trial, it is somewhat surprising that this reason so heavily out-ranked an interest in kangaroo income.
66% of respondents (n=145) felt that kangaroos had been a significant financial cost on their property during the last 5 years. Just over half of these attempted an estimate of such costs, with the median estimate being $20 000-$30 000 for an average year. These costs were seen to lie mostly in pasture loss/foregone stocking potential, followed by damage to fences and watering points. 51% (n=145) felt that graziers should be compensated for these costs. With regard to who should pay such compensation⁵, three main groups were identified (n=77):

- government (including specific agencies as well as generic terms such as ‘taxpayers’)
- conservationists (a.k.a. ‘environmentalists’ or ‘greenies’)
- kangaroo industry (including processors and shooters).

Results were slightly different for the Barrier Ranges subgroup (n=14), with less regarding kangaroos as a significant cost (50% v 66% overall) and a lower median estimate of costs ($10 000 v $20 000 - 30 000 overall). In addition, responsibility for compensation was seen as lying mostly with industry

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⁵ Question allowed anyone to be nominated (i.e. no list was provided) and allowed multiple nominations.
(four nominations) rather than government (two nominations). This is reflective of the view commonly expressed within trial group meetings that the kangaroo industry should compensate landholders for providing it with a valuable resource.

7.3.4 Measures to control total grazing pressure (TGP)

Commercial shooting was the most common measure reported for managing kangaroos in the past 5 years, with 90% of survey respondents (n=145) either allowing a commercial shooter onto their property or undertaking commercial shooting themselves. In contrast, only 52 landholders (36%) reported using non-commercial shooting (25 by themselves, 14 by someone else and 13 doing both). The most common kangaroo management actions apart from shooting were turning off watering points (19% of respondents) and fencing kangaroos out of certain areas (17%).

Landholders were also asked to report non-kangaroo-related grazing pressure management actions (from a list provided), with the following actions being most common (n=142):

- temporarily spelling paddocks to allow regeneration (89%);
- harvesting feral goats (71%);
- controlling rabbits (35%);
- permanently destocking paddocks to allow long term regeneration (25%);
- fencing out feral goats (21%).

No major differences were reported by the Barrier Ranges subgroup.

Nine landholders amongst those surveyed (6%; n=145) reported participation in the WCMA’s Enterprise-Based Conservation (EBC) scheme. Under the EBC scheme, landholders are paid to manage parts of their properties for conservation, which generally involves destocking paddocks or significantly reducing stock numbers. Most areas under EBC agreement were 2000-6000 ha, although two respondents had only a few hundred hectares under agreement and one had 50 000 ha. EBC participation amongst the Barrier Ranges subgroup was proportionate to the survey group overall (one out of 14 = 7%).

7.3.5 Effectiveness of kangaroo control

Landholders were asked to rate the effectiveness of the commercial kangaroo industry in reducing kangaroo grazing pressure in their district. Results were mixed, with ‘partially effective’ being most commonly selected (62%; n=142), followed by roughly equal selection of ‘effective’ (20%) and ‘not effective’ (18%). The Barrier Ranges subgroup (n=14) tended to see the industry as more effective overall, with 64% selecting ‘partially effective’, 36% selecting ‘effective’ and none selecting ‘not effective’.

Landholders were then asked to nominate which factors (from a list provided) they felt were barriers to the effective control of kangaroo grazing pressure on their properties (Fig. 7.7). Getting tags or licences was seen to be the greatest barrier, followed by kangaroo behaviour and weather/land conditions. The Barrier Ranges subgroup also nominated getting tags or licences as the greatest barrier, although weather/land conditions was ranked second ahead of kangaroo behaviour.
To further explore the effectiveness of commercial harvesting, landholders were asked for details of one ‘major kangaroo influx event’ they had experienced over the past five years. 58% of respondents (n=145) reported such an event, with 67 landholders giving an estimate of the influx size. Many gave an estimate of ‘thousands’, making statistical analysis difficult. Excluding these responses, the median estimate is 2000-3000 kangaroos (which may well be what was meant by ‘thousands’ anyway).

When asked to nominate the causes of their influx, drought/seasonal conditions was ranked highest (48%; n=87), followed a specific storm or rainfall event (43%). 6% noted that it was both drought conditions generally and a rainfall event specifically that caused the influx, although it’s likely this combination also applied to many others who only cited one factor or the other. The presence of crops was the only other significant cause reported (7%).

Among the 87 landholders who described an influx, 66 of them (76%) used shooting to control numbers at that time, with 91% of these using commercial tags. When asked whether shooting was effective, results were mixed. 46% selected ‘no’, 45% selected ‘yes’ and 9% either selected both or otherwise indicated that shooting was partly effective.

Interestingly, the size of the influx did not have a clear influence on perceptions of effectiveness, with those reporting influxes of over 10 000 just as likely to say shooting was effective as those reporting less than 1000 (Fig. 7.8). Those who gave ‘thousands’ as an estimate were most likely to see shooting as ineffective, however this may simply indicate that by saying ‘thousands’, many respondents meant ‘too many to control’. As with kangaroo management overall, difficulty getting tags was the most commonly cited barrier to effective management of influxes.

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* These 145 responses include three ‘no responses’ that were interpreted to mean ‘no influx’.
* ‘Yes’ and ‘no’ were the only options given for this survey question, thereby reducing the number of responses indicating partial effectiveness.
* With regard to influxes, respondents could nominate any barrier (i.e. no list of barriers was provided).
A smaller percentage of landholders in the Barrier Ranges subgroup had experienced a major influx (36% v 58% overall), but those who did reported larger numbers of kangaroos (median estimate of 5000 v 2-3000 overall). They were also more likely to see shooting as effective (67% v 45% overall). Identified causes (storms, drought) and barriers (tags) were similar.

Overwhelmingly, when asked where they had obtained most of their knowledge about the commercial kangaroo industry and its impacts on land management, landholders selected their own observations (71%; n=109). The next most common answers, information from shooters and processors (12%) and from other graziers (6%) were ranked well behind.

### 7.3.6 Potential for earning income from kangaroos

When asked to nominate which factors (from a list provided) landholders saw as barriers to gaining income from kangaroos (Fig. 7.9), government control of kangaroo management (including quota-setting and licensing) ranked first, followed by the attitude of city people toward kangaroos and kangaroo industry opposition to landholder entry. While the price of kangaroo products is often cited as the biggest barrier to landholders gaining entry to the industry (e.g. Grigg 2002; Payne 2006 pers comm), it only ranked fourth as a major barrier amongst respondents to this survey.
The Barrier Ranges subgroup differed slightly from the overall survey group, with kangaroo industry opposition ranking higher (equal first with government control) and price (third) being ranked ahead of city attitudes (fourth). This may be reflective of the fact that this group has gone further than most in attempting to enter the industry, encountering industry opposition and price issues first-hand as well as through interaction with other groups such as the Tilpa Rangeland Investment Company (Henry and Watson 1998).

Figure 7.10 shows how respondents rated five different models for obtaining income from kangaroos (Fig. 7.10), based on:

- how compatible they were with existing grazing enterprises;
- how much income potential they offered;
- how fair they were;
- which option was best overall.
Figure 7.10 Ratings for Different Models of Landholder Involvement in the Kangaroo Industry.

(a): Compatibility with existing grazing enterprises (n=145)

(b): Income potential (n=145)

(c): Fairness (n=145)

(d): Best option overall (n=117)
The option of landholders receiving a payment from a processor for supply was ranked first in relation to all criteria. The options of receiving a payment from a shooter and landholders shooting kangaroos themselves were ranked second and third respectively in terms of overall preference, compatibility and income potential. However, payments from shooters were seen as less fair than landholders shooting kangaroos themselves. Options involving landholders owning or operating chillers were seen as undesirable under all criteria.

Comments were sought in relation to the fairness criteria. Extra workload and costs were the main concerns regarding landholders becoming shooters or owning/operating chillers. Concerns for shooters were also expressed, including there not being enough money in it for payments to landholders and shooters doing landholders a favour by shooting. Some considered it unfair to shooters for landholders to take up shooting (deprives them of a job) and for processors to have to make payments to landholders (they might pay shooters less as a result). In contrast to the high level of concern about landholders and shooters, only two respondents raised concerns about potential negative impacts on processors.

The only major difference for the Barrier Ranges subgroup was that processor payments were not the most-preferred option in terms of income potential, being outranked by the option of landholders becoming shooters.

### 7.3.7 Potential for collaboration

52% of respondents (n=137) indicated that they currently collaborate with other landholders in their district on land management, business, political or social activities. Among these, social/recreational activities had the highest participation, followed by formal land management group cooperation, informal land management cooperation and industry or political organisations (Fig. 7.11). Joint business ventures were not common in this region (9% of respondents). For the Barrier Ranges subgroup, formal land management activities were more common that social/recreational activities, although other activities followed the overall group pattern.

**Figure 7.11 Reported participation in collaborative activities (number of respondents participating and average hours per participant per month).**

![Collaborative Activities Chart]

In terms of time spent on collaborative activities, social or recreational activities again came out the highest, both for the average hours per participant (i.e. amongst those who said they participate in that activity) and for the total hours spent on these activities overall. However, it is notable that while joint...
business activities and collaborative industry/political activities are undertaken by relatively low numbers of landholders, these activities are more time-consuming for those who participate in them.

When asked how they view the potential need for cooperation to manage kangaroos as an economic resource, 92% agreed that ‘cooperation is a good idea and should be encouraged’ and only 8% disagreed (n=130). This breakdown was the same for the Barrier Ranges subgroup (n=13).

Landholders were then asked how they would feel about a system similar to Queensland’s being introduced in NSW, whereby commercial harvest tags are not tied to individual properties, but rather are purchased centrally for use on any property (Fig. 7.12). 47% felt this would make cooperation easier, 31% felt it would make no difference and 13% felt it would make things harder (n=137).

**Figure 7.12 Attitudes towards a change to a Queensland-style system.**

<table>
<thead>
<tr>
<th>Attitude</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easier</td>
<td>47%</td>
</tr>
<tr>
<td>No Difference</td>
<td>31%</td>
</tr>
<tr>
<td>Depends</td>
<td>9%</td>
</tr>
<tr>
<td>Harder</td>
<td>13%</td>
</tr>
</tbody>
</table>

Comments in favour of a switch to a Queensland-style system related to:

- Kangaroos move across property boundaries/shooters should be able to also (15 respondents).
- Shooters do this anyway/change would make it legal (seven respondents).
- It enables a quicker response to influxes/storms (four respondents).
- It requires less paperwork (two respondents).

For those selecting ‘harder’, ‘depends’ or ‘no difference’, comments included:

- Less accessible properties would have more trouble getting shooters (seven respondents).
- It is harder to ensure that the shooter actually reduces numbers on your property (five respondents).
- It would result in more trespassing-illegal shooting (four respondents).
- Tags are easily available now (two respondents).

Landholders were also asked whether communication and collaboration could be improved between graziers, the kangaroo industry and government. 56% of respondents (n=124) felt that cooperation between the industry and graziers could be improved, with most comments calling for greater feedback from the industry, payments to landholders and for shooters to listen to landholders more. A
greater proportion of respondents, 78% (n=134), felt there was room for improvement between government and graziers. Most comments were that government agencies should to listen to graziers more (especially in relation to kangaroo numbers), agencies provide more feedback to graziers and that agencies should make more tags available or make them easier to obtain.

7.4 Discussion

7.4.1 Baseline data

A range of baseline data was obtained for kangaroo management in the Western CMA region, including that:

- The most commonly-reported tools for TGP management were commercial kangaroo harvesting and destocking of paddocks. This validates the focus of BRSWET on creating incentives for improved management in these two areas.

- While commercial shooting of kangaroos on properties was widespread (90% of respondents), very few landholders obtained income from kangaroos (<10%). This is strongly consistent with previous studies.

- Kangaroos were widely seen to have significant costs, but the common assumption that landholders view them primarily as ‘pests’ was challenged by the finding that ‘a problem at times’ was a more accurate description.

- This survey provides some evidence of a shift towards the view that kangaroos are a potential resource for landholders. Interest in kangaroos as substitute income for livestock ranked about equal with interest in managing them to reduce TGP.

- Respondents were equivocal about the effectiveness of commercial shooting to control kangaroo numbers, both overall and in relation to specific influxes. However, the Barrier Ranges sub-group, which had above average harvest rates, were more likely to see commercial harvest as an effective means for controlling kangaroo numbers. This may be as a result of the greater knowledge and visibility of the industry as a result of their involvement in this trial.

- The greatest perceived barrier to effective control of kangaroos was government control over licensing and tags. This was also the greatest perceived barrier to landholders obtaining income from kangaroos. Price was seen to be less of a barrier to obtaining kangaroo income than is often assumed.

- There were also comments about the incompatibility of a property-based tag system for a resource that freely moves across property boundaries. Tag swapping was mentioned in comments as an apparently widespread practice resulting as a consequence of too rigid a system. On balance, a switch to a Queensland-style system was seen as offering more positives than negatives.

There were some notable similarities and differences between this survey and the 1999 survey in SW Queensland (Chapman 2003). Both revealed low income levels from kangaroos (4% harvesting professionally in SW Queensland compared with 5.5% in this survey). Both also highlighted government control as the greatest perceived barrier to obtaining income from kangaroos (price was second in SW Queensland as opposed to city attitudes in this survey).

Respondents to this survey saw commercial shooting as less effective than in the SW Queensland survey (where 64% said it significantly reduced grazing pressure) and viewed the need for collaboration in obtaining kangaroo income more positively (92% positive v 61% in SW Queensland). This difference between the states may be due to their different kangaroo tag systems. NSW has property-based tags while in Queensland, harvesters apply for tags that can be used on any property. As a result, landholders in NSW have more to gain through collaboration.
7.4.2 Barrier Ranges subgroup

Members of the Barrier Ranges subgroup were younger, had larger properties and were more dependent on sheep for income than the overall group. They also tended to have a greater interest in managing kangaroos to reduce TGP rather than for income. One possible explanation for this is that exposure to BRSWET has actually reduced interest in obtaining income from kangaroos (e.g. by exposing the difficulties involved in obtaining processor payments). While the data is not really sufficient to draw definitive conclusions, further support for this interpretation comes from the fact that, unlike the overall group, the subgroup considered processor payments to offer lower income potential than becoming a shooter.

The subgroup’s greater focus on TGP management as a reason for being interested in kangaroos is also puzzling, as they tended to estimate lower average costs for kangaroos, have a lower incidence of influxes (albeit with bigger numbers per influx) and see current commercial management as more effective. One interpretation is that the subgroup’s greater belief in the industry’s effectiveness in controlling kangaroos leads to a view of kangaroo harvesting as a more important component of TGP management. Another possibility is that Barrier Ranges landholders may have interpreted the question regarding their interest in kangaroo management differently to the overall group. Having been exposed to Conservation through Sustainable Use (CSU) ideas through BRSWET, they may be more likely to see commercial management of kangaroos as a way to make reductions in livestock levels (and hence TGP) by earning alternative income, rather than seeing kangaroo harvesting purely as a way to reduce kangaroo numbers.

Key points from the discussion follow:

- On balance, a movement to a Queensland-style tag system that allowed shooters to move across property boundaries legally and respond to influxes more quickly would be a positive development for landholders in this survey. However, such outcomes may depend on the exact nature of any change in system and trade-offs would be required against some perceived negatives of the Queensland approach.

- Widespread tag swapping reduces confidence in the trace-back capacity of the system, a key quality requirement for access to markets and risk management strategy. Rather than making it illegal and therefore unmeasurable and uncontrollable, it would seem very sensible to encourage trappers to self-report when they do it without penalty.

- Some form of payment from processors appears to be the most-preferred option for landholders to obtain kangaroo income, although there is also a strong feeling that the government should be liable for the costs of kangaroos. Landholder sympathies toward shooters work against shooter payments and lack of time and money work against chiller options. The option of landholders becoming shooters also has disadvantages of time requirements and poor compatibility with existing grazing businesses. However, considering that it is currently the main way for landholders to earn income from kangaroos and was ranked highly for income potential amongst the Barrier Ranges subgroup, it may have some growth potential.

- Survey respondents were overwhelmingly positive about the need for collaboration in managing kangaroos as a resource, but careful consideration is needed in relation to how this is approached. It may be most efficient to incorporate kangaroo collaboration into existing social or land management activities, as many landholders participate in these already. Conversely, collaboration on kangaroo management may be more difficult if it takes the form of a joint business venture, both because very few landholders participate in such ventures already and because they are relatively time-consuming. Work within BRSWET also supports these notions, with much higher landholder attendance and more efficient use of time when meetings have been incorporated into social or Rangecare group events rather than being stand-alone activities.
Overall, there appears to be a reasonable level of interest in this region for landholders to take on greater management of kangaroos as an economic resource. However, considering the barriers that exist to achieving this, an active adaptive management approach that explores possible enterprise options with trial groups of landholders would appear prudent (such as that followed with BRSWET). This survey has highlighted a number of priorities for further research, including collaborative management based around existing social networks, potential payments from processors and possibly government, impact of collaborative arrangements on shooters and landholder-shooters and alternative licensing and tagging arrangements that reduce delays and facilitate the movement of shooters across property boundaries.
8. Economic modelling and business case

This chapter covers two main areas of work under BRSWET – economic modelling of collaborative kangaroo harvest management options and the development of a business case for a collaborative kangaroo enterprise based on the group involved in the BRSWET. This was undertaken in the context that landholders couldn’t expect to get something for nothing. For landholders to gain income from the kangaroos harvested on their properties, they would have to work within the current system and develop ways of adding value to the system. We have assumed that, when the extra value is recognised, the landholders could anticipate a premium price.

The economic modelling work was subcontracted to Jonathan Moss and Richard Stayner at the Institute for Rural Futures at the University of New England (UNE). The business case development was subcontracted to Peter van Herk (business and industry development consultant). This chapter also draws on work undertaken by Rosie Cooney (FATE Research Fellow at UNSW) which explored different models for landholders to share benefits from kangaroo harvesting (Cooney 2009).

8.1 Objectives

The UNE economic modelling featured the following objectives:

- Investigate the economic desirability of several different cooperative kangaroo harvesting models from the perspective of the landholders in the Barrier Area Rangecare Group (BARG).

- Determine the combination of income from conservation management, kangaroo harvesting and other sources (such as carbon credit payments) that would make the Enterprise Based Conservation (EBC) land-use option more economically attractive to landholders in Western NSW.

- Determine the sensitivity of the models to a variety of harvesting and land-use scenarios.

The key objectives of the business case analysis were:

- To develop a business framework, based on knowledge gained during the BRSWET, that described and assessed the viability of a collaborative enterprise comprising landholders and harvesters that managed harvest in the Barrier Ranges.

- To explore the achievement of quality of harvest, quality of storage and quality of processing through profit and determine membership requirements, & peer group regulation to ensure the business is reputable, consistent and reliable.

This business framework was designed to realise the income potential of improved kangaroo harvesting practices and quality, facilitate strategic alliances with processors, increase market demand, obtain regular and reliable markets, holistically manage kangaroo populations, generate income for landholders and work collaboratively with government and industry.

The discussion section (8.4) pulls the economic modelling, business case and co-operative development components together.

8.2 Methods

8.2.1 Economic modelling

The UNE economic modelling involved the construction of economic models for five proposed harvesting scenarios. A hypothetical conservation area was included for each participating property similar to the Western CMA’s Enterprise Based Conservation (EBC) scheme. This area was de-stocked of domestic stock and it was assumed that kangaroo populations would increase in these areas.
The five models explored were:

A. Landholders obtain their own harvesting licence, vehicle and equipment and operate as individuals (used as a ‘base case’ as some landholders do this already).

B. Landholders cooperatively purchase a harvesting vehicle but each pays a shooter to harvest on their own property using the vehicle (one vehicle per five properties).

C. Landholders operate as a cooperative and receive a price premium from processors for quality kangaroos and/or for the quality control of field harvest and field processing practices.

D. Landholders operate as a cooperative, running a chiller (or chillers) owned by processors. Landholders receive a margin from processors for operating chillers and a margin for quality.

E. Landholders operate as a cooperative, which purchases and runs chillers and receives a margin from processors for quality.
## Table 8.1 Baseline data and assumptions used in the models.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Data/Assumption</th>
<th>Source/Justification</th>
</tr>
</thead>
</table>
| **Property size** | Average size: 44 266 ha.  
Range: 18 000-82 000 ha | 20 properties participating in the BRSWET General Licence in 2008/09. |
| **Baseline harvest levels** | Average annual harvest per property: 685 kangaroos/yr  
Range of annual average harvests across properties: 42-1371 kangaroos/yr | 2001-2007 harvest data for the 19 BRSWET properties that harvest kangaroos (i.e. excludes Fowlers Gap) |
| **Conservation area** | Assumed to cover 23% of each property. | Average proportion de-stocked under EBC scheme (Moss 2007). |
| **Kangaroo increase in conservation area**<sup>9</sup> | Population is assumed to increase in conservation areas by up to 300% following the removal of stock. This is assumed to result in an increase of up to 300% on 2001-07 harvest levels<sup>10</sup>. This was included to show the sensitivity of the results to an increase in kangaroo numbers as a result of destocking. | 300% is conservative compared with Norbury and Norbury’s (1993) observed increase in kangaroo dung following removal of sheep (600%) and Wilson and Edwards’ (2008) estimate that removal of cattle and sheep from rangeland Australia could increase kangaroo populations by 240 million (5 to 10-fold increase on 2001-08 levels). |
| **Carcass weight** | Average: 22.5 kilograms | Stayner (2007) |
| **Size of foray** | 40 kangaroos obtained from average foray (i.e. per night) | Stayner (2007) |
| **Labour cost per foray** | 10 hours per foray @ $25 per hour = $250 per foray  
Where harvest labour is undertaken by the landholders themselves, this amount is included to reflect the opportunity cost of their time. | Stayner (2007) |
| **Capital (fixed) costs** | Total = $42 510 (mostly made up of vehicle $35 000, rack $4000, hot water unit $1500 & rifle $1000) | Stayner (2007) |
| **Interest rate on capital items** | 9.95% | Assumed that a loan is taken out covering the useful life of capital items |
| **Useful life of capital items excluding chiller and generators** | 8 years | Stayner (2007) |
| **Running costs for vehicle** | $0.65 per kilometre | Stayner (2007) |
| **Kangaroo price at chiller** | $0.80 per kilogram | Stayner (2007) |

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<sup>9</sup> De-stocked revegetation areas were assumed to provide a resource that acts as a ‘sink’ to which kangaroos are attracted (Norbury and Norbury 1993). The harvest of kangaroos from such areas was assumed to be consistent with conservation objectives (Gardiner 1986). It is recognised that, due to the highly variable and non-equilibrium nature of kangaroo populations, more complex responses would be expected that assumed in this simple population response model (Bayliss and Choquenot 2002).

<sup>10</sup> These models employed a simple assumption that the 2001-07 harvest on each BRSWET property was directly proportionate to that property’s kangaroo population. As discussed in Chapter 4, real-world dynamics are much more complex, affected by factors such as accessibility and harvester behaviour.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Data/Assumption</th>
<th>Source/Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chiller purchase and set-up costs</td>
<td>Small chiller = $11 000 Generator = $2000.</td>
<td>Assumed that a loan is taken out covering the chiller costs at 9.95% p.a. over the assumed useful life of 10 years</td>
</tr>
<tr>
<td>Chiller running costs</td>
<td>Power = $5000 p.a. Maintenance = $1000 p.a. Labour = $40 per foray (i.e. $1 per kangaroo)</td>
<td></td>
</tr>
<tr>
<td>Number of chillers</td>
<td>Minimum of three needed to service the BRWSET area spatially and capacity-wise.</td>
<td>Peter Ampt (pers. comm. 2009). Chillers assumed to have capacity of 150 carcases when storing at a rate to ensure premium quality.</td>
</tr>
<tr>
<td>Commissions and price premium for quality</td>
<td>Price premium for quality = $0.05/kg (model baseline) $0.03-0.30/kg (model range) Commission for operating a processor-owned chiller = $0.07/kg If group also owns chiller = additional $0.08/kg</td>
<td></td>
</tr>
<tr>
<td>Proportion of kangaroos for which a price premium is paid for quality</td>
<td>Baseline assumption is that price premiums apply to 20% of kangaroos harvested. Ratios of 10% and 100% also modelled.</td>
<td>Peter Ampt (pers comm. 2009).</td>
</tr>
<tr>
<td>Distribution of payments to individual members</td>
<td>For cooperative models, landholder margins were assumed to be distributed to landholder members based on the proportion of total harvest that occurred on their property.</td>
<td>Considered fairest starting point given the large variation between property harvest levels at present. Landholders undertaking shooting would receive payment for that activity as any other shooter would.</td>
</tr>
</tbody>
</table>

In addition to the five models described above, the UNE modelling work also involved development of a bio-economic model analysing a series of hypothetical income streams for UNSW’s Fowlers Gap research station (Table 8.2). A 15-year model of pasture growth and animal dynamics was used, based on the GRASP model described by Littleboy and McKeon (2005). It was adapted to include stochastic weather, flock dynamics and an economic component, as described in Moss (2008).
Table 8.2  Income parameters and assumptions for the Fowlers Gap bio-economic model.

<table>
<thead>
<tr>
<th>Income Parameter</th>
<th>Data/Assumption</th>
<th>Source/Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stewardship payment</td>
<td>$20,000 annually to manage 8,495 hectares as a conservation area (23 per cent of property)</td>
<td>Assumed to be similar to the Western CMA’s EBC scheme.</td>
</tr>
<tr>
<td>Carbon payment</td>
<td>Kangaroos emissions = 0.003 tonnes CO$_2$e/kangaroo/year.</td>
<td>Kempton et al. (1976)</td>
</tr>
<tr>
<td></td>
<td>Sheep emissions = 21.1 grams CO$_2$e per kilogram of total standing dry matter consumed.</td>
<td>Kurihara, Magner et al. (1999)</td>
</tr>
<tr>
<td></td>
<td>Agricultural emissions assumed to be included in future carbon emissions trading scheme (ETS).</td>
<td>Wilson and Edwards (2008)</td>
</tr>
<tr>
<td></td>
<td>Baseline assumption carbon prices of $23 per tonne CO$_2$e avoided (prices of $10-51 also considered)</td>
<td>Switzer (2008)</td>
</tr>
<tr>
<td>NSW Western Lands Lease Rebate</td>
<td>Rebate of $0.30/ha/annum if land is conserved. $0.45 if land is conserved in perpetuity</td>
<td>Shepherd (pers comm. 2006)</td>
</tr>
<tr>
<td>Kangaroo Population Dynamics</td>
<td>Numerical response function: $r = -a + c(1 - e^{-dx})$</td>
<td>See Bayliss (1987) for equation parameter values for red and western grey kangaroos.</td>
</tr>
<tr>
<td></td>
<td>Assumed starting population in conservation area was 878 kangaroos, rising to 2553 following removal of sheep.</td>
<td>Baseline populations based on average harvest levels across BRSWET properties 2001-07 and assumption that harvest = 15% of population.</td>
</tr>
<tr>
<td>Kangaroo pasture consumption</td>
<td>1 kangaroo = 0.35 dry sheep equivalent (DSE)</td>
<td>- Dawson and Munn (2007)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- University of Sydney (2009)</td>
</tr>
<tr>
<td>Kangaroo income</td>
<td>$0.05/kg price premium paid for each kangaroo harvested from conservation area.</td>
<td>Same baseline assumption as for models above.</td>
</tr>
</tbody>
</table>

8.2.2 Business case

The business case development (available on request from the corresponding author) involved:

- a SWOT (strengths, weaknesses, opportunity and threats) analysis for a potential Barrier Ranges Kangaroo enterprise (BaRaRoo)
- review of the kangaroo harvesting and processing chain, identifying potential opportunities for BaRaRoo to position itself
- analysis of the key factors constituting quality in the kangaroo sector;
- analysis of a potential cooperative model for BaRaRoo involving landholders and harvesters, drawing on model analysis undertaken by Cooney (2009)
- Development of a process for implementation of a cooperative kangaroo business (BaRaRoo)
- Financial analysis of key costs and income sources for a cooperative kangaroo enterprise
- Analysis of potential roles for BaRaRoo in future industry and market development in conjunction with other industry stakeholders.
The financial analysis component of the business case development drew on results obtained through the economic analysis undertaken by UNE. Collaboration between the two project managers ensured that key assumptions and data sources were complementary between the projects.

8.3 Results

8.3.1 Economic modelling

Model A (landholders acting as individual harvesters)

Of the 19 properties modelled, five show a profit when labour costs were excluded (range of profits $18 to $5361). However, with labour included as an opportunity cost to landholders, all 19 properties show negative returns (Table 8.3). Even with a three-fold increase in kangaroo numbers on conservation areas (other 77% of property is assumed to retain 2001-07 population levels), returns would be negative.

Table 8.3 Profit expected under Model A for the 19 BRSWET properties.

<table>
<thead>
<tr>
<th>Increase in kangaroo population in the conservation area</th>
<th>Number of properties that would be feasible</th>
<th>Net kangaroo harvesting business return</th>
<th>Return on capital</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Minimum</td>
<td>Mean</td>
</tr>
<tr>
<td>No increase</td>
<td>0</td>
<td>-$5657</td>
<td>-$4592</td>
</tr>
<tr>
<td>1.5-fold</td>
<td>0</td>
<td>-$5198</td>
<td>-$4005</td>
</tr>
<tr>
<td>2-fold</td>
<td>0</td>
<td>-$4736</td>
<td>-$3416</td>
</tr>
<tr>
<td>3-fold</td>
<td>0</td>
<td>-$3811</td>
<td>-$2241</td>
</tr>
</tbody>
</table>

Model B (landholders cooperatively owning vehicle)

Under this model, with one harvest vehicle shared amongst 5 properties, 18 of the 19 properties show a profit (Table 8.4). The mean annual return amongst these 18 landholders would be $1250/property/yr rising to $2707 if a three-fold harvest increase from conservation areas is achieved. This equates to an average number of harvest nights of 17.1 per property (25.3 nights if a three-fold population increase occurs on conservation areas). Thus, each shared harvest vehicle would be used for 85 nights per year (126 with population increase).

Table 8.4 Annual returns for the 18 properties where the cooperative model will be viable.

<table>
<thead>
<tr>
<th>Increase in kangaroo population in the conservation area</th>
<th>Number of properties that would be feasible</th>
<th>Net kangaroo harvesting business return</th>
<th>Return on capital</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Minimum</td>
<td>Mean</td>
</tr>
<tr>
<td>No Increase</td>
<td>18</td>
<td>$66</td>
<td>$1250</td>
</tr>
<tr>
<td>1.5-fold</td>
<td>18</td>
<td>$138</td>
<td>$1614</td>
</tr>
<tr>
<td>2-fold</td>
<td>18</td>
<td>$165</td>
<td>$1979</td>
</tr>
<tr>
<td>3-fold</td>
<td>18</td>
<td>$219</td>
<td>$2707</td>
</tr>
</tbody>
</table>
Model C (landholder cooperative receiving price premium for quality)

Assuming a premium of $0.05/kg is paid to the landholder group for 20% of the kangaroos they supply to a processor and profits are divided according to each property’s harvest level, landholders would obtain, on average, **$154/property/yr** at baseline (2001-07) harvest levels (Table 8.5).

**Table 8.5  Landholder returns from price premium payments from processor, assuming a premium for 20% of kangaroos harvested.**

<table>
<thead>
<tr>
<th>Harvest increase in conservation area</th>
<th>Landholder returns under price premium scenarios (premiums in $/kg)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$0.03</td>
<td>$0.05</td>
</tr>
<tr>
<td>None</td>
<td>$5</td>
<td>$9</td>
</tr>
<tr>
<td>Mean 1.5-fold</td>
<td>$77</td>
<td>$154</td>
</tr>
<tr>
<td>Maximum</td>
<td>$154</td>
<td>$308</td>
</tr>
<tr>
<td>Minimum 2-fold</td>
<td>$5</td>
<td>$11</td>
</tr>
<tr>
<td>Mean 2-fold</td>
<td>$86</td>
<td>$172</td>
</tr>
<tr>
<td>Maximum 2-fold</td>
<td>$172</td>
<td>$345</td>
</tr>
<tr>
<td>Minimum 3-fold</td>
<td>$6</td>
<td>$12</td>
</tr>
<tr>
<td>Mean 3-fold</td>
<td>$95</td>
<td>$191</td>
</tr>
<tr>
<td>Maximum 3-fold</td>
<td>$191</td>
<td>$382</td>
</tr>
<tr>
<td>Minimum 3-fold</td>
<td>$7</td>
<td>$14</td>
</tr>
<tr>
<td>Mean 3-fold</td>
<td>$114</td>
<td>$227</td>
</tr>
<tr>
<td>Maximum 3-fold</td>
<td>$227</td>
<td>$455</td>
</tr>
</tbody>
</table>

A premium of $0.30/kg would result in a mean return of **$925/property/year** at baseline harvest rates. Kangaroo population increases on conservation areas are not as significant as in Models A and B, but a three-fold increase on such areas would boost landholder returns by about 48% on baseline harvest levels. If premiums are obtained for 100% of kangaroos harvested by the group, then returns are five times higher than those shown in Table 8.5, with a $0.05/kg premium at baseline harvest levels resulted in a mean return of **$771/property/year** and a $0.30/kg premium with a three-fold conservation area population increase resulting in a mean return of **$6891/property/year**.

Model D (landholder cooperative operating chillers and receiving quality premium)

Table 8.6 shows results for Model D. Net returns are negative at baseline (2001-07) harvest levels with a commission of $0.07/kg for chiller operation paid on all kangaroos harvested and a $0.05/kg quality premium paid on 20% of kangaroos harvested. Even with a three-fold conservation area harvest increase, net returns remain negative. Energy is the most significant cost, followed by labour.
Table 8.6  Costs, income and net returns from Model D. *Assumes $0.07/kg commission for chiller operation (on 100% of kangaroos harvested) and $0.05/kg quality premium (on 20% of kangaroos).

<table>
<thead>
<tr>
<th>Increase in kangaroo population in the conservation area</th>
<th>Annual labour cost</th>
<th>Annual energy cost</th>
<th>Annual maintenance cost</th>
<th>Total annual cost</th>
<th>Total annual commission and premium*</th>
<th>Annual income for distribution to landholders</th>
</tr>
</thead>
<tbody>
<tr>
<td>No increase</td>
<td>$13 013</td>
<td>$15 000</td>
<td>$3000</td>
<td>$31 013</td>
<td>$23 423</td>
<td>-$7590</td>
</tr>
<tr>
<td>1.5-fold</td>
<td>$14 557</td>
<td>$15 000</td>
<td>$3000</td>
<td>$32 557</td>
<td>$26 203</td>
<td>-$6354</td>
</tr>
<tr>
<td>2-fold</td>
<td>$16 104</td>
<td>$15 000</td>
<td>$3000</td>
<td>$34 104</td>
<td>$28 987</td>
<td>-$5117</td>
</tr>
<tr>
<td>3-fold</td>
<td>$19 193</td>
<td>$15 000</td>
<td>$3000</td>
<td>$37 193</td>
<td>$34 547</td>
<td>-$2646</td>
</tr>
</tbody>
</table>

Model E (landholders own and operating chillers and receiving quality premium)

This model shows a net profit of $9662/yr for the group, assuming baseline harvest levels, a commission of $0.15/kg for chiller ownership and operation and a quality premium of $0.05/kg on 20% of harvested kangaroos (Table 8.7). This equates to a mean return of $509/property/yr.

Table 8.7  Costs, income and net returns from Model E. *Assumes $0.15/kg commission for chiller ownership and operation (on 100% of kangaroos) and $0.05/kg quality premium (on 20%).

<table>
<thead>
<tr>
<th>Increase in kangaroo population in the conservation area</th>
<th>Annual labour cost</th>
<th>Annual energy cost</th>
<th>Annual maintenance cost</th>
<th>Annual purchase and setup cost</th>
<th>Total annual cost</th>
<th>Total annual commission *</th>
<th>Annual income for distribution to landholders</th>
</tr>
</thead>
<tbody>
<tr>
<td>No increase</td>
<td>$13 013</td>
<td>$15 000</td>
<td>$3000</td>
<td>$6172</td>
<td>$37 185</td>
<td>$46 847</td>
<td>$9662</td>
</tr>
<tr>
<td>1.5-fold</td>
<td>$14 557</td>
<td>$15 000</td>
<td>$3000</td>
<td>$6172</td>
<td>$38 729</td>
<td>$52 405</td>
<td>$13 676</td>
</tr>
<tr>
<td>2-fold</td>
<td>$16 104</td>
<td>$15 000</td>
<td>$3000</td>
<td>$6172</td>
<td>$40 276</td>
<td>$57 974</td>
<td>$17 699</td>
</tr>
<tr>
<td>3-fold</td>
<td>$19 193</td>
<td>$15 000</td>
<td>$3000</td>
<td>$6172</td>
<td>$43 365</td>
<td>$69 095</td>
<td>$25 730</td>
</tr>
</tbody>
</table>

As seen in Table 8.7, a three-fold increase in kangaroo harvest on conservation areas would increase overall returns by approximately 266% over baseline levels to $25 730/yr for the group - a mean of $1354/property/yr.
Comparison of models and sensitivity analyses

Table 8.8 Comparison of models using baseline assumptions (2001-07 population and harvest levels). $0.05/kg quality premium on 20% of kangaroos is assumed in C, D & E. $0.07/kg commission for chiller operation in D and $0.15/kg commission for combined chiller ownership and operation in E.

<table>
<thead>
<tr>
<th>Landholder Returns under each Kangaroo Harvesting Models</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>-$5657</td>
<td>$66</td>
<td>$9</td>
<td>-$800</td>
<td>$31</td>
</tr>
<tr>
<td>Mean</td>
<td>-$4592</td>
<td>$1250</td>
<td>$154</td>
<td>-$399</td>
<td>$509</td>
</tr>
<tr>
<td>Maximum</td>
<td>-$3089</td>
<td>$2687</td>
<td>$308</td>
<td>-$24</td>
<td>$1018</td>
</tr>
</tbody>
</table>

Model B offers the best returns per landholder, while Models A and D have negative returns. While Model E offers better returns than C, this is partly a reflection of the fact that E incorporates the quality premiums used in C and builds on them with a chiller ownership and operation commission. Without the price premiums, Model E would still do better than Model C in the baseline analysis, but small variations in price premiums or chiller commissions could change this result.

A number of further sensitivity analyses were also undertaken. If processors only offered price premiums for smaller kangaroos (average 16 kg rather than 22.5 kg based on an assumption that younger animals have better meat quality), Model C would be most affected (a 40% decline in returns). If a lower carcass size is assumed for all kangaroos in all models, impacts are greatest for Models A, B, D & E, which would deliver negative returns under a 16 kg carcass average (C cannot become negative due to the lack of any direct costs to landholders). Conversely, an increase in average size to 25 kg increases returns by over 50% in Model E and over 100% in Model B.

Changes in chiller commissions also have significant impacts on the models. An increase in chiller operation commissions of 3-4c/kg would produce a positive return for Model D. Conversely, a drop of 2c/kg for chiller operation and 2c/kg for chiller ownership (i.e. a total of $0.11/kg rather than $0.15/kg) would push Model E into negative territory. Changes in interest rates were also explored, but were much less significant.

Fowlers Gaps bio-economic model

Under the bio-economic model developed for Fowlers Gap, the potential for increased kangaroo harvest income from a hypothetical de-stocked conservation area (8495 ha, 23% of property) was relatively insignificant compared to other income sources (Figure 8.1). The most significant hypothetical income source within the conservation area was the stewardship payment under an EBC-style scheme ($20 000/yr), followed by potential carbon payments under a future ETS ($23/tonne of CO₂e avoided) and Western Lands Lease rebates.
Increased kangaroo income made up only 1.4% of conservation area income. This was based on a bioeconomic model which showed that the kangaroo populations (and hence harvest) across this area would increase on average by almost 300% with the establishment of the conservation area (from a population of 878 to 2553). While there is actually no harvesting on Fowlers Gap at present, the assumption was made that an annual harvest of 15% of the kangaroo population would occur and that each kangaroo harvested from the conservation area would attract a $0.05/kg price premium for the landholder. Under these assumptions, the kangaroos harvested from the conservation area would provide $431 per annum on average. If only 20 per cent of the kangaroos harvested receive a $0.05 per kilogram royalty for premium quality, kangaroo harvesting in the conservation area would be expected to generate $86 per annum on average.

The carbon price used ($23/tonne of CO2-e avoided) was based on analysis of the proposed Australian ETS by The Treasury (2008). Other carbon prices were explored, including the proposed price cap for the first 5 years of the ETS ($40/tonne) and observed prices from the European ETS. An increase in the hypothetical carbon price from $23/tonne to $40/tonne would increase the contribution of carbon credits to the total profit from the conservation area from 20.19% to 30.56%. It is important to emphasise that agricultural emissions are not expected to be covered by an Australian ETS until at least 2015, if at all.
Table 8.9  Annual carbon credit income at different carbon prices for hypothetical conservation area on Fowlers Gap. \(^a\) (The Treasury 2008), \(^b\) (Ford, Gurney et al. 2009), \(^c\), \(^d\) and \(^e\) (Point Carbon 2009).

<table>
<thead>
<tr>
<th>Cost CO2 per tonne</th>
<th>Annual Carbon Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>Estimated initial price (Australian ETS)</td>
<td>AUD$23.00(^a)</td>
</tr>
<tr>
<td>Price cap (for first 5 years of the Australian ETS)</td>
<td>AUD$40.00(^b)</td>
</tr>
<tr>
<td>Lowest historical cost (European Scheme)</td>
<td>AUD$10.26(^c)</td>
</tr>
<tr>
<td>Spot price 24 February 2009 (European Scheme)</td>
<td>AUD$19.10(^d)</td>
</tr>
<tr>
<td>Highest historical cost (European Scheme)</td>
<td>AUD$51.46(^e)</td>
</tr>
</tbody>
</table>

Figure 8.2 compares expected profitability (E) and associated variability in profit (V) for seven different land-use options over a fifteen year period. This chart shows that for the case study property, kangaroo harvesting coupled with stewardship payments is a superior to the option of remaining with a traditional sheep enterprise (due to the higher expected value and lower variance). Adding carbon payments on top of stewardship payments and kangaroo royalty income would make it even more attractive.
Figure 8.2 EV analysis to determine the optimal land-use option for the case study landholder. Note that it is possible to retain a traditional sheep enterprise and still obtain a kangaroo royalty (however, due to a lower kangaroo population, this royalty will be less than if the area is destocked).

The option at the bottom-left of Figure 8.2 highlights the hypothetical results if the area was destocked for conservation but the only income obtained from it was kangaroo income (i.e. no stewardship payment or carbon income). This option would be less attractive than conventional grazing due to the lower expected profitability. However, variance in profitability under the kangaroo option is lower than for conventional grazing (due to greatly reduced costs) and this lower risk may be attractive to some landholders. If carbon credits for reduced methane emissions are included but stewardship payments are unavailable, the option of removing domestic stock and harvesting kangaroos will be more attractive than conventional grazing (higher expected income, with a lower variance).

8.3.2 Business case analysis

Table 8.10 shows results of the SWOT analysis undertaken for a hypothetical collaborative kangaroo enterprise established in the Barrier Ranges (BaRaRoo).
Table 8.10  SWOT Analysis for hypothetical BaRaRoo collaborative enterprise.

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Ecologically sustainable kangaroo resource</td>
<td>• Slow or difficult to obtain responses from landholders and trappers to communications by BaRaRoo administration</td>
<td>• If introduced stock are replaced with kangaroos as a source of income</td>
<td>• Drought continues long enough for stakeholders to lose interest due to lack of viable kangaroo harvesting numbers</td>
</tr>
<tr>
<td>• Large land holdings offering relatively stable kangaroo populations as compared to the Broken Hill and Tibboburra regional areas</td>
<td>• Significant distance between stakeholders which inhibits the ability to meet and communicate face-to-face</td>
<td>• Potential carbon credits (kangaroos do not emit methane)</td>
<td>• Loss of kangaroo meat markets - due to inconsistent quality - before BaRaRoo can secure stable long-term markets</td>
</tr>
<tr>
<td>• Simplified bureaucratic and regulatory processes in keeping with the nature of the resource and harvesting methods</td>
<td>• Lack of dedicated full-time business and market development activity (i.e. business development manager)</td>
<td>• Increased biodiversity with associated benefits</td>
<td>• Discontinuation of support for BaRaRoo on a political and financial level</td>
</tr>
<tr>
<td>• Ability to respond quickly to harvest kangaroo population influx in localised areas</td>
<td>• Relatively long timeframe before BaRaRoo can operate as a completely independent financial entity, thus requiring financial subsidy for implementation in a reasonable time frame</td>
<td>• Simplified animal husbandry and land management</td>
<td>• Discontinuation of the current General Licence and reimposition of the standard regulatory and bureaucratic framework</td>
</tr>
<tr>
<td>• High level of credible research and development by FATE</td>
<td>• Difficult to obtain leadership and commitment as members have full time commitments elsewhere</td>
<td>• Changes in market trends desiring:</td>
<td>• Low fat foods</td>
</tr>
<tr>
<td>• Excellent research, academic and political resources for continual support of BaRaRoo by the FATE program</td>
<td></td>
<td></td>
<td>• Ecologically sustainable products</td>
</tr>
<tr>
<td>• Proactive landholders and trappers desiring the objectives of increased income, sustainable land and wildlife management and reduction of bureaucratic hurdles</td>
<td></td>
<td>• Green credentials</td>
<td></td>
</tr>
</tbody>
</table>

The review of the kangaroo harvesting and processing chain highlighted potential roles for BaRaRoo in the kangaroo harvest that takes place in the paddock, along with field storage and delivery. Figure 8.3, from Cooney (2009), outlines the basic structure of such a cooperative. Figure 8.4 expands on the roles undertaken by each type of member and the potential outcomes.
Figure 8.3 Potential operating model for a landholder/harvester cooperative (Cooney 2009).

Figure 8.4 BaRaRoo co-op structure developed by Peter van Herk.
Kangaroo product quality was highlighted as a key element which a co-op such as BaRaRoo may need to target. Analysis of kangaroo industry quality issues determined that:

- **Restaurateurs and food service operators that already use kangaroo meat call for more consistent quality and this inhibits them from more active promotion. Existing buyers of kangaroo meat are variety seeking consumers who look for a point of difference and do not necessarily buy meat in supermarkets. They would buy it more often if it was in gourmet butchers and premium food distributors and outlets. The current product is not visible to them, hindering development of this market.**

- **Loin fillet is of consistent quality in terms of tenderness, but other large cuts are tougher from older (larger) animals. The industry can easily sell higher quality cuts but sells other cuts at very low prices, impacting on the profitability of the whole industry.**

- **Of the kangaroos delivered at the chiller, only a certain proportion are premium carcasses which will provide premium quality cuts of meat, but the same price is paid to the harvester regardless of the quality of carcass.**

- **A significant proportion of kangaroo meat is used in pet food or is exported but high protein filler in smallgoods, both lower-priced products. Generally, not all of the carcass is used for human consumption, as prime cuts are removed and the rest relegated to pet food. This method of processing reduces the overall value of the carcass.**

- **A good-quality carcass can be used completely for human consumption with the prime cuts being sold as large pieces, smaller cuts being sold as diced meat and mince. This is similar to beef scotch fillet, stewing steak and mince respectively.**

- **If good-quality carcasses are separated at time of delivery (or even before delivery) and processed independently to ensure the whole carcass enters the higher value markets, the carcass is far more valuable than a carcass which has mixed value or is purchased in the same batch as lower quality carcasses.**

Quality issues could be addressed by restricting harvesting on BaRaRoo properties to shooters who were Shooter Members of the BaRaRoo cooperative. This would allow for imposition of higher quality standards that are above compliance and exclusion of shooters who are unwilling or unable to implement the higher standards. The cooperative could also own chillers and include chiller operators as Members. Strategic alliances would be sought with processors interested in purchasing premium quality product from the cooperative, as well as working on industry development and marketing.

While it is expected the BaRaRoo overall number of members would be relatively stable over time, there will be people leaving and entering the business who will have vested interests in success and profitability. The initial stakeholders will have invested significant unpaid time in meetings, trials and changing of methods. This input can be considered as an investment in future business success and the stakeholders would assume to reap rewards commensurate with being founding Members. As the business evolves, new stakeholders will be capitalising on the investment of the founders and with reduced risks.

For a variety of reasons the performance of Members may rise and fall over time. A once productive member may become non-cooperative, or simply uninvolved. If this Member has part ownership of corporate assets or significant voting power the business can become dysfunctional. Such a situation can demoralise other owners who are working diligently but see their investment diluted by the uninvolved shareholders. This situation can create factions and encourage the proactive Members to form alternative business activities and structures to ensure the results of their hard work comes to them and not those who are seen as ‘bludging’. Thus, the ability for the business to be able to give and take away membership on a transparent and objective criteria is important. Table 8.11 outlines some key recommendations regarding rules for a BaRaRoo co-op.
### Table 8.11 Key issues and recommended rules for BaRaRoo co-op.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Recommended Rules</th>
</tr>
</thead>
</table>
| Landholder membership criteria | • Provision of land to the co-operative for the purposes of harvesting  
• Must allow unrestricted entry to approved trappers according to co-operative policy and codes of conduct (developed with Landholder input) |
| Shooter membership criteria    | • Minimum supply of carcasses per year (level to be determined)  
• Operates according to the adopted BaRaRoo harvesting requirements relating to quality control and Landholder relationships (as well as statutory regulations) |
| Combined membership            | • To hold each category the Member must fulfil the membership criteria of each category. A Landholder who is also a trapper contributes in two ways to the Co-Operative and is involved in two distinct commercial activities. These two commercial activities are individually eligible for the proportional disbursement of dividends/income from the co-operative |
| Voting rights                  | • Each membership confers one vote to the Member. Consequently combined membership allows for a vote for each category entitling the holder to two votes if they hold two categories. |
| Losing membership privileges   | • Membership criteria specific enough to allow objective assessment of performance. Main aim is to ensure consistency of quality and production, not to punish Members for temporary changes in circumstances.  
• Annual review of Member performance (with interim review possible if nominated by peer).  
• Review undertaken by Manager, revocation of membership decided by Board.  
• Reputations protected by confidential review (only seen by Manger and one reviewing Board member unless disputed) |
| Distribution of profits according to proportional inputs | • While other membership rules are based on fixed factors (e.g. payment of membership fee & adherence to quality standards), distribution of profits would be based on variable factors.  
• Landholder returns based on size of property, historic contribution of kangaroos to total harvest and actions undertaken to increase population and harvest levels (e.g. de-stocking).  
• Shooter returns based on number of kangaroos harvested, reliability and level of quality achieved.  
• Founding membership and start-up costs would be considered long-term liabilities of the co-op to be repaid as profits are obtained. |

Figure 8.5 outlines the key steps involved in implementing a business structure such as is proposed for the BaRaRoo co-op. Key issues that will need to addressed include the level of investment required from founding members or other sources (e.g. external funding) and the leadership of such a project, given that FATE’s leadership under the RIRDC-funded trial ceases in June 2009. Annual membership fees of around $200-300 per member have been proposed.
Financial analysis by Peter van Herk showed that higher quality standards could potentially increase chiller costs by $0.06/kg, mostly due to a lower storing rate of carcasses in chillers (110 kangaroos/chiller compared with 150 at present). A kangaroo quality premium of at least $0.06/kg would be needed to cover this cost increase. No additional harvester costs were assumed in order to implement best practice.

Over the longer-term, a premium of approximately $0.30/kg would be needed to cover the costs of a Business Development/Co-operative Manager (Tables 8.12 & 8.13).

Table 8.12 Possible annual revenue from premium pricing options.

<table>
<thead>
<tr>
<th>Possible revenue from different premium pricing</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Base information</strong></td>
<td></td>
</tr>
<tr>
<td>Historical harvest quantity</td>
<td>20,000</td>
</tr>
<tr>
<td>Expected harvest quantity</td>
<td>17,000</td>
</tr>
<tr>
<td>Average carcass weight</td>
<td>22</td>
</tr>
<tr>
<td>Total kg</td>
<td>374,000</td>
</tr>
<tr>
<td>Extra $/kg</td>
<td>$0.10 $0.15 $0.20 $0.25 $0.30 $0.35 $0.40</td>
</tr>
<tr>
<td>$ collected</td>
<td>$37,400 $56,100 $74,400 $93,600 $112,200 $130,900 $149,800</td>
</tr>
</tbody>
</table>
Table 8.13 Possible Annual Costs for Business Development/Co-operative Manager.

<table>
<thead>
<tr>
<th>Business Development/Co-operative Manager</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ease Salary</td>
<td>$60,000</td>
</tr>
<tr>
<td>Super and Workers Comp</td>
<td>$7,200</td>
</tr>
<tr>
<td>Holiday leave loading</td>
<td>$8,75</td>
</tr>
<tr>
<td>Vehicle lease</td>
<td>$9,240</td>
</tr>
<tr>
<td>Fuel</td>
<td>$6,200</td>
</tr>
<tr>
<td>Office Rent</td>
<td>$6,200</td>
</tr>
<tr>
<td>Phone and internet</td>
<td>$1,800</td>
</tr>
<tr>
<td>Travel</td>
<td>$15,000</td>
</tr>
<tr>
<td>Office costs</td>
<td>$600</td>
</tr>
<tr>
<td>Total</td>
<td>$106,116</td>
</tr>
<tr>
<td>$/kg price premium to pay for Co-op manager</td>
<td>$0.20</td>
</tr>
</tbody>
</table>

A part-time manager (most likely employed from within the landholder group) could significantly reduce costs (although not by 50%). Analysis results for this option suggested a premium of $0.20/kg would be required to cover such costs.

Given these cost factors and the desire for landholders to obtain profits from kangaroos, prices paid by processors may need to be around 36% higher than those presently paid to harvesters.

Table 8.14 Total cost analysis for a premium-quality BaRaRoo co-op.

<table>
<thead>
<tr>
<th>Costs</th>
<th>$/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proactive part time management</td>
<td>$0.20</td>
</tr>
<tr>
<td>Extra Chiller costs</td>
<td>$0.06</td>
</tr>
<tr>
<td>Desired Return to landholder</td>
<td>$0.05</td>
</tr>
<tr>
<td><strong>Total premium $/kg</strong></td>
<td><strong>$0.31</strong></td>
</tr>
<tr>
<td><strong>Existing price</strong></td>
<td>$0.85</td>
</tr>
<tr>
<td><strong>Final price $/kg sought as a minimum</strong></td>
<td><strong>$1.16</strong></td>
</tr>
</tbody>
</table>

An alternative ‘bare-bones’ option was also considered in which the only costs were one-off co-op establishment ($9000 for a consultant) plus annual costs ($9100 p.a.) for a coordinator who was employed to handle tags and prepare reports to DECC only. The costs of this model would come close to being covered by membership fees of $200-300, but would not offer resources to develop quality assurance standards or to maintain collaborative relationships with processors.

Another alternative option would be for BaRaRoo co-op development to be undertaken as part of a much larger research and development project. This could include working with a processor partner to
analyse key factors in ensuring quality supply, as well as trialling different approaches to the marketing of premium quality kangaroo with branding from the BaRaRoo co-op. This would involve the development of quality guidelines and marketing strategies. It would have the advantage of requiring only a small number of harvesters and a small quantity of kangaroo meat to test options that could be taken up by the broader group. Indicative costs for a two-year project to implement such a project are $200 000-400 000 total.

8.4 Discussion

Economic analysis showed that landholders becoming harvesters themselves offered the greatest economic returns, but only if they could share the key capital expense of a harvest vehicle (Model B). Landholders becoming harvesters and each owning a harvest vehicle (Model A) showed negative returns because the low levels of harvest available on a single property did not justify investment in a dedicated harvest vehicle. However, the option of landholders sharing a vehicle across properties has several practical difficulties, including access to the vehicle and lack of flexibility in harvesting. In practice, most landholders who undertake kangaroo shooting share a vehicle between their kangaroo harvesting activities and their other farm enterprises.

The option of chiller ownership and operation (Model E) showed medium levels of profitability. Chiller operation alone (with chiller owned by a processor - Model D) was unlikely to offer a positive return due to the investment of labour required relative to commission levels. While relatively profitable, Model E was highly susceptible to changes in carcass weight and processor commissions, indicating that chiller ownership could end up being a net liability for landholders if decreases in either of these factors occurred.

The option of processor price premiums for quality (Model C) produced quite low levels of return under baseline assumptions ($0.05/kg premium and no population increase). Much higher premiums (~$0.30/kg), combined with population increases on conservation reserves, would be required in order to make this option a particularly attractive one for landholders. This is further emphasised by the findings of the business case analysis which showed that premiums of around $0.26-0.36/kg would be required just to cover the costs of a co-op manager, before any profits were disbursed to members. A co-op could be established without such a manager, although price premiums for quality would be much less likely without someone to ensure compliance with quality standards and to handle the relationship with processors.

It is also important to note that the models explored are cumulative. Those involving landholders shooting (Models A and B) could be added onto Model C to benefit from quality premiums as well or onto Model E to benefit from the full range of profits from shooting, chiller ownership, chiller operation and quality price premiums.

Overall, these results reflect some of the findings of the landholder survey (Chapter 7). Chiller options were least-preferred by surveyed landholders, reflecting the high set-up costs and potential risks shown here through the economic sensitivity analyses. Taking up shooting was found in the survey to be the most common way for landholders to earn kangaroo income at present and surveyed landholders in the Barrier Ranges also felt this option provided the greatest potential for returns. However, this contrasted with overall WCMA landholders, who felt that processor payments offered a better potential for returns. This difference may be due to Barrier Ranges landholders having looked at this option more closely, but it should also be noted that processor payments were considered “best overall” by both Barrier Ranges and WCMA landholders. The economic analysis indicates that this could be due to the lower risk to landholders under this option, as returns from processor premiums can only diminish but not become negative. Such attitudes could change if landholders were asked about their willingness to pay for a co-op manager to help them obtain such premiums.

The bio-economic model developed for Fowlers Gap indicated that, while kangaroo income combined with either stewardship payments or carbon credits offers a viable alternative to conventional grazing, this was mostly due to the income from stewardship payments or carbon credits, with kangaroo income being a minor component. Kangaroo income on its own would be unlikely to offer a better return than conventional stock grazing. Furthermore, the model showed that kangaroo income would
be unlikely to “tip the balance” toward conservation management rather than conventional grazing, as either stewardship or carbon payments would be able to do this on their own.

However, despite their lower profitability compared with conventional grazing, kangaroo enterprises do appear to have less variable profitability for landholders (mainly due to the lower investment costs involved). This may be appealing to some landholders who are seeking a lower-risk option but cannot obtain stewardship or carbon payments. As indicated in Chapter 4 (harvest statistics), collaboration with one’s neighbours has the potential to further lower such variability in kangaroo income.

Future funding decisions will determine the extent to which large numbers of landholders can access stewardship payments through EBC. Under the original West 2000 Plus pilot EBC scheme ten landholders were paid an average of about $65 000 each to undertake strategic grazing only on land managed for conservation. Western CMA took over the scheme which now has 60 000 hectares under conservation agreements with nine additional landholders at a total cost of $4.1 million. WCMA has bids in to the Caring For Our Country Investment program to continue and extend the scheme and in addition is seeking philanthropic contributions. Landholders who have already entered the scheme have clearly benefitted, but it is probably unrealistic to assume that the scheme will ever benefit a majority of landholders. As a result more direct commercial market arrangements that are not subject to public funding will remain the best available option in the foreseeable future.

The option of a landholder/harvester cooperative explored in the business case analysis has many appealing traits, as was confirmed by several harvesters and landholders at the BRSWET Workshop in February 2008 (see Chapter 9). These include low set-up costs, simple structure, provisions for entry and exit and mechanisms for differential distribution of profits according to resources invested. The main difficulty for a co-operative enterprise based around obtaining price premiums from processors is that the level of coordination involved is likely to require a costly co-op manager. Thus, such a group is likely to require continued subsidisation (unsustainable in the long-term) or be able to demonstrate very significant advantages for a processor in terms of quality assurance and/or marketing opportunities.

Another issue that the Steering Committee viewed as a problem was the restriction in the number of Fauna Dealers Licences (FDLs). This means that any landholder group wishing to ‘own’ and trade in kangaroo carcasses would need to reach agreement with an existing FDL holder to operate under their licence. Whilst the Tilpa Rangeland Investment Corporation successfully applied for their own FDL some years ago, and DECC has previously undertaken a review of the FDL policy, this remains a barrier to innovation in the value chain.

A summary of the key points from the discussion follows:

- Landholders becoming harvesters may be the best option in terms of economic returns, but requires the greatest investment of time and labour. The option of processor price premiums for quality showed quite low levels of return under economic analysis. Very high premiums (~$0.30/kg) are likely to be required in order to make this option an attractive one for landholders.

- The option of a landholder/harvester cooperative has many appealing traits, including low set-up costs, simple structure, provisions for entry and exit and mechanisms for differential distribution of profits according to resources invested.

- The business case analysis showed that high price premiums would be required just to cover the costs of a co-op manager, before any profits were disbursed to members. A co-op could be established without such a manager, although price premiums for quality would be much less likely without someone to ensure compliance with quality standards and to handle the relationship with processors. Thus, such a group must be able to demonstrate very significant advantages for a processor in terms of quality and/or marketing or will require continued subsidisation.
From economic analysis, it would appear that chiller options could offer good returns for a committed and well-managed landholder group, but this needs to be balanced against negative attitudes towards chiller options revealed through the landholder survey discussed in Chapter 7.

Land-use options based on stewardship payments, carbon credits and kangaroo income could be more attractive than conventional grazing. However, kangaroo income would only be a small component of this and would unlikely to ‘tip the balance’ towards conservation management.

The ways in which the findings of this chapter can be used are largely controlled by the processors and will be dealt with in the next Chapter.
9. Kangaroo industry responses

This chapter deals with the interaction between the project and the kangaroo industry as a whole, bringing relevant activities within and beyond this project into the picture. We viewed the existing kangaroo industry and its various components as a complex human activity system that has evolved over several decades and has been quite resilient in the face of factors that impact on the system. In fact, much of the resistance that we encountered throughout the project can be related to industry players having worked very hard to keep the industry going and being sceptical about interventions such as this project. If we were to have accepted the wisdom of key industry players in the beginning we would not have embarked on the project. Whilst the industry remains resilient in the face of the change that we were exploring, we remain confident that change along the lines this project has moved can be good for the industry in the long run, but perhaps the time is not now.

9.1 Objectives

- To develop knowledge and understanding of the way the kangaroo industry works nationally and locally.
- To bring that knowledge to the participants within the project so that it can influence the direction of the trial (AM principles).
- To use that knowledge to generate research questions that can help develop the industry.

9.2 Methods and results

The key activities that inform this chapter are summarised in Table 9.1. The overall project methodologies described in Chapter 3 were used to bring knowledge and understanding of the industry to the trial participants. The development of research questions that can help further develop the industry flow from FATE’s analysis of the industry gained through our engagement with the key activities.

White Cliffs Landcare Forum participants at Mound Springs
Table 9.1 Key project activities that build knowledge of the kangaroo industry.

<table>
<thead>
<tr>
<th>Key Activity</th>
<th>Timing/ frequency/ duration</th>
<th>Description</th>
<th>Summary of results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry analysis by FATE prior to BRSWET</td>
<td>Began with FATE’s inception at the Australian Museum in 2002 and continued through the BRSWET.</td>
<td>Scoping study completed by George Wilson for FATE in 2003, Consultation with industry figures, FATE Marketing think tank in Broken Hill 2003 culminating in publication (Ampt and Baumber 2006).</td>
<td>Lack of landholder involvement in the kangaroo industry prevents it from generating benefits of conservation through sustainable use (CSU) and it continues despite calls for change. FATE outlined a case for change and set about trialling it. See Chapter 1 for a more detailed summary.</td>
</tr>
<tr>
<td>‘Choosing Kangaroo’ Project</td>
<td>Preliminary Proposal submitted to RIRDC New Animal Products Program September 2006, funded 2007 and completed 2008.</td>
<td>Steering Committee including KIAA, a kangaroo processor and a small goods manufacturer, consumer survey using discrete choice methods, manufacturer and retailer survey using semi-structured interviews culminating in a final report</td>
<td>Final report (Ampt and Owen 2008) stated that domestic kangaroo meat consumption is increasing slowly among mostly ‘variety seeking’ urban consumers, kangaroo meat is barely considered by mainstream meat manufacturers and retailers, mince is a key potential growth area, widespread misconception that kangaroos are farmed, weak links in the value chain occur around harvest and immediate post-harvest.</td>
</tr>
<tr>
<td>Shooters’ meeting</td>
<td>August 2006</td>
<td>Attended by 15 shooters and two processors</td>
<td>Strong suspicion and scepticism about the project was expressed forcefully by a vocal minority of shooters that: landholders ‘wanted something for nothing’ and; FATE were trouble-makers that would damage the industry. Some of the less vocal participants ultimately became involved in the Steering Committee.</td>
</tr>
<tr>
<td>Key BARG meetings</td>
<td>November 2005, August 2006</td>
<td>Well attended meeting at which FATE and consultants outlined plans and story of Tilpa Rangeland Investment Company was told. Well attended meeting after Project commenced and following Shooters’ meeting.</td>
<td>Provided the level of support needed to complete the full RIRDC proposal and generated the resolve to work with FATE to explore avenues for landholder involvement. Established Steering Committee, provided permission for FATE to access harvest data, passed three key resolutions that opened the way collaboration with harvesters.</td>
</tr>
<tr>
<td>Steering Committee</td>
<td>Established Oct 06, met 14 times either face-to-face or teleconference</td>
<td>Landholder, Harvester, WCMA and FATE representatives. Made decisions about General Licence and on-going strategy on behalf of other participants. Forum for discussing harvest, chiller and processor practices.</td>
<td>Whilst they have their differences, landholders and harvesters have strong interests in common and working together can generate opportunities that are resisted under the present industry structure. Examples of undetected non-compliance with existing regulations were described. Through a co-operative arrangement, the delivery of strong compliance is possible and there is clear potential for delivery of quality above compliance.</td>
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</tbody>
</table>
Table 9.1—continued  Key project activities that build knowledge of the kangaroo industry.

<table>
<thead>
<tr>
<th>Key Activity</th>
<th>Timing/ frequency/ duration</th>
<th>Description</th>
<th>Summary of results</th>
</tr>
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<tbody>
<tr>
<td>SWE Workshop Broken Hill</td>
<td>Feb 2008, 50 participants (see appendix C for full list of attendees).</td>
<td>Brought together key processors, regulators, harvesters, landholders and researchers from NSW, Queensland and South Australia in an historic meeting.</td>
<td>Outcomes were: Landholders and harvesters need to work together on their common interests and should work towards a national kangaroo grower and harvester association; there is a need for greater transparency and understanding of each others’ interests which could generate considerable benefits to the industry; there are ways for landholders and harvesters to add value to the industry and: commercial and regulatory models being developed through SWE projects may have broad applicability. For a full report of the workshop see Appendix C.</td>
</tr>
<tr>
<td>Kangaroo industry development activities</td>
<td>Two events during 2008 following release of ‘Choosing Kangaroo’ report (Ampt and Owen 2008).</td>
<td>Chef’s Roundtable on Kangaroo meat at ‘Wildfire’ Restaurant, Circular Quay, Sydney May 2008. 12 Chefs attended DSRD event at State Parliament in Sept 2008 hosted by Lindey Milan with a panel including KIAA President, Native food advocates and FATE Manager, involving five high profile chefs and attended by 70 food trade and food media guests and 80 others.</td>
<td>There was a high level of interest from the chefs and food service people present in kangaroo as a meat and the story behind kangaroo. Long-term celebrity chef supporters of kangaroo meat presented favourite dishes, experts discussed issues following questions from the floor. The event generated very strong support for kangaroo meat with 87% reporting improved perceptions and 94% of trade people likely to use it. Need expressed for more marketing and a premium line with clear regional and quality attributes. Described risk to businesses due to the relative invisibility and inconsistent quality of existing products. There is a strong potential for significantly higher prices to be paid for premium product.</td>
</tr>
<tr>
<td>NLIS project</td>
<td>Meeting held in Sydney in Feb 2009 to demonstrate potential for a particular inventory system to trace-back from point of sale to origin.</td>
<td>Organised by Qld DPI and attended by processors, regulators, researchers and harvester/chiller operator and hosted by technology company.</td>
<td>Meeting recognised the need for trace-back and were impressed by the potential of the technology that was demonstrated to achieve it. The possibility of linking harvest regulation to trace-back was discussed and viewed as desirable but considered unlikely due to cost.</td>
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<tr>
<td>Informal contact</td>
<td>Numerous phone and face-to-face conversations with harvesters and landholders during the trial.</td>
<td>Anecdotal reports of tag swapping and other ways of working around the regulatory system and instances of illegitimate harvester and processor practices.</td>
<td>Tag swapping and bringing in extra shooters under a single Trapper’s Licence are accepted ways that harvesters deal with large influxes of kangaroos on their ‘territory’. Property specific tags and penalties for tag swapping do not deter this.</td>
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</table>
9.3 Discussion

The landholder and harvester support for BRSWET which was established through BARG, shooters’ and Steering Committee meetings and facilitated by the research officer was critical to the instigation and implementation of the project.

Industry responses to BRSWET have changed during the life of the project. Whilst harvesters, processors and other industry representatives repeatedly expressed scepticism and suspicion, they have engaged on various levels with the project and the FATE Program as demonstrated by the activities in Table 9.1 above. The project has clearly been a stimulus for significant discussion in the industry and time will tell whether this has a lasting impact. Whilst many of the industry’s concerns with the approach we have taken have proven to be legitimate and accurate, others have been the result of misinformation and rumour. A key benefit of engaging with the industry over the period of the trial has been that areas of confusion and suspicion have been worked through.

For example, the strident and forcefully articulated suspicion from some harvesters towards the landholders and FATE personnel (expressed at the Shooters’ Meeting) did not prevent key harvesters from joining the Steering Committee. In a key BARG meeting (August 2006) immediately following the Shooters’ Meeting, landholders acted swiftly to pass three resolutions that clearly stated intentions to try and slow the rumour mill of misinformation that had stirred up the Shooters’ Meeting. These resolutions were:

**Resolution 1:**

The intention of the BARG/FATE group is to work in collaboration with trappers and processors to improve the flexibility, stability, consistency and security of kangaroo harvest across the participating properties. It is not the intention of the group to charge shooters and/or processors access rights or kangaroo royalties.

**Resolution 2:**

The meeting has agreed that the best approach for the project would be for the BARG/FATE group to create a model that would ultimately provide better services and advantages for trappers, processors and landholders through managing harvest quota and tags, coordinating shooting activities across properties and ensuring secure supply for processors.

**Resolution 3:**

This meeting of the BARG/FATE group recognizes there are significant barriers in the existing kangaroo management program to landholders having the ability to collaborate and to undertake strategic planning of kangaroo harvests. The meeting supports and requests that Peter Ampt and Alex Baumber act on their behalf in discussions with the Department of Environment and Conservation on the future development of an adaptive management trial that removes these barriers.

Harvester representatives on the Steering Committee were open and forthcoming in their views and brought a depth of knowledge and understanding of the industry from their point of view to the discussion. As several of the harvesters have been in the industry for many decades and have a long history of working with the processors, and some also managed chillers, the process yielded useful information and understanding. It made it possible to develop scenarios whereby a cooperative group of landholders and shooters could undertake many of the harvest management activities currently done under difficult circumstances by processors. If such a group was able to guarantee access to a dedicated and skilled group of professional harvesters, risk of non-compliance with existing regulations would be significantly reduced, and with little additional effort, the achievement of a consistently higher quality product, above compliance, should be possible.
The industry co-operated with and provided in-kind support for the ‘Choosing Kangaroo’ project (Ampt and Owen 2008), which provided clear recommendations in terms of uses for kangaroo manufacturing meat and marketing strategies. It also recommended action on:

- correcting the public misconceptions regarding how kangaroos are produced and harvested
- addressing the lack of confidence in kangaroo meat from meat processors and retailers because of its relative invisibility and doubts about quality.

These recommendations, the other findings generated by BRSWET and our analysis of the future of the industry suggest that quality management in the value chain and the positive practical and public relations role that landholders could play in the industry are key issues. These issues were discussed in detail at the SWE workshop in Broken Hill in February 2008. Processor representatives at that workshop maintained a unified front that the industry had quality sorted and that business as usual was fine, but individual processors approached FATE afterwards to express off-the-record support. KIAA representatives also expressed agreement regarding the approach we were taking through BRSWET, including acceptance of the potential role of landholders and the importance of developing the domestic market.

**Participants in the Broken Hill Workshop, February 2008**

The industry development activities in which FATE was an instigator or key participant have reinforced the recommendations of the Choosing Kangaroo project. It is clear that resistance to kangaroo meat exists but it is a small proportion of the population and is overwhelmed by those that already accept or are open to it. It is also clear that current kangaroo consumers are variety seekers, a consumer group that are willing to try new things and are prepared to pay for what they want. In contrast, the industry structure is biased towards kangaroo as a commodity rather than a desirable product with strong positive attributes for which consumers may be prepared to pay a premium price.
In the domestic market, eating kangaroo is not yet mainstream or ‘normal’. In this respect kangaroo meat is still a niche product. It is clearly risky to try to generate a premium quality niche product out of a niche industry. Existing processors have looked at it and apparently judged that it is too risky. Any premium line will need to establish a point of difference to achieve a premium price in the market. To do this the commodity product will need to be de-valued in the eyes of the prospective consumers of the premium product. This flies against the kangaroo industry’s position of supplying a well-regulated quality product. Under this logic, processor reluctance to embrace premium quality is understandable. However, business as usual from the industry will mean continued slow adoption domestically and increasingly risky reliance on exports. This was reinforced in discussions that took place with industry leaders at Kangaroo Industry Development activities.

Evidence suggests that existing quality standards and practices are holding the industry back both from its existing variety-seeking consumers and from more conservative potential consumers. Australians have shown that they can embrace new eating habits. New ethnic cuisines, for example, have apparently started with variety seekers in inner city suburbs and spread to the broader population. The food industry is saying that it is unsure about the visibility and reliability of kangaroo meat. Consumers are saying that they are open to it but it is not visible or familiar enough. Variety seekers are the same demographic that looks for a story behind their purchases, and existing consumers include ‘kangatarians’ – people whose only meat of choice is kangaroo due to health and animal welfare considerations. Premium lines exist in other industries and have been successful in generating low volume, high value products. Mainstream supermarkets have picked up many of these products after they have proved to have established a market. The kangaroo industry would appear to be well placed to explore these possibilities and generate a different future.

This project has identified existing short comings in the value chain and has show that there is potential for local management, by landholders and harvesters, to overcome those shortcomings. Further, local collaboration supported by the processor side of the industry could develop a pilot premium line that could be compared to the regular line. From this process the potential market for a differentiated product could be determined.

Even if the existing industry chooses to ignore or fails to support these opportunities, the NSW regulator could make it possible for local groups to develop small-scale regional enterprises that are independent of the commodity industry. By issuing additional fauna dealer licences to local co-operatives, the regulator could open the way to innovative approaches that would need to survive in the market place in parallel to the existing industry. This would allow the development of enterprises that deliver low volume premium products directly to select markets within the existing industry structure.
10. Discussion

This chapter is divided into three sections. The first addresses the performance indicators identified in the adaptive management plan submitted to DECC, describes the key findings and identifies where they are dealt with in the report. The second picks up on discussion points from Chapters 4-9 and integrates them. The third is a description, from a book chapter about the BRSWET, which describes the nature of the problem situation.

10.1 Achievement of performance indicators

Table 10.1 Achievement of performance indicators.

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<thead>
<tr>
<th>Performance Indicator</th>
<th>Key Finding</th>
<th>Data Sources</th>
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<tr>
<td><strong>5.1.1</strong> Success in obtaining a joint General Licence and the number of landholders choosing to participate.</td>
<td>• Three General Licences were obtained over the course of the trial, with the number of landholders relatively high (16 for GLs 1&amp;2 and 15 for GL 3).</td>
<td>• Adaptive Management Group Licensing Trial (Chapter 5)</td>
</tr>
<tr>
<td><strong>5.1.2</strong> Landholder and shooter satisfaction with the methods of distributing tags and access rights amongst shooters.</td>
<td>• 1/3 landholders and 2/3 harvesters said tags were more readily available under this system and this was supported by responses to this question at Steering Committee meetings. • Landholder survey showed that issues relating to the normal tag/licensing system were perceived to be the greatest barriers to effective control of kangaroo grazing and landholder entry into the industry.</td>
<td>• Post-trial interviews (Chapter 5) • Landholder survey (Chapter 7)</td>
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<tr>
<td><strong>5.1.3</strong> Number of transactions required for shooters to obtain tags throughout the year and the time taken between landholder/shooter identifying need for harvest and obtaining necessary tags.</td>
<td>• In the trial year, there were 5.3 tag transactions required per 1000 kangaroos harvested. This compares with 3.8 transactions per 1000 kangaroos for 2001-07. • The higher number of transactions indicates that the option of using tags across several properties did not reduce administrative load. However, it may have more to do with the fact that shooters could get tags all month and thus may have sought them in smaller batches. • It proved impractical to measure the exact time that a need for harvest was identified (also, such data is not collected under the normal system for comparison). • Some delays in obtaining tags were encountered due to the part-time nature of the local coordinator position. However, this was not considered a problem by the shooters.</td>
<td>• Adaptive Management Group Licensing Trial (Chapter 5) • Post-trial interviews (Chapter 5)</td>
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<tr>
<td>Performance Indicator</td>
<td>Key Finding</td>
<td>Data Sources</td>
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| **5.1.4** Desire to continue with group licensing arrangements following the end of the initial trial at the end of 2008. | • Landholders and shooters were willing to continue under group licensing arrangements. However, administrative costs were prohibitive in the absence of additional funding.  
• In the landholder survey, 92% (both overall and in Barrier Ranges) felt that collaboration was a good idea and should be encouraged. | • Post-trial interviews (Chapter 5)  
• Landholder survey (Chapter 7) |
| **2.2** Perceived effectiveness of collaborative response to localised population increase events. | • Landholders indicated that there were no substantial influxes during the trial period to test the response. However, a significant influx late in the trial on a district property was reported. The harvester was able to harvest heavily using tags issued for neighbouring properties, a clear and specific example of tag swapping of benefit to shooter, landholder and environment.  
• Harvest data suggests that the trial posed no barrier to successful harvest response (increased harvest compared to 2007, while overall KMZs declined).  
• Landholder survey showed current regime is perceived to have mixed effectiveness (20% effective, 18% not effective, 62% partially) | • Landholder consultation (Chapter 9)  
• Harvest data (Chapter 4)  
• Landholder survey (Chapter 7) |
| **2.2** Number of landholders in the group trained in LFA and number of landholders undertaking LFA transects on their properties. | 9 landholders representing 6 properties were trained in LFA. A number have reported applying LFA principles on their properties, but not the formal undertaking of LFA transects. | • LFA training (Chapter 6) |
| **2.3** Success in setting up representative LFA sites for each major rangetype which are monitored at least once annually. | Key rangetypes across the BRISWET area were identified and an outline of a group monitoring program was developed. Benchmark data was obtained for representative sites on some rangetypes. | • LFA group monitoring (Chapter 6) |
| **2.4** Degree to which landholders are prepared to share data on other aspects of total grazing pressure through cross-property GIS. | AEMS did not deliver on the proposed cross-property GIS. Future data-sharing would be dependent on the adoption of a group monitoring strategy. | • LFA group monitoring (Chapter 6) |
| **3.1** Success of landholders in the group in obtaining a commercial return from kangaroos harvested under the trial | • Landholder group was not successful in obtaining commercial returns during the trial. This was due to the short trial duration, low demand for kangaroo during the period and scepticism of some processors.  
• Economic modelling suggests landholders becoming shooters holds highest income potential, followed by joint chiller ownership. Payments from processors for quality assurance hold good potential if | • Landholder/harvester consultation (Chapter 9)  
• Economic modelling (Chapter 8)  
• Landholder survey (Chapter 7) |
<table>
<thead>
<tr>
<th>Performance Indicator</th>
<th>Key Finding</th>
<th>Data Sources</th>
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<td>premiums are large (30c/kg) and apply to all kangaroos harvested.</td>
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<td>• Surveyed landholders ranked processor payments highest, with chiller options very unpopular.</td>
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<td>• Current landholder income from kangaroos is very low (5.5% report minor income, mostly from shooting).</td>
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<tr>
<td>3.2 Success of landholders in devising a method of distributing economic returns amongst themselves collaboratively.</td>
<td>• As no kangaroo income was obtained, no distribution occurred.</td>
<td>• Business case (Chapter 8)</td>
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<tr>
<td></td>
<td>• Cooperative model explored offered strong potential as an option for distributing returns.</td>
<td>• Stakeholder consultation (Chapter 9)</td>
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<td></td>
<td>• Different roles need to be considered in distributing returns (shooting, chiller operation, harvest management and landholders with high harvest and low harvest properties).</td>
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<tr>
<td>4.1 Change in perceptions of kangaroos as a resource amongst participating landholders.</td>
<td>• Landholder survey found that dominant perception of kangaroos is “can be a problem at times”, with “pest” and “potential resource” roughly equal.</td>
<td>• Landholder survey (Chapter 7)</td>
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<td></td>
<td>• Post-trial interviews (Chapter 5)</td>
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<td></td>
<td>• Landholder consultation (Chapter 9)</td>
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<tr>
<td>4.2 Involvement of participating landholders in managing land for conservation under the Western CMA’s Enterprise-based conservation program and the degree to which collaboration and income from kangaroo harvesting has influenced their decision-making</td>
<td>• Current involvement in EBC program amongst landholders surveyed was 6% across WCMA area and 7% in Barrier Ranges.</td>
<td>• Landholder survey (Chapter 7)</td>
</tr>
<tr>
<td></td>
<td>• No direct impact from kangaroo income observed as income from kangaroos not obtained in trial.</td>
<td>• Economic modelling (Chapter 8)</td>
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<td>• Economic modelling suggests kangaroo income combined with either stewardship payments or carbon credits offers a viable alternative to conventional grazing. However, this is mostly due to the stewardship or carbon income, with kangaroo income being a minor component.</td>
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<td>4.3 Reported conservation actions by landholders involved in the trial such as reducing stock numbers to conserve key areas and protection of native vegetation mosaics that promote biodiversity</td>
<td>• Surveyed landholders reported the following major conservation actions: commercial kangaroo shooting (90%), spelling paddocks to allow regeneration (89%), harvesting feral goats (71%).</td>
<td>• Landholder survey (Chapter 7)</td>
</tr>
<tr>
<td></td>
<td>• Significant shifts in behaviour were not reported as a result of the licensing trial (due to the short duration and lack of kangaroo income).</td>
<td>• Post-trial interviews (Chapter 5)</td>
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<tr>
<td></td>
<td>• Changes in interpretation of land condition and triggers for management intervention were reported as a result of LFA training.</td>
<td>• LFA training (Chapter 6)</td>
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10.2 Discussion to integrate Chapters 4-9

Participation of landholders in the kangaroo industry

This trial has confirmed that landholders in the arid and semi-arid rangelands continue to derive most of their declining on-farm income from conventional pastoral activities and goat trapping. The few landholders that are involved in the Enterprise Based Conservation Scheme receive a ‘stewardship’ payment for managing for conservation, but apart from that, engagement in economic activities serving established markets remains the key on-farm income generating activity.

The trial also confirms that the extent to which landholders are active participants in the kangaroo industry remains minimal. The nature of that participation for the vast majority is to apply for an Occupiers Licence and provide access to licensed trappers. A very small number are part-time trappers, mostly on their own properties, and an even smaller number own and / or manage a chiller.

This trial also sheds significant light on the reasons why landholder participation is so low. The key barriers from the landholders’ point of view to their gaining income from kangaroos are government control over kangaroo management, perceived attitudes of city people to kangaroos and industry opposition to their involvement in that order. The trial worked closely with landholders and harvesters and gained their support and co-operation to test a new strategy for making government control less of a barrier. In the process, other aspects of regulation were scrutinised sufficiently to reach the conclusion that the system of regulation that has evolved could be much better both for landholders and trappers. Recent consumer research cited in this report challenges the view that city attitudes are a barrier, but the perception of industry opposition was reinforced during the trial.

While landholders ranked the price of kangaroo products as less of a barrier, this trial has shown that the price offered by processors at the chiller door leaves little or no margin for landholders to generate any income. It is clear that unless the legislation is changed to make payment of a royalty to landholders mandatory (a highly unlikely and probably undesirable scenario), landholders will have to add value to the process or product to have any chance of earning a price premium from processors.

The data collected on historic harvest on participating properties and the harvest data from the trial of the group licence provided further reasons for the lack of landholder involvement. Extreme harvest variability was evident at a property level for most properties, and the low per property harvest showed that it is extremely unlikely for an individual property to generate a large or consistent enough harvest to justify the expense of setting up an enterprise. This was reinforced by the economic modelling. Only those properties that had a consistently high harvest could begin to justify the expense.

The potential of multi-landholder co-operation and collaboration with harvesters

The trial provides evidence that, while the potential for a landholder to act individually is very low, there is a strong case that collaboration between neighbours may be the key to their ability to add value to the industry, and thus to generate some income from kangaroos harvested from their properties. This was reinforced by the harvest data which shows that group harvest variability is much less than that for individual properties.

Key pieces of evidence included:

- Much evidence for the benefits of landholder collaboration was obtained.

- Harvest analysis shows that collaboration has significant potential to reduce the exposure of landholders to harvest variability. This could have benefits both in terms of reduced exposure to business risk for a kangaroo enterprise and greater ability to respond to highly variable influxes of kangaroos onto a single property.

- Landholder survey results also showed positive attitudes to collaboration amongst landholders.
• The trial showed that a group of landholders and shooters can successfully manage the allocation of harvest tags amongst themselves. This was apparent in the fact that the group expressed a desire to continue if funding for administrative costs could be obtained. The group also increased their harvest on 2007 levels while the rest of the region was in decline overall. This shows that group licensing was not a burden on the ability of shooters to harvest.

• However, quotas were not threatened in 2008/09 and it is unknown how well the allocation of tags would hold up under such a circumstance (i.e. would conflict emerge?).

In consultation with stakeholders, the trial pursued the potential of collaboration further by developing a group licence and tag allocation system, conducting economic modelling on several collaboration scenarios and developing a business case for a kangaroo harvest management co-operative. Whilst these initiatives still require refinement, they are sufficiently well developed to become a starting point for the BARG group and others to develop a collaborative enterprise.

A significant aspect that had already emerged was the strong potential for collaboration to generate mutual benefit between a group of landholders and the harvesters that operate on their properties. There had been a significant shift in attitude between landholders and harvesters during the progress of the trial from scepticism and suspicion to openness and a willingness to contribute constructively. Close contact between landholders and harvesters in the trial steering committee revealed the extent of the common interests of both. This was taken further with the development of a model co-operative that included both groups and incorporated chiller management and ownership.

This model provides significant possibilities, not just for better kangaroo management and potential income for the business, but for improvement in quality, both within and beyond compliance. It raised the possibility of the group taking over the role of field manager now paid for by processors (thus reducing their costs) while providing better quality control. This concept was originally suggested by a processor’s field manager and a small-scale processor and enthusiastically received by the stakeholder meeting held in Broken Hill in February 2008. A key to its success would be that, as members of the co-operative, harvesters and chiller operators would have a vested interest in its success and the group could control who is involved.

Lessons on income potential of kangaroos and collaborative business structures included:

• This trial was unable to obtain returns for landholders for a number of reasons, the most critical being its short duration, a severe industry downturn and resilience of the existing system to change. However, the trial generated additional knowledge from which, landholders, harvesters, regulators and processors can benefit.

• The option of a landholder/harvester cooperative has many appealing traits, including low set-up costs, simple structure, provisions for entry and exit and mechanisms for differential distribution of profits according to resources invested.

• The main difficulty for a co-operative enterprise based around obtaining price premiums from processors is that the level of coordination involved is likely to require a costly co-op manager. Thus, such a group is likely to require continued subsidisation (unsustainable in the long-term) or be able to demonstrate very significant advantages for a processor in terms of quality assurance and/or marketing opportunities.

• The option of processor price premiums for quality showed quite low levels of return under economic analysis. Very high premiums (~$0.30/kg) are likely to be required in order to make this option a particularly attractive one for landholders. This is further emphasised by the findings of the business case analysis which showed that high premiums would be required just to cover the costs of a co-op manager, before any profits were disbursed to members. A co-op could be established without such a manager, although price premiums for quality would be much less
likely without someone to ensure compliance with quality standards and to handle the relationship with processors.

- From economic analysis and the landholder survey, it would appear that chiller options are risky and expensive, but could offer good returns for a committed and well-managed landholder group. These options were least-preferred by surveyed landholders, reflecting the high set-up costs and potential risks shown through the economic sensitivity analyses.

It was a perhaps overly optimistic hope that, by the conclusion of this trial, there would be group of landholders ready to take on the challenge of setting up a collaborative enterprise. That hope was in part generated by the enthusiasm and optimism of the BARG. The group was building up when the trial was instigated and it probably reached a peak of activity (social, agricultural and environmental) through 2006-7. This corresponded with the early implementation stages of the Native Vegetation Act 2003 and Regulations, particularly to do with the Invasive Native Shrub module and the time when WCMA incentive and other funds were readily available. Since that time WCMA funding has been restricted, the drought has continued and the kangaroo industry has had a pronounced downturn due both to lack of supply and the loss of a major export market. There was a corresponding decline in attendance at BARG meetings and events that has corresponded with the difficulties we have had in getting people together for this project. This, coupled with the complexity of the problem with which the trial grappled, contributed to the final decision to not pursue a business venture.

**Arguments for reform of the regulatory system**

- The landholder survey results showed that normal government licensing and tagging arrangements were widely perceived as the greatest barriers to both effective control of kangaroo grazing and landholder entry into the industry. This was also reflected in the desire of the group to continue managing their own tags rather than have to switch back to DECC’s management.

- One complication for this study (as well as the collection of data under the normal system) is the strong incentive for harvesters to work around the system (e.g. tag-swapping). This is due to the fact that the property-scale tag allocation system works against the natural movement patterns of kangaroos and the strategies of harvesters to mitigate the risk that harvest variability poses to their income stream (Thomsen and Davies 2007). Cross-property approaches such as those of this trial are more consistent with these natural patterns. However, it should also be recognised that trials such as this may not actually show a measurable increase in the level of flexibility available to harvesters, simply because harvesters already have the unrecorded and unmeasured option of tag-swapping to resort to when additional harvest flexibility is required.

- Tag-swapping introduces potential error into harvest results, although the degree to which this occurs is unknown. While such practices do not pose sustainability risks (regional harvest is still bound by quotas) it works against the principles of Conservation through Sustainable Use (CSU). In particular, such approaches violate the principle that, where possible, regulatory arrangements should be compatible with the social and economic goals of local communities rather than working against them. Obviously, if the goals of local people are fundamentally incompatible with conservation aims, then some conflict between local goals and regulation is to be expected, but this is not the case here and such conflict could be removed with regulatory reform.

- Overall, 47% of landholders surveyed indicated that they felt a Queensland-style system would be easier (most others said ‘no difference’). This would appear strong grounds for further trialling alternative arrangements where tags are not bound to individual properties. This trial has shown how a general licence could be used as tool for facilitating such trials without needing to amend legislation.

- During protracted and detailed discussion in the steering committee on the business case for a collaborative enterprise, the DECC policy limiting the number of Fauna Dealer’s Licences was
viewed as being a key factor maintaining status quo in the industry and preventing innovation. This policy is not included in the legislation so a review of policy could look at its impact and explore alternative models. There is nothing in the Kangaroo Management and Harvest Plan that justifies its inclusion.

- The contact that the FATE team has had with kangaroo harvest regulation in three states (NSW, SA and Qld) has highlighted the differences between them and, as the industry operates across all of those states, obviated the need for coordination between states. If these states and the Commonwealth were to contribute to a task force to generate a common set of regulations, the cost would be shared and the resulting benefit to the industry could be significant. Cooperation in conducting kangaroo population surveys could also provide potential benefits in terms of efficiency and accuracy.

- The adaptive management provisions in the NSW system made the trial of the group licence possible. However the process of gaining approval was complex, expensive and time consuming. A more streamlined, well-defined process would lower the barrier to researchers seeking to help the regulator would result in more progress towards a better regulatory system.

- The development of more localised population surveys that integrate with larger scale surveys would help in understanding the relationships between local populations and local harvest patterns and therefore the viability of local harvest management. However, as indicated in Chapter 4, careful consideration is required before using local population surveys to set local harvest quotas, as factors such as past harvest rates and local needs for grazing pressure management are also important.

10.3 The complexity of the problem

The problem at the centre of this project is declining sustainability of pastoralism in the rangelands and the perceived lack of alternative enterprises. Linked to this is public pressure to manage land for enhanced environmental outcomes. The FATE team viewed landholder involvement in kangaroo management as a management option with potential to improve this situation. In taking on landholder involvement in kangaroo management as a key component, the team immersed itself in a complex environmental management problem. A description of this complexity (Ampt 2009) was included in a book about implementing adaptive management (Allan and Stankey 2009) and is reprinted here.

Multiple uses and multiple objectives

The Barrier Ranges are used primarily for pastoral activities, but the wider community has an interest in their iconic outback cultural status and in maintaining environmental values. In the same way, kangaroos can be used for meat and skins, to promote local tourism, and as a component of our community well-being – we are happier in the knowledge that they are there in their natural environment. They are also used as a pawn in the political game around animal rights in that they are convenient media target for animal activists. The objectives of the key stakeholders are diverse, sometimes overlapping and sometimes in competition as is described further below.

A mix of scales of interest and boundaries of responsibility

Landholders primarily operate at the single property scale except when they are active in a group like BARG; harvesters operate on several properties to spread their risk – kangaroos regularly move across property boundaries so harvesters follow. Full-time harvesters may have up to ten properties on which they harvest regularly while part-timers may have two or three; regulators have a state-wide perspective that in NSW is divided into zones. They assess population and quota at a zone level but apply policy and issue tags at an individual property level. Processors operate across Australian states to ensure they can maintain continuity of supply to large processing plants. Processors may employ
area managers to coordinate the harvest effort across localities. They locate field chiller boxes depending on where the harvest is occurring to minimise transport to chillers.

Landholders are primarily responsible for their own property but may recognise the benefits of acting collectively on a number of natural resource management activities. They are also accountable for the impact of their actions off-farm and are restricted in their on-farm actions by legislation, regulation and policy of government departments. They provide access to the kangaroo resource to harvesters through the licence system. They provide this free of charge because they generally perceive it is better that the kangaroo population is controlled, that if commercial shooters didn’t do it they would have to and it would cost them money. If landholders acted collectively, they could choose to exercise power over the harvest by demanding certain conditions be met for access with the ultimate threat of closing down the industry through denying access if those conditions were not met. In reality this is unlikely to happen. Many landholders appreciate the role that shooters play in management and in small local communities.

Harvesters are responsible for ensuring they comply with the licence conditions and for maintaining good relationships with landholders on whom they rely for access to the resource. They are also responsible for the quality of their work, which includes maintaining their equipment, kangaroo selection, marksmanship, field processing and transport to field chiller boxes. A load of kangaroos can and will be rejected at the chiller if they are too small or are unhealthy, if they are not head shots (ensuring instant death), if they have been processed carelessly in the field or if they don’t arrive at the chiller in time to be chilled to the required core temperature in the specified time. Harvesters also have to administer the royalty tags correctly and complete accurate harvest returns to the Kangaroo Management Program.

**Divergent needs and desires of stakeholder groups**

Landholders wanted better control of grazing pressure due to kangaroos and were curious whether they could generate any income from kangaroos. They were sceptical but had a sufficient level of interest to support FATE in going forward and supported the Steering Committee. There were BARG members who were passively resistant or disinterested in the trial, others that were content to observe its progress and those that volunteered for the Steering Committee and put time into participating in meetings.

Initially most harvesters were suspicious of the trial, and some were strongly antagonistic. At a public meeting in August 2006 FATE and landholders were accused of various degrees of stupidity, opportunism and self-interest. There was widespread scepticism about whether any of the initiatives were worth anything. Views were forcefully expressed that landholders just wanted something for nothing and that the only likely result of the initiative was that harvesters would be squeezed because any income for landholders would come at the harvesters’ expense. It became clear during this meeting that what harvesters needed was secure access to the resource, more consistent demand for the product from processors and a fairer and more predictable price at the chiller.

Processors need to be able to manage supply to maintain continuity and to match supply to market demand. They do this by manipulating the price they offer at the chiller and by closing or moving chillers for which the supply is inadequate. They value reliable and efficient harvesters and provide strong incentives to some to keep them loyal.

Processors were dismissive about the project. They maintained a consistent line collectively that the industry is functioning fine without landholder input and without FATE’s intervention. This position is not surprising, as, they retain control over price and supply through regional managers and relationships with key chiller operators and shooters while working hard to maintain markets. A small processor trying to break in expressed a desire to work with landholder groups who could coordinate harvest and maintain quality management to ensure consistent and better than average quality for specific markets.
The regulators (The NSW Kangaroo Management Program of DECC) were sceptical but had the adaptive management provision in their Kangaroo Management Plan (dealt with later in this chapter) so were obliged to engage with the project. They remained clearly focused on the goals of the Kangaroo Management Program and the need to fully comply with their legislative obligations. They expressed the view that the current system was flexible enough to allow landholders to participate more fully, and that the reason they didn’t was because of the lack of an adequate profit margin in the industry.

**Tight economic imperatives around ecosystem exploitation**

A continuation of pastoralism requires ongoing maintenance of pastoral infrastructure (fences, yards, stock water, roads, vehicles, silos, sheds and significant labour associated with stock management (shearing, crutching, drenching, lamb-marking, mustering) all of which come at a considerable cost in terms of time, labour and capital. Commodity prices are uncoupled from this, and the (until recently) cost-price squeeze pushed landholders onto bigger and bigger areas to make an economic return. Critical components of productivity are lambing percentages and wool clip. Both rely on maintaining stock numbers and improving genetic lines of stock, a strategy that is not compatible with the extreme year to year variability of feed in the semi-arid rangeland environment. There is a trade-off between production per animal and production per ha that is mediated by stocking rate, but landholders generally attempt to maintain as high a stocking rate as they can to maximise economic return.

While landholders derive no economic return from kangaroos harvested from their properties any kangaroo is a threat to the profitability of their pastoral enterprise. A complicating factor in this is the increasing reliance of landholders on off-farm income.

Harvesters have to make a significant outlay to get into the business. Once licensed, their big challenge is minimising the harvest effort. The distance travelled and wear and tear on vehicle are major costs. If Kangaroo density is low the cost per harvest increases. Studies (Hacker, McLeod et al. 2004) indicate that the commercial industry is not viable at kangaroo densities that might threaten the viability of the commercial species. This indicates that with current cost structures harvesters will cease harvesting long before a critical density is reached.

**Reduced ecosystem health and ecosystem services**

The WCMA Catchment Action Plan sets targets aimed at improving ecosystem health and the provision of ecosystem services. These are to some extent in competition with economic imperatives as outlined above. These targets exist despite major rangeland monitoring systems lacking any systematic biodiversity component (Fisher, Eyre et al. 2008) and reporting little positive or negative change in range condition (Eldridge and Grant 2004; Eldridge and Grant 2004). Catchment action plans emphasise incentives which, in the judgment of the WCMA Board, will move the catchment towards the targets. The targets are precautionary in that they are judged to be sufficient, if achieved, to maintain or improve biodiversity and enhance the provision of ecosystem services. A key ecosystem service is the resilience of the ecosystem and cultural and aesthetic benefits of knowing we are managing ecosystems to maintain and enhance biodiversity.

However, land management remains dominated by the private good need to generate income from pastoralism, and the public good need for improved ecosystem health remains under-resourced. This suggests that strategies that combine private good and public good will be beneficial.

**Significant technical information on parts of the system**

Sufficient technical information existed on parts of the system such as:

- land systems in the area
- the colonial history of the rangelands of Western NSW
• grazing management
• rangeland ecology
• past kangaroo harvest data
• extensive biological, geological and ecological research from the Fowlers Gap Arid Zone Research Station situated in the Barrier Ranges
• kangaroo behaviour, biology and ecology; kangaroo population survey methodology and results
• landscape function
• a landholder survey on kangaroo management from Queensland
• research consumer attitudes.

An extensive review of this literature revealed to the researchers significant areas where the functioning of the system was far from optimal according to the principles of ecologically sustainable development. As a consequence, there were potential benefits in intervening in the system using an adaptive management framework.

**Competing or open mandates, with different policy options and system targets**

The Kangaroo Industry Association of Australia aims to significantly increase domestic consumption of kangaroo meat and actively promotes the health and environmental attributes of kangaroo.

Presently landholders provide free access to the resource because they accept the pest status of kangaroos. This is despite significant scientific evidence that kangaroos and sheep only compete when biomass gets below a critical threshold. As a pest control strategy, the commercial industry has limited effectiveness because kangaroo densities that are required to make harvesting profitable are considerably higher than those that landholders perceive to be desirable (Hacker, McLeod et al. 2004). Also, large influxes of kangaroos rarely are dealt with effectively by commercial harvesters because of difficulties with getting enough harvesters with tags to the influx quickly enough (Landholder survey 2008 unpublished).

While this continues, landholders give away any bargaining power they have in the industry. Increased landholder involvement in the industry has been perceived as a threat by processors, largely because it raises the possibility that landholders will exercise influence to gain commercial benefit from the harvest. Yet landholders increasingly see kangaroos as a potential resource and good relationships between landholders and harvesters are common and mutually beneficial (Thomsen and Davies 2007). Many consumers also hold a view that landholders are actively involved in some way in bringing kangaroo meat to market (Ampt and Owen 2008).

The regulators are charged with ensuring harvest is consistent with maintaining sustainable kangaroo populations and a humane harvest according to the principles of ecologically sustainable development. Landholders (Chapman 2003); Landholder Survey 2008 unpublished) report that regulatory arrangements restrict their ability to manage kangaroo component of total grazing pressure especially in times of influx and prevent them from adding value to the industry. Harvesters reluctantly report that it is normal for them to ‘work around’ the property specific tagging system and use tags issued for one property on another.

There are also problems with the funding of the regulation. KMP is supposed to operate on a cost recovery basis but is currently running at a loss because population surveys and administration are costing more than income from the sale of royalty tags. Processors are not (according to KMP) likely to contribute further, so KMP is anticipating a large increase in cost of royalty tags which currently cost 80c per tag.
11. Implications

11.1 Implications for the kangaroo harvesting, processing and marketing system

The work undertaken for this project provides significant information for stakeholders in the kangaroo harvesting, processing and marketing system. It can be argued that this system is relatively stable and resilient, but has significant shortcomings. There are considerable barriers to change in the industry and lack of change is causing problems currently that threaten the viability of the industry in the future. Key features of the current system include:

- Wild kangaroos are harvested at night almost exclusively by self-employed licensed shooters who field process the kangaroos and transport them to field chillers. The kangaroos are cooled and stored in the field chillers until they are collected and transported to processing plants that may be many hundreds of kilometres away.

- Most field chillers are owned by processors who pay a chiller operator a price per kilogram to manage the receipt, storage, cooling and dispatch of the kangaroo carcasses and do the paperwork.

- A very small volume of product goes into human consumption either in the domestic market or for export at moderate prices. This product is the large primal cuts such as loins, fillets, rumps, topside and silverside.

- The bulk of the product, known as manufacturing meat, goes into low priced export human consumption and pet food products.

- No significant premium quality product exists – what premium market exists is generated by sorting at the processor but is not serving the needs of restaurants and food service. Meat quality research has found that eating quality declines with age in all cuts other than the loins and fillets. If the carcass is hung by a leg (common practice) the meat in the hanging leg is toughened compared to the other leg. This research has not been acted upon.

- Processors offer harvesters a per kilogram price depending on demand.

- Harvesters gain no economic advantage from maintaining high quality, and can often get away with supplying non-compliant product due to the organisation of chillers.

- Landholders have little chance of generating any economic return from kangaroos harvested from their properties and routinely provide access to their properties to harvesters. They accept this as the only viable way of controlling kangaroo populations on their properties.

- Whilst there have been some attempts to organize the harvesters, they remain unrepresented and powerless.

It is very difficult for any one stakeholder in the system to implement change. The industry is heavily regulated, and while compliance with regulation is probably quite strong, there clearly are areas where undetected non-compliance occurs. In a global environment where quality control and trace-back is becoming a condition of access to markets, the kangaroo industry is at risk.

The loss of export markets in Europe during 2008 on the grounds of (contested) micro-biological contamination highlights the nature of the risk of non-compliance or even apparent non-compliance to the industry. Recent publicity from opponents of the industry (Good Weekend, May 23, 2009) questioning harvest and chiller practices also threatens access to markets.
There is risk associated with the fact that there is a common misconception that kangaroos are farmed, or at least that farmers are involved in the process of bringing them to the market (Ampt and Owen 2008); a misconception that is even reinforced in the rural press11. Consumers have difficulty with connecting their meat to an animal, and for kangaroo this is particularly acute due to the iconic status of the kangaroo and the ‘Skippy factor’. Any apparent revelation that is unexpected can lead to lack of trust in the product. The gritty reality of the harvest can be sufficient to deter would-be kangaroo consumers. There would appear to be greater risk to the industry of allowing this misconception to continue than to tell it like it is. Whilst there is no quantitative data on it, there appears to be a growing band of people, for whom the term ‘kangatarian’ has been coined, who see kangaroo meat as the best choice from environmental, health and animal welfare grounds.

11.2 Implications for landholders

Under current regulatory, industry and marketing conditions:

- There is insufficient opportunity for individual landholders to gain economic return from the kangaroos legally able to be harvested from their properties.
- There is an opportunity for groups of landholders to work together to provide harvest infrastructure in collaboration with harvesters.

Under current industry and marketing conditions and using a group licence similar to the one trialled in this project:

- Landholders can gain greater control over harvesting at a landscape scale, making a more rapid response to local influxes of kangaroos possible because they can call on any harvester on the group licence if the regular harvester is not available or if large numbers of kangaroos appear.
- Landholder groups can generate greater bargaining power with harvesters by offering secure access to larger areas. This provides the opportunity for them to set conditions for access, such as control of feral animals, that provide conservation and business benefits. Without a group licence this is possible but more difficult.

If regulators were to allow landholder / harvester co-operatives to trade in harvested kangaroos, and processors were to offer contract processing:

- Co-operatives could take the risk of testing the market for a premium, regionally-branded line of kangaroo meat.
- This would provide an opportunity for landholders to generate a viable business based on kangaroo harvest that also delivered more control over the impact of kangaroo on other enterprises.

If regulators and processors were to recognise the benefit of landholder / harvester cooperatives and provide incentives for them such as a premium price:

- Co-operatives could manage tag allocation, harvest and chiller functions and could potentially deliver beyond compliance quality.
- The industry could confidently use landholder participation and conservation benefit as key marketing strategies.

• This would provide an opportunity for landholders to generate a viable business based on kangaroo harvest that also delivered more control over the impact of kangaroo on other enterprises.

11.3 Implications for regulators

Our experience with using the adaptive management provisions of the NSW KMP highlights a number of points:

• Adaptive management should involve the clear statement of all goals that drive policy. Without clear statement of goals, it is often very difficult to argue the case for adaptive management proposals such as BRSWET. Very little data is likely to be available for comparison and objectives of the research team are likely to clash with unstated goals of regulators and other stakeholders. Such impacts result in a heavy bias towards maintaining the status quo.

• Agency Plans that call for adaptive management need to state clearly what factors can be experimented with (e.g. population monitoring, quota-setting, socio-economic considerations) and by whom (regulators only, ecological researchers, socio-economic researchers).

• Adaptive management should be viewed holistically, not as simply the implementation of experiments that are unconnected from the rest of management. Plans should not have ‘adaptive management sections’ whereby some aspects of management are open to adaptive approaches and others are not. Under true adaptive management, all management actions should be seen as experiments, with clear processes of goal-setting, monitoring and review.

Harvesters work around the current regulatory system in a number of ways including tag swapping. This is a sign that the system is not sufficiently flexible to accommodate harvester requirements and the risk of getting caught is insufficient a deterrent. There is currently no way of knowing how widespread tag swapping is because it is illegal and reporting of it risks incurring penalties. It creates a hole in the trace-back capacity of the regulatory system and ensures that harvest data are inaccurate. It is difficult to see the wisdom of continuing with a system that is largely unenforceable and apparently incompatible with the viability of harvesters’ businesses and the aims of the system.

If the penalties for tag swapping were removed and replaced with a requirement for harvesters to report tags used on the wrong property, it would improve both trace-back and the integrity of the data. In the longer term it would be better to work towards a more flexible purposefully designed system of harvest regulation that could be implemented in all states.

The limit on Fauna Dealers Licences in NSW is one factor that reinforces the control of the industry by the processors. This trial suggests that relaxing this policy and looking at the option of a specific licence category for landholder and harvester cooperatives may provide greater opportunities for innovation in the industry.

11.4 Implications for harvesters

Successful harvesters maintain access to prime kangaroo territory by maintaining the trust and loyalty of landholders at the same time as remaining loyal to a processor. The trial revealed instances where harvesters that were loyal to a particular processor achieved significant benefits such as a premium price or an occasional cash bonus. These harvesters probably supply a large percentage of the product for some processors. Harvesters without a special relationship with a processor are subject to variations in the price they receive and the willingness of processors to pick up kangaroos from chillers that they supply. These harvesters are vulnerable, especially if they harvest full-time.

Part-time harvesters generally have other sources of income and can move in and out of the industry. By raising the price, processors can attract them when they need more product, and drop the price if supply is too high for the demand. As such they fulfil a useful role in an industry in which populations
fluctuate with the availability of feed, and markets come and go. However, it is harder for them to maintain secure access to land because landholders may become dissatisfied with the degree of population control that they achieve. This may prompt the landholder to seek a different shooter, or to conduct damage mitigation shooting. Conflict can also occur between part-time and full-time harvesters when harvestable populations are low and competition exists for available territory and quota.

The trial has shown that there are potential advantages for a harvester to join a group of landholders and other harvesters. Trail participants could see the advantage of having clear rules for membership that make it possible to gain greater control over harvesting strategies and quality of harvest. Being part of a may also provide more reliable access for harvesters and deal with part-time shooters attempting to take over country.

11.5 Implications for chiller operators

Chiller operation is a critical step in compliance and yet chiller operators work with minimal supervision and are lowly paid (currently around 7 cents per kg). Chiller operators’ income is determined by the weight of kangaroos going through the chiller. They have no control over how many kangaroos are delivered to the chiller but they have a vested interest in maximising the number that is collected by the processor after chilling and storage. They are accountable to the regulators through the returns that they submit each month, but they currently have no stake in the quality of the kangaroos that go through.

Chiller operators should ideally inspect each load that arrives at their chiller and either accept it or reject it according to whether it is compliant with the regulations. If a harvester delivers a load to a chiller that is below compliance, it is in the processor’s interest for that load to be rejected by the chiller operator. If this occurs, the harvester receives a strong and immediate message that compliance is essential, providing a strong incentive for the harvester to improve the quality of their work to ensure a load is not rejected. However, if chiller operators accept non-compliant loads and get away with it, they are better off financially because they are paid on quantity, not quality.

If the load is accepted they then supervise the hanging of the carcasses in the chiller to ensure there is adequate ventilation to facilitate cooling to the specified core temperature in the specified time. Uneven stacking or overloading a chiller can lead to carcasses cooling too slowly for compliance, but if operators get away with it they end up with more money in their pockets.

It was clear from discussions with harvesters and chiller operators that variation exists between operators as to what they will accept and how they run their chillers. Also, it is common practice for harvesters to unload carcasses directly into a chiller without the chiller operator being present. This represents a significant risk to the industry as this is a critical point for ensuring compliance.

Chiller operators also ensure that the chiller is kept clean and the unit is in proper working order. If the chiller is owned by a processor (as most are) then if the chiller malfunctions the owner fixes it. If it is locally owned the owner/operator fixes it in return for a higher payment (currently an additional 8 cents per kg).

11.6 Implications for processors

Processors dominate the industry by setting the prices paid to harvesters and chiller operators. They compete with each other for harvest territory and for markets but collaborate on other issues. They have helped shape a complex system that has built-in safeguards developed over many years of working with harvesters, regulators and buyers. However, there are clear signs that gaining access to and maintaining reliable export markets is becoming more difficult, and the industry’s objective of increasing domestic human consumption of manufacturing meat remains problematic.
The management of compliance and quality from field harvest through to the collection of the product from chillers is a major weak link in the industry. This weakness is difficult and costly for processors to rectify because of the remoteness and wide separation of chillers and the solitary and night-time nature of the work. The payment structure for harvesters and chiller operators rewards quantity, not quality and casual or haphazard supervision increases the risk of non-compliance.

The industry is vulnerable from the point of harvest to the collection of kangaroos from the chiller. Trace back capability is limited due to harvesters ‘working around’ the regulations and the removal of harvest tags at the processing plant. Guaranteeing compliance is difficult with harvesters operating without supervision in isolated places in the middle of the night. Existing arrangements to ensure compliance are haphazard and expensive when done properly. Processors rely on loyal harvesters and chiller operators to whom they sometimes provide incentives. Where this is in place it can work well. However, the structure of industry does not embed these incentives so it appears relatively easy for harvesters and chiller operators to get away with non-compliance.

A locally managed harvest and chiller co-operative of the type investigated in this project has the clear potential to provide the quality management that the industry needs. Under the current system, it is up to processors to send the right signals to landholders and harvesters to encourage them to take on the task. This project suggests that the co-op will need to be paid a premium of at least 30c per kg to provide quality compliance. At present, processors have indicated that they are unwilling to do this.
12. Recommendations

12.1 Recommendations for landholders

1. Landholders should attempt to find a kangaroo harvester with whom they can establish clear lines of communication in an effort to achieve kangaroo population management and other potential benefits (such as feral animal management) in return for security of access and harvest support.

2. Where practical, landholders should attempt to form a group, preferably of neighbouring properties, and negotiate with a reliable harvester or harvesters by offering harvest support and access rights to the whole group in exchange for desired harvester behaviour such as a commitment to harvest when necessary and the management of feral animals. This can be achieved under the current Occupiers and Trappers Licences but there are advantages to using a group General Licence.

3. Landholder groups in areas where kangaroo populations are high and for whom effective kangaroo management is a high priority should use the information generated by this trial to develop workable kangaroo management strategies in collaboration with harvesters and processors. In particular, they should determine whether the production of a premium line is possible and work towards establishing a co-operative which provides incentives for provision of quality in return for a premium price.

4. Landholders and landholder groups interested in generating evidence of environmental stewardship and seeking objective means of assessing the impact of management practices on resource condition should consider implementing a system based on Landscape Function Analysis.

12.2 Recommendations for harvesters

5. Harvesters should consider approaching landholder groups and other landholders to collaborate on harvest management in their area. This project has demonstrated clear benefits from collaboration and cooperation across properties and between harvesters. Harvesters can take a leading role in this.

12.3 Recommendations for regulators

6. Property specific tags should be phased out. This is because they are not sufficiently flexible to allow for the habits of kangaroos and the livelihoods of harvesters and they are not necessary to ensure zone quotas are upheld. In states where they occur, tag swapping is practiced which compromises harvest data and trace-back reliability. Whilst it is illegal, tag swapping is difficult to detect and therefore ineffectively enforced.

7. If property specific tags are retained, penalties for using them on another property should be replaced by a requirement for such use to be reported. This would require minimal changes to the existing system, would remove the perverse incentive to falsify harvest returns, would provide more reliable harvest data and would improve the accuracy of trace-back.

8. If property specific tags are retained, a group licence similar to the one tested in this trial should be made to groups that provide coordination and administration of harvest.

9. The system of Fauna Dealers Licences should be reviewed to remove the barrier for a local kangaroo harvest management co-operative or corporation to develop a business independent of existing processors.

10. The NSW KMP should include more detail on social, cultural and economic objectives.
11. The adaptive management provisions in the NSW KMP should be streamlined and broadened to provide a clearer path for researchers to design and implement adaptive management trials.

12.4 Recommendations for processors

12. Investigate the possibility of generating a line of kangaroo meat from the existing value chain that is of sufficient quality and consistency to demand a higher price from the domestic restaurant, food service, gourmet and specialist retail market. Consider the contribution of size, age, species, field processing, chilling, transport and location to the achievement of a market-appropriate quality differential.

13. Develop and implement ways of providing incentives for landholder groups, harvesters and chiller operators to meet and exceed compliance to develop quality rather than incentives solely based on quantity.

14. Evaluate the possibility of providing a processing service to harvest management groups that allows them to have their animals processed for a fee while retaining ownership through to the retailer.

12.5 Recommendations for the kangaroo industry as a whole

15. A task force should be set up that aims to develop a national kangaroo harvest regulation system that removes differences between states, is based on ecologically sustainable development and allows for devolution of management to local groups that can demonstrate their ability to successfully manage the harvest. Consideration should be given to a system of tradeable tags.

16. The industry should support the development of a system driven by quality rather than quantity. This will involve supporting research into the measures needed to generate differentiated products, assess the potential volume of those products and develop the markets for those products. This research suggests that achieving a quality driven system could involve providing incentives to local business / landholder / harvester groups to provide quality harvest and chiller management.

17. The industry should explore innovative ways of increasing the visibility of kangaroo meat and awareness of its positive market attributes.

18. The industry should develop closer ties with landholders and landholder groups and seek to work more closely on mutually beneficial areas such as integrating commercial kangaroo harvest with good land management. Through this the industry can utilise the promotional benefits of landholder involvement and support for the industry, which links closely with consumer attitudes looking farmer ‘management’ of kangaroo production. One possible mechanism is to support the establishment of a National Kangaroo Grower and Harvester Association.
Appendices

Appendix A: Interview proforma

BRSWET interviews with landholders and harvesters

Interviews conducted by Kristy Andrews via telephone between May 20 and June 5. Kristy will take notes on a new pro forma for each interview. Interviewees will not be identified to anyone except Kristy unless they agree to have their name on the pro forma. If they do, they will only be known to members of the research team. It will not be possible to link any information in the final report with any particular interviewee.

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Thank for agreeing to be interviewed, and thank for being part of this project. This interview will allow us to accurately describe the contribution that this project has made and to help determine future research directions. It has been made necessary because of the difficulty of getting people to face-to-face meetings. Please speak your mind openly and honestly. Only Kristy will know what you have said (and the research team if you allow your name to go on this pro-forma).

**Question 1-7 (All interviewees)**

1. What involvement have you had in the trial?
   a. First meeting – put name down as a supporter of the idea
   b. Permission to use harvest data
   c. Steering Committee member
   d. Attended training in Landscape Function Analysis
   e. General Licence participant
   f. Reading Newsletters
   g. Listening to reports at BARG meetings
   h. Other

2. What would you say was your main reason for being interested in the trial? Was it
   a. for better control of kangaroo grazing pressure,
   b. the potential to earn income from kangaroos,
   c. both of these reasons or
   d. something else?

3. Has your involvement been worthwhile? Please explain.

4. What have you learnt as a result of your involvement?

5. Have you changed the way you deal with kangaroos or other land management as a result of the trial? Please explain.

**Questions 8-14 (General Licence Participants and Steering Committee members only)**

6. How successful is the Group Licence (Group Tags)? What works well? What doesn’t work well?
7. Were you satisfied with the way that tags were distributed under the trial? Compared to the way that National Parks & Wildlife handle tags, was the trial better, worse or the same?
8. Did the trial make it any difference in how you could respond to influxes of kangaroo? If so, was it better or worse and why?

9. Would you continue to sign up to the General Licence if:
   a. FATE continues to run it?
   b. The group runs it?
   c. Other?

10. One of the objectives of the trial was for the group to take over the general licence and to establish a collaborative kangaroo enterprise that at least pays for itself and provides better management of large kangaroo influxes. Do you still want this to happen? What are you prepared to do to help it happen?

11. What do you think the group tag trial has achieved?

12. What would you like to see happen as a result of the trial?

Questions 15-16 (All Interviewees)

13. What future do you see in:
   a. A co-op or company of landholders and/or harvesters managing a profitable local kangaroo harvesting business?
   b. A premium line of kangaroo meat that returns bigger margins to a kangaroo harvesting business?

14. Is there anything else you would like to say about the project and this area of work?

15. What did we do right?

16. What did we do wrong?
Appendix B: Interview proforma

Landholders trained in LFA

Land and enterprise description

- History on land, brief description of enterprises, land, land types
- Time on present property and plans for future.

Land manager

- Experience prior to present property, experience in the district and on present property? How well do you know your land?
- How did/do you learn land management? Who was influential? Any formal training? How would you rate yourself as a manager? Are you still learning? Any courses undertaken?

Making management decisions about land condition

- How would you describe the condition of your property/properties?
- Is it stable/improving/deteriorating?
- Focus on particular paddocks or land types that may be improving or declining. What are the signs of decline? What are the signs of improvement? Are there any critical observations that would ring alarm bells or would make you feel confident things are going well?
- On what basis do you make that judgement?
- Do some areas of the property cause you concern? Why?
- What management actions are available to you to improve problem areas? What actions have you used? What was the result? Do you have plans for the problem areas?

Stock management

- How do you decide on stocking rate? Does stocking rate vary much from paddock to paddock? What types of country can you stock more heavily? How do you decide (on the basis of what information) to vary SR? What is happening to your SR rates over time – increasing? Decreasing?
- Apart from adjusting SR, do you have any other stock management strategies?
- Time control? Spelling paddocks? Cell and/or rotational grazing?

Other land management strategies

- Any other land management strategies? INS control, water ponding/spreading etc
- Any particular strategies to prepare for drought and to cope during drought?
- Management of weeds, ferals, wildlife?

LFA and LFA training

- When did you do LFA training? What did you think of the training?
• How useful was the training? What stays with you about the training?

• Has LFA training effected how you manage your land? Are there any differences in how you read the land now that you have been introduced to LFA? Have you used it since the training? Do you intend to use it? Are you interested in further training? Do you want to be involved in group monitoring?

• Do you see any benefit in group monitoring using LFA? What advantages might it provide?
Appendix C: Sustainable Wildlife Enterprises Workshop

Musicians Club Broken Hill, 14/15 February 2008

A workshop was held in Broken Hill on 14 and 15 February 2008 to bring together members of the three landholder/harvester groups (Barrier Area Rangecare Group - BARG, Mitchell and District Landcare Association and Rangeland Management Action Plan-RMAP) who have been working on projects under the Sustainable Wildlife Enterprises (SWE) research program funded by RIRDC, National Landcare Program and others.

The workshop also featured invited speakers addressing specific issues affecting kangaroo management and SWEs. Representatives of the kangaroo industry, state and federal government agencies, regional NRM bodies and other landholder groups also participated in the workshop, which culminated in a panel discussion featuring representatives of the different stakeholder groups present on the topic of “the role of landholders in the kangaroo industry”.

Workshop Presentations

George Wilson and Katrina Gepp presented the following background presentations on the SWE program and the Barrier Ranges trial specifically:

- George Wilson, Rural Industries Research and Development Corporation : Sustainable Wildlife Enterprises - Can commercial value of wildlife make rangeland agriculture more sustainable?
- Katrina Gepp, Western CMA and FATE Program UNSW: Introduction to the BARG/FATE Trial

Other presentations from the workshop have been organised according to theme below. Adobe Reader is required to view presentations and can be downloaded free at http://www.adobe.com/

Summary of Workshop Discussion

The key themes explored through the workshop were:

- Managing risk (as individuals or as a group of harvesters and landholders)
- Commercial models for landholders and harvesters
- Aligning regulatory structures with landholder and harvester interests
- Capitalising on new marketing opportunities
- Supply chain issues and transparency in the kangaroo industry

The issue of risk in the kangaroo industry was revisited a number of times. Paul Moloney looked at rangeland landholders managing risk by diversifying incomes into different livestock as well as kangaroos and Alex Baumber looked at the risks posed to landholders by high variability in kangaroo numbers. Individual landholders are exposed to risks from large and unpredictable numbers of kangaroos coming onto their properties and consuming resources and also, if they are looking to invest in a kangaroo enterprise, they face business risks in trying to provide a stable supply of kangaroos to market. Data from the Barrier Ranges indicates that landholders can reduce the harvest variability they are exposed to individually by grouping together.

- Paul Moloney, RMIT University: Reducing risk through diversifying rangeland incomes
- Alex Baumber, FATE Program UNSW: Collaboration and managing risks in landholder kangaroo enterprises
Rosie Cooney’s model for setting up cooperatives involving landholders and harvesters as members generated a large amount of discussion at the workshop (see Rosie’s presentation below). The cooperative model could allow landholders and harvesters to set standards for hygiene and quality, invest in chillers and other equipment, negotiate collective supply arrangements with kangaroo processors and potentially market a specific line of kangaroo products sourced from their group.

The coop model received mostly positive comments from landholders, harvesters and even processors, although key questions also arose about the costs of managing a coop, the balance of power between landholders and harvesters and the need for good communication. Overall, there was a strong interest in learning more about the coop model as it develops. The Mitchell and District Landcare Association and their associated harvesters will be exploring this model in further detail and Rosie will be working on developing a version of the coop model for BARG to explore.

- Rosie Cooney, FATE Program UNSW: Models for landholder engagement in the kangaroo industry

The issue of how well regulatory structures work in with the interests of landholders and harvesters was discussed at length. Margaret Chapman demonstrated that landholders in Queensland saw government controls over kangaroos as a disincentive to get involved in the kangaroo industry, although greater discussion overall was dedicated to the regulatory issues in NSW and South Australia. Dana Thomsen outlined a number of ideas on how legislative and policy frameworks could be amended to create incentives for landholders and harvesters to revitalize the industry in SA. Harvester numbers in SA are in decline and the harvest rarely exceeds 50% of the available quota, yet around 200,000 carcasses are imported from interstate by SA processors annually. Many reasons were suggested for this at the workshop, including the remoteness of the SA rangelands and competition for young workers with the mining industry, however, Dana argued that policy changes such as greater tag flexibility, group licensing, reduced barriers to new harvesters and incentives for major harvesters could all make a difference.

Alex Baumber summarised the experiences of FATE and BARG in developing a group licensing system under the Department of Environment and Climate Change’s NSW Kangaroo Management Program. This process has been a long one, with many challenges, although significant progress was made at side meetings during and after the workshop on progressing a group licence for BARG members and harvesters. It was also stressed by people involved with the trial that the group’s motivation is as much about developing a more flexible system of licensing and tagging for better land management as it is about generating economic returns from kangaroos.

The challenges posed by a single property licensing system, as exists in NSW and SA (where tags can only be used on one property and not transferred), were debated at the workshop. Whilst FATE argued that such a system makes collaboration more difficult, Nicole Payne of DECC argued that the current system has a lot of flexibility for landholders, but many aren’t aware of how it can be used. Dana Thomsen also argued that tying tags to a specific property works against harvesters’ interests by preventing them from focusing their harvest effort where kangaroo numbers are greatest at a given point in time.

A number of examples were cited in the workshop of where regulators make decisions based on ensuring the economic viability of the kangaroo processing industry (eg limiting the number of fauna dealers in NSW, setting minimum carcase weights for economic rather than conservation reasons and banning skin-only shooting). This indicates that regulators are clearly prepared to step beyond the species-protection role emphasised in their management plans. Harvesters and landholders can therefore reasonably expect their economic interests to figure in decision-making too - provided that they express those interests clearly and lobby for them.

- Margaret Chapman, University of Queensland: Factors affecting landholders views of kangaroos as an economic resource in SW Queensland
The marketing of kangaroo products with landholder involvement was explored by Peter Chudleigh and Peter Ampt on the Friday morning session of the workshop. Peter Chudleigh concluded that a market niche could be developed for environmentally-badged kangaroo products but it would be challenging and would require high quality, clear environmental credentials and heavy promotion. Peter Ampt’s presentation on FATE’s consumer choice research showed that attractively-priced kangaroo mince and deli meats were the most promising options for increasing the sales of manufacturing meat on the domestic market.

Peter Ampt also reported that most consumers surveyed were unaware that kangaroos were wild-harvested and suggested that promoting a connection to landholders and a positive environmental message could offset any negative reaction to the idea of wild harvest. The ideas of regional and environmental badging received strong support from landholders involved with the SWE program. There wasn’t much indication from processors at the workshop regarding whether they thought these ideas had commercial potential, however, there was discussion on the fact that one processor (Macro Meats) had recently introduced an environmental badge for its domestic supermarket packages, highlighting that kangaroos were softer on the environment than sheep or cattle and did not produce methane, a highly potent greenhouse gas. The issue of kangaroos vs cattle regarding the production of methane received considerable media attention in late 2007, both in Australia and overseas.

Peter Chudleigh, Agrtrans Research: Marketing of products from SWEs

Peter Ampt, FATE Program UNSW: Consumer choice behaviour and lessons for the marketing of kangaroo meat

Supply chain issues in the kangaroo industry were covered in a number of workshop presentations and also generated a large amount of discussion in their own right. Meat quality, quantity and consistency of supply and skin size were three of the main areas discussed. The issue of transparency and accountability in the kangaroo industry came up a number of times and in some ways the workshop helped to bring about improvements in these areas by attempting to understand supply chain issues from the points of view of the different stakeholders.

The main issues regarding quality from processors’ perspective were detailed as: how well dressed a carcase is; how quickly it enters a chiller after shooting; how it is stored in the chiller; and whether the carcase has been affected by dust or dirt. The view was expressed that these issues are less about final product quality reaching the consumer and more about yield – the better condition the carcase is in when it reaches the plant, the greater the yield of high-value cuts and the less meat that is wasted or downgraded. Quantity issues were based around efficiency and reliability of carcase collection – if a large number of carcases can be collected reliably from fewer locations, this adds value to the industry through efficiency gains.

The issue of skin size generated considerable discussion. Processors reported a glut of small skins and a number of measures they have undertaken to address this problem, including refusing to take smaller kangaroos, encouraging regulators to lift minimum weights and implementing a two-tiered pricing structure, where kangaroos above the desired weight attract 80c/kg and those below 40c/kg. Harvesters particularly take issue with the two-tiered pricing system, as it leaves them in the difficult position where landholders who have concerns about large numbers of small kangaroos (especially in Qld) are pressuring harvesters to take them, whilst processors are pressuring harvesters not to deliver small kangaroos through pricing mechanisms which make it uneconomic.

Opportunities were identified for landholder and harvester groups working together to improve a number of these supply chain issues. The Mitchell group has been negotiating for a return from processors if certain steps are implemented, such as reducing the number of shoot-and-let-lie licenses,
imposing voluntary weight restrictions and applying standards that exceed regulatory requirements - all of which would benefit the industry overall. The small skin issue is a clear case where a better understanding of each stakeholders’ business needs could be to the benefit to all – landholders could receive a return for accepting some of the impacts of smaller kangaroos, whilst processors could pay more to get a consistently larger-sized skin and a sustainable source of maturing kangaroos and harvesters could escape being squeezed from both ends.

Outcomes

There were a number of clear messages coming out of the workshop discussions:

- **Landholders and harvesters need to work together on their common interests:** This was reflected in a decision taken after the workshop by members of the three SWE groups to work towards a National Association of Kangaroo Growers and Harvesters. The SWE groups were initially formed around landholder organisations and sought to find economically valued roles for landholders in the kangaroo industry. However, these groups have morphed over time to include strongly-motivated kangaroo harvesters and much of the progress so far has been driven by the knowledge and interests of harvesters. Each of the groups has agreed to nominate a landholder, harvester and landcare/NRM representative to work towards the formation of a national association and FATE has agreed to provide secretariat support, including a website which can act as an information exchange for the SWE groups. The association’s name, status, membership, aims and future funding requirements will all be considered over coming months.

- **There is a need for transparency and understanding each others’ interests:** A number of participants (particularly landholders and harvesters) felt that the level of information-sharing, transparency, accountability and unity in the kangaroo industry was less than for other primary production industries. Partly this was explained by the ever-present need to defend the very existence of the industry from attacks by animal rights and “wildlife protection” groups, however, many participants argued that this lack of unity and transparency was a threat to the industry in itself. Understanding the business needs of each stakeholder and the ways in which decisions taken by one player impact on the others, particularly through business arrangements involving processors, harvesters and landholders, may help to resolve some of these issues.

- **There are ways for landholders and harvesters to add value to the industry:** The kangaroo processing industry indicated that, as a whole, it would continue to be hostile to any landholder/harvester proposals that did not add value to the industry. A number of different ways of adding value to the industry were discussed at the workshop, generally falling into two categories – increased sales (eg creating new markets or attracting higher prices from consumers) and reduced costs (eg efficiency gains through less transport or higher yields). In addition, it was also argued that the ability of a group to provide a processor with exclusive access to their product adds value as well. Discussions with processors collectively have not been able to identify which of these options present the best opportunities for landholder/harvester groups and therefore negotiations with individual processors would seem to provide the best course of action. Deals between individual processors and landholder/harvester groups may initially be based around the benefit of exclusive access, but over time other ways of adding value to the industry overall may be demonstrated - which could help overcome the collective resistance of the processing industry.

- **Commercial and regulatory models may have broad applicability:** There was strong interest amongst landholders, harvesters and other stakeholders in learning from the experiences of other groups with regard to commercial and regulatory models. The experiences of the Mitchell group with their processor negotiations and cooperative model and the experiences of the Barrier Ranges group with group licensing arrangements should be shared with other interested parties. The agreement to work towards a National Association of Kangaroo Growers and Harvesters should assist with this process and the new SWE website and contact group will facilitate further information-sharing.
We’ve attempted to cover the key points here, but of course there was a lot more discussed over the two days than we can fit in this summary. If you feel that any key points have been left out or misrepresented, please let us know by email or post a comment on the SWE blog.

The SWE website and blog will also feature news and information on developments taking place as part of the establishment of the National Association and other activities arising from the workshop.
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Glossary

BaRaRoo: The Barrier Ranges Kangaroo business proposal.

Chiller: Generally and insulated and refrigerated container which will accumulate, hang and chill approximately 100 carcasses waiting to be delivered to the meat processor. Usually owned by the meat processors.

Chiller Operator: The person contracted to manage the chiller, usually a harvester but can be a Landholder or professional Chiller Operator.

Field processing/Dressing: The cleaning of a carcass once shot by decapitation and removal of internal organs.

Harvester: The person who holds a Trappers License and is legally entitled to shoot kangaroos under the official regulatory system – called a Trapper in the regulatory system.

Land Holder: A person who holds land under freehold title or under a Western Lands Lease.

Member: A person who is considered a Member of a co-operative on the basis of meeting membership criteria.

Processor: Carcasses are broken down into meat and skin products at an abattoir.

Returns: The forms filled out by Harvesters to record information on species, quantities, area harvested, weights and in the future for BaRaRoo, carcass quality.

Shooter: Another term for Harvester or Trapper.

Shooting: The kangaroo is mesmerised by a bright spotlight at night and shot through the brain. Studies have shown death is instantaneous and it is considered more humane than subjecting an animal to the transport, holding and processing at an abattoir. Using more than one bullet significantly reduces profitability, so accuracy is important.

Trapper: Another term for Harvester, derived from the Trapper’s License they hold.

Coliform: A rod-shaped bacterium, esp. Escherichia coli and members of the genus Aerobacter, found in the intestinal tract of humans and other animals. Its presence in water indicates faecal contamination and can cause diarrhoea and other dysenteric symptoms.

FATE: Future of Australia’s Threatened Ecosystems program. A project run through the University of NSW http://www.fate.unsw.edu.au/
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Eldridge, D. and R. Grant (2004). Rangeland change in the western Riverina Saltbush Range-type, Department of Infrastructure, Planning and Natural Resources, NSW Government.


The Barrier Ranges Sustainable Wildlife Enterprise Trial, conducted over three years from July 2006 to June 2009, is a participatory action research study that focuses on the present and future role of landholders in the kangaroo industry. Through a range of strategies involving extensive consultation, analysis, intervention and adaptive management, the study has examined key aspects of the commercial kangaroo harvest system.

It has revealed a complex set of interactions between landholders, harvesters, regulators and processors in the case study area and beyond, and has implemented changes to components of the system and assessed the impact of those changes.

RIRDC is a partnership between government and industry to invest in R&D for more productive and sustainable rural industries. We invest in new and emerging rural industries, a suite of established rural industries and national rural issues.

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