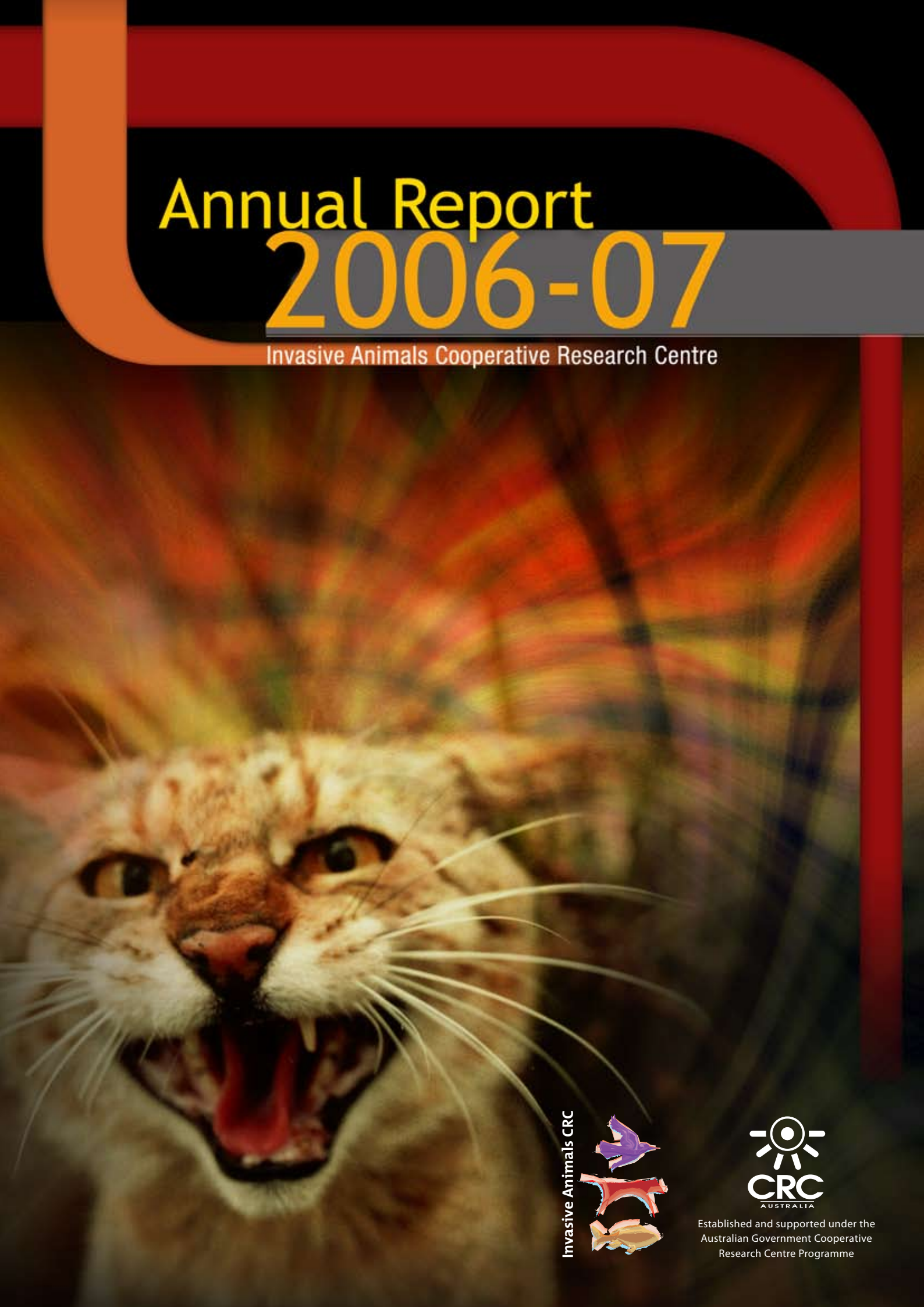
Annual Report 2006-07

Invasive Animals Cooperative Research Centre



Invasive Animals CRC

CRC AUSTRALIA

Established and supported under the Australian Government Cooperative Research Centre Programme

Annual Report 2006-07

Invasive Animals Cooperative Research Centre

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CONTENTS

More information:

Visit our website http://www.invasiveanimals.com for research reports, scientific papers, fact sheets and other information and publications of the CRC and participants.
Email: contact@invasiveanimals.com

OUR GOALS

Improving the environment for business and biodiversity. By 2011 we expect to:

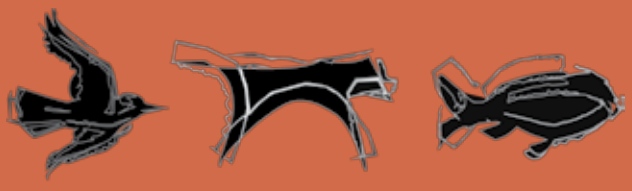
- reduce the impacts of fox and wild dogs by 10%
- reduce feral pig damage by 15%
- reduce rodent damage by 20%
- deliver improved quality of inland water through reduced impacts and rates of spread of pest fish
- reduce the impact of feral cats over 5 million hectares
- improve control options for rabbits.

Reducing risk:

- of disease transfer from invasive animals to livestock and humans
- of economic loss, environmental damage and social stress by forecasting and responding to potential, new, expanding or emerging invasive animals problems.

Building capacities and new industries through:

- collaboration
- education and training
- improved community awareness
- promoting uptake of new control strategies and tools.



Invasive Animals Cooperative Research Centre

CHIEF EXECUTIVE'S SUMMARY

ACHIEVEMENTS AND ACTIVITIES

The second year of the Invasive Animals CRC (IA CRC) was busy and productive. Late in the first year and into this financial year, we completed the first annual program reviews, and were very pleased with the establishment of new projects and new collaborations. The Board was impressed that the "teething troubles" one might expect in setting up a large number of new projects in a 41-participant CRC didn't really eventuate and collaborators got down to their assigned tasks very quickly and efficiently indeed. The long gestation period of a collaborative Research Centre seems to have meant that researchers were chomping at the bit to get on with the range of exciting new projects.

Some important milestones were reached during the year; for example:

- the CRC conducted its first week-long Balanced Scientist™ training program for our postgraduates
- PIGOUT®, the first product from the CRC, was lodged for registration with the Australian Pesticides and Veterinary Medicines Authority; and
- the Tasmanian government put in place a ten-year fox eradication program, relying heavily on recommendations from a CRC review.

Internal communications have been a focus of our activities. Having such a large number of participants, as well as many other interested parties, we see a major role of the CRC as being simply to promote interaction across agencies. "Feral Flyer", our weekly email newsletter, has become a popular publication. It has grown from a base of the CRC's researchers to having many hundreds of people on the mailing list. The CRC displayed at a number of industry events during the year and we provided researchers for many media interviews.

RISKS, OPPORTUNITIES AND RESPONSES

The Board conducted a risk review during the year and identified the top-ranked risks to the new CRC as:

- poor acceptance or adoption of the CRC's research and its outputs, and failure to meet the CRC's stated objectives

Our stated operational targets are very ambitious and rely on success at both the research level and also the adoption level. They are targets at economic, environmental and social issues and are often difficult to measure. Our response to this risk area is to ensure that every project established has strong and meaningful links to end-users and the project is targeted to achieving outcomes in a reasonable timeframe.

- animal welfare

In a generic sense, a tool or technique widely used in the industry might cease to be available due to a change in public acceptance. The CRC provided significant staff time to the Australian Animal Welfare Strategy, and conducted a project and hosted a workshop on Standard Operating Procedures and Codes of Practice in pest animal control. We liaised closely with the country's peak animal welfare group, the RSPCA, during the year.

CONTEXT AND MAJOR DEVELOPMENTS THROUGHOUT THE YEAR

The Board has identified a number of major changes in the environment in which the CRC operates. These include:

- The changing face of delivery of natural resource management services in Australia

There are now 56 natural resource management (NRM) boards (or catchment management authorities) delivering a range of services in regional Australia. They are the major recipient of Natural Heritage Trust money and they have each developed plans that include pest or feral animal mitigation. In recognition of the importance of these bodies, the CRC is in the process of establishing a liaison unit to work directly with them.

- The potential role of genetic manipulation for pest animal control

During the term of the Pest Animal Control CRC, genetic manipulation was the principal research focus.In general, the IA CRC has sought to exploit shorter-term methods. Two major genetic techniques are contained in the CRC's Business Plan: virally-vectored immunocontraception of mice and "daughterless" technology. Virally-vectored immunocontraception was phased out of the CRC's activities during the year, following reviews in the previous year. We found that while immunocontraception could be achieved in 95% of mice, we were unable to successfully transfer the infertility from one mouse to another at a level necessary to stop mice plagues. While a disappointing result, it is clear that the research power we were able to exert on the issue through a cooperative research effort brought us to this conclusion earlier than would otherwise have been the case.

NATIONAL RESEARCH PRIORITY GOALS

NATIONAL RESEARCH PRIORITY HIGHLIGHTS

The IA CRC addresses the National Research Priority "Safeguarding Australia" (Table 1). We directly address the goal "protecting Australia from invasive diseases and pests".

The CRC's research brief mirrors the government's objective of "counteracting the impact of invasive species through the application of new technologies and by integrating approaches across agencies and jurisdictions". Reducing the impact of invasive animal pests must be achieved by a combination of technological advances and enhanced on-ground application. This requires partnership between the public and private sectors.

- The public sector manufactures and markets pest control products and manages our primary production industries
- Public sector research agencies undertake most pest animal research and public sector land management is responsible for almost one quarter of Australia's land area

No individual land manager or agency carries the whole invasive pest animal problem, but all are responsible for making a contribution and a commitment to the solution. State and federal agriculture and natural resource management agencies have a significant role in managing public land and in supporting farmers, graziers, conservation managers and foresters in their efforts to control terrestrial invasive animals. Individual land managers often work to reduce on-site impacts, but the mobility and stealthy nature of these animals makes their local eradication difficult, if not impossible. Similarly, river systems interconnect as do their fish populations. Management of a pest fish in one catchment is meaningless if the pest can quickly recolonise adjacent, unmanaged catchments.

Australia is particularly vulnerable to many exotic (and endemic) livestock diseases for which widespread populations of invasive animals are important potential sylvatic hosts. Our ability to develop appropriate contingency plans for exotic disease emergencies is directly influenced by the ongoing effectiveness of pest management strategies and knowledge of current distribution and abundance.

The CRC's broad membership assembles a unique partnership, creating critical mass to address this national priority — it brings together private and public land managers to integrate approaches to invasive animal management. The CRC is committed to delivering the means to deal with existing high profile invasive animal pests as well as those that have the potential to cause catastrophic impacts in the future.

The CRC's research also addresses the priority "An Environmentally Sustainable Australia", focusing particularly on the "sustainable use of Australia's biodiversity" goal (Table 1).



Images L to R: Tony Buckmaster attaching radio collar, electrofishing (VIC DPI), radio-tracking

NATIONAL RESEARCH PRIORITY GOALS Cont'd

This report describes research on the CRC's key objectives, which include:

- developing and delivering new tools and strategies to control invasive animals (including birds and freshwater fish)
- developing new services and removing impediments, empowering communities to take greater and more effective action against invasive animals
- advancing our understanding of the nature and behaviour of Australasia's invasive animals to maximise delivery from the above objectives
- providing partners with mechanisms for national and international business collaboration, to facilitate "route to market" for products and services
- building greater capacity to anticipate, detect, prevent, limit or manage the impacts of existing or new invasive animals.

Table 1: National Research Priorities and CRC Research

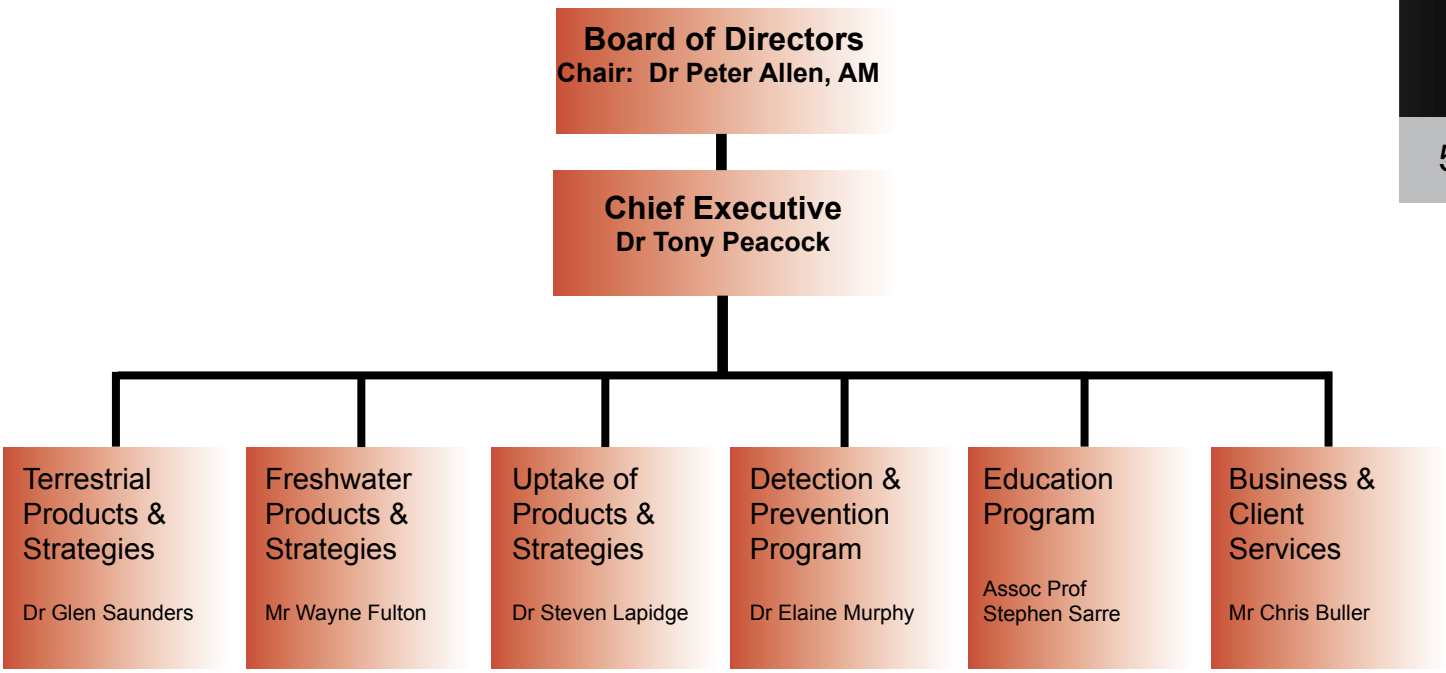
NATIONAL RESEARCH PRIORITIES	CRC RESEARCH (%)
AN ENVIRONMENTALLY SUSTAINABLE AUSTRALIA – *Transforming the way we use our land, water, mineral and energy resources through a better understanding of environmental systems and using new technologies*	
Sustainable use of Australia's biodiversity	20
SAFEGUARDING AUSTRALIA – *Safeguarding Australia from terrorism, crime, invasive diseases and pests, and securing our infrastructure, particularly with respect to our digital systems*	
Protecting Australia from invasive diseases and pests	80

L to R: Cat with kill, courtesy Wendy Henderson. Pig eating lamb prey. Alex Diment with prey killed by fox .

GOVERNANCE AND MANAGEMENT

CORPORATE STRUCTURE

Figure 1: corporate structure



"I think we have done a very thorough job in ensuring most aspects of governance have been identified and addressed while not losing sight of the big picture – ensuring we deliver benefits to the nation. The journey has really only just begun, but I feel assured on what I have been involved in to date, that we are definitely focused in the right direction to make a significant impact for Australia."
Chris Hancock, Director, CEO of Aarnet.

"The National Research Priority, "Safeguarding Australia", the recent government acceptance of the Australian Pest Animal Strategy, the development of AusBIOSEC, current reviews of various national threat abatement plans for pest vertebrates, reports from such groups as the Australian Biosecurity Group, and the national shift to regional Catchment Management Authorities/Natural Resource Management Boards provide strong bases for promoting the concerns and need for action against invasive pest species nationally".
Peter Allen AM, Chair.

"The IA CRC's focus on coordinating pest control efforts across Australia is very important. Before the CRC was formed, so much work was fragmented, under-resourced and duplicated, and as a result there was very little real impact on most invasive vertebrate species. Of all the major challenges that still exist in this area, perhaps the greatest is to turn talk into action. Unless we can actually deliver mechanisms for managing the impact of these animals, all the talk is worth little. The discoveries are only the beginning. Commercialising products for pest animal control is an enormous challenge in itself. When you look around Australia you do not see companies falling over each other to deliver new products to the pest control community."
Joan Dawes, Director, biochemist, wildlife rescuer.

ABOUT OUR BOARD

Table 2: Board members

NAME	ORGANISATION	POSITION/ROLE
Dr Peter Allen, AM	Independent director	Chairman of the Board
Mr Atticus Fleming	Australian Wildlife Conservancy	Director
Mr Chris Hancock	Aarnet Ltd.	Director
Dr Dedee Woodside	Independent director	Director
Ms Helen Cathles	Independent director, primary producer	Director
Dr Mark Lonsdale	CSIRO	Director
Dr Tony Peacock	Invasive Animals CRC	CEO








"If nothing changes, nothing changes!
It is so important to work together, drop suspicions and give it a go. If this problem could have been solved by a single farmer, grazier, or public land manager on their own it would have been done a long time ago."
Helen Cathles, primary producer.

Above L to R: Chris Buller (Company Secretary), Atticus Fleming, Joan Dawes, Tony Peacock (CEO), Dedee Woodside, Mark Lonsdale, Helen Cathles, Peter Allen. (Absent, Chris Hancock).

FUNCTION AND FREQUENCY OF MEETINGS:

The CRC's Board of Directors met quarterly in 2006/07, preceded by meetings of the Audit Committee. The Board acts on behalf of participants in supervising a company. The Board implements the organisation's strategy and oversees management's actions aimed at achieving those CRC's goals.

Specifically, the Board reviews the medium and long-term goals of the organisation, recommends the annual budgets, monitors business performance and evaluates the CEO's performance. During the CRC's establishment phase the Board focused on establishing the controls framework to ensure major risks are identified and managed; it now reviews and tests these controls.

Table 3: The extent of private sector representation on the Board and committees:

Name	Organisation	Position/ role	Key Skills
2.1 CEO and Governing Board Members			
Dr Peter Allen, AM	Independent director	Chairman of the Board	Governance, pest animals
Ms Helen Cathles	Independent director	Director, Deputy Chair	Primary production
Prof Joan Dawes	Independent director	Director	Commercialisation
Mr Atticus Fleming	Australian Wildlife Conservancy	Director	Conservation
Mr Chris Hancock	Aarnet Ltd	Director and member of the Audit Committee	Business relations, risk analysis
Dr Mark Lonsdale	CSIRO	Director and member of the Audit Committee	R&D management, pest animals
Dr Dedee Woodside	Independent director	Director and Chair of the Audit Committee	Communications, social sciences

Table 4: Specified Personnel

Name	Organisation	Position /role
2.1 Program Leaders		
Dr Tony Peacock	IA CRC	CEO
Dr Glen Saunders	NSW Department of Primary Industries	Program Leader, Terrestrial Products & Strategies; Research Leader, Vertebrate Pest Research Unit.
Dr Elaine Murphy	New Zealand Department of Conservation	Program Leader, Detection & Prevention Program; Snr Scientist, Research Development & Improvement.
Mr Wayne Fulton	Victorian Department of Primary Industries	Program Leader, Freshwater Products & Strategies; Principal Scientist, Statewide Leader Aquaculture & Freshwater Fisheries Science. Primary Industries Research Victoria.
Dr Steven Lapidge	IA CRC	Program Leader, Uptake of Products & Strategies.
Mr Chris Buller	IA CRC	Deputy CEO, Program Leader, Business & Client Services, Company Secretary.
Assoc Prof Stephen Sarre	University of Canberra	Program Leader, Education Program Snr Lecturer, Applied Ecology & Research.

Table 5: End-user Involvement and CRC Impacts on End-users

End-user name	Relationship with CRC (e.g. Industry, Participant, International)	Type of activity and end-user location	Nature / scale of benefits to end-user (e.g. exports increase, productivity, employment)	Actual or expected benefit to end-user ($ terms)
Animal and Plant Control Commission of SA	Core participant	Integrated feral pig, deer, cat control in SA	Improved land-use management.	Not yet quantified
Animal Control Technologies Australia Pty Ltd	Core participant	Rodent control research. Manufacturer of new feral pig bait, fox bait and wild dog bait nationwide.	License to market new fox, dog, feral pig control products. Enlarged market. Export opportunities.	Increased/ new product sales est. $500 000 p.a. by 2009
Murray-Darling Basin Commission	Core participant	Invasive fish control, user of new tools/techniques, throughout Murray-Darling Basin.	Improved river condition to deliver environmental and social benefits.	Not yet quantified
NSW Department of Primary Industries	Core participant	Collaborative research into new tools and techniques for fox, wild dog, feral pig, rabbit control. Research node in Orange, field activity throughout NSW.	Improved land-use management. Reduced negative impacts of fox and wild dog attacks and cost of controls. Improved conditions for graziers.	$15.5m p.a. on-farm impact reduction by 2012
NSW Department of Environment & Conservation (now Environment & Climate Change)	Core participant	Collaborative research into new tools and techniques for fox, wild dog, feral cat control. Field sites throughout NSW.	Improved land-use management. Reduced negative impacts of fox and wild dog attacks and cost of controls.	Not yet quantified
Parasitech	Core participant	Collaborative research into new tools and techniques for fox, wild dog control. Based in ACT.	Increased research opportunity and service provision.	Not yet quantified
Pestat Limited	Core participant	Collaborative research into new tools and techniques for fox, wild dog control. Based in ACT.	Increased research opportunity and service provision.	Not yet quantified
Qld Dept of Natural Resources, Mines & Energy (now Qld Dept of Natural Resources & Water)	Core participant	Collaborative research into new tools and techniques for fox, wild dog, feral pig, rabbit control. Research node in Toowoomba, field activity throughout Qld.	Improved land-use management. Reduced negative impacts of fox and wild dog attacks and cost of controls. Improved conditions for graziers.	$15.5m p.a. on-farm impact reduction by 2012
South Australian Research & Development Institute	Core participant	Invasive fish control, develop and employ new tools/techniques.	Improved river condition to deliver environmental and social benefits.	Not yet quantified
ValueMetrics Australia	Core participant	Collaborative research into new tools and techniques, socioeconomic evaluation. Based in Sydney.	Increased research opportunity and service provision.	Not yet quantified

End-user name	Relationship with CRC (e.g. Industry, Participant, International)	Type of activity and end-user location	Nature / scale of benefits to end-user (e.g. exports increase, productivity, employment)	Actual or expected benefit to end-user ($ terms)
Vic Department of Primary Industries	Core participant	Invasive fish control. Develop and employ new tools/techniques.	Improved river condition to deliver environmental and social benefits.	Not yet quantified
WA Conservation and Land Management	Core participant	Collaborative research into new tools and techniques for fox, wild dog, feral pig, rabbit control. Large research sites in WA.	Improved land-use management. Reduced negative impacts of fox and wild dog attacks and cost of controls. Improved environmental conditions.	Not yet quantified
Connovation	Core participant	Collaborative research into new tools and techniques for fox, wild dog control. Based in NZ.	Increased research opportunity and service provision.	Not yet quantified
NZ Department of Conservation	Core participant	Collaborative research into new tools and techniques for feral cat, rodent control. Field sites throughout NZ.	Improved land-use management. Reduced negative impacts of feral animals and cost of controls.	Not yet quantified
Qld Dept of Primary Industries & Fisheries	Core participant	Invasive fish control. Develop and employ new tools/techniques.	Improved river condition to deliver environmental and social benefits.	Not yet quantified
Vic Dept of Sustainability & Environment	Supporting participant	Collaborative research into new tools and techniques for feral cat, rabbit control. Research site in Gippsland, Vic.	Improved land-use management. Reduced negative impacts of feral cats and cost of controls. Improved environmental conditions.	Not yet quantified
WA Dept of Agriculture	Supporting participant	Collaborative research into new tools and techniques for fox, wild dog, rabbit control. Research activity throughout WA.	Improved land-use management.	$15.5m p.a. on-farm impact reduction by 2012
Australian Wildlife Conservancy	Supporting participant	Collaborative research into new tools and techniques for fox, wild dog, feral pig, rabbit control. Research site in WA.	Improved land-use management. Reduced negative impacts of fox and wild dog attacks and cost of controls. Improved environmental conditions.	Not yet quantified

PROJECTS IN THE PAST YEAR

OUR PROJECT NUMBERS

The CRC's project identifiers form a matrix— the first number refers to the CRC's goal, the middle letter identifies the Program and the third number is the project in sequence. Thus, **1.T.2** indicates that: the project addresses IA CRC Goal 1 (to reduce the impact of foxes and wild dogs by 10%), this project falls within the Terrestrial Program (T) and it is the second project which specifically addresses this goal.

The following pages list the CRC's research projects. This listing complies with a reporting requirement of the government's CRC Programme.

Minister McGauran launching the CRC's Strategic Plan. L to R: Dr Tony Peacock (CEO), the Honourable Peter McGauran (Minister for Agriculture, Fisheries & Forestry), Dr Peter Allen AM, Chair of our Board. Image courtesy of Kerryn Molloy.

TERRESTRIAL PRODUCTS AND STRATEGIES PROGRAM

Project Title:	**Facilitating strategic management of wild dogs throughout Australia**
Project Number:	1.T.2
Project Leader:	Mr Jim Thompson
Lead Agency:	Queensland Department of Natural Resources, Mines and Water
Objective:	To assist local groups in wild dog management, and document case studies.
Project Title:	**Towards best practice for wild canid and felid management**
Project Number:	1.T.4
Project Leader:	Dr Peter Fleming
Lead Agency:	New South Wales Department of Primary Industries
Objective:	Setting priorities, developing models and updating skills of end-users.
Project Title:	**Roll-out of pig control solutions**
Project Number:	2.T.1
Project Leader:	Dr Steven Lapidge
Lead Agency:	Animal Control Technologies Australia Ltd
Objective:	Registering and commercialising a 1080 feral pig bait - PIGOUT®.
Project Title:	**Control of rodent infestations in intensive crops, industrial and island situations**
Project Number:	3.T.2
Project Leader:	Prof Linton Staples
Lead Agency:	Animal Control Technologies Australia Ltd.
Objective:	Data gathering and analysis; trialing selected formulations; developing advisory information.
Project Title:	**Cane toad ecology and control**
Project Number:	5.T.1
Project Leader:	Prof Rick Shine
Lead Agency:	University of Sydney
Objective:	Investigating the use of pathogens to reduce toad densities and/or fitness.
Project Title:	**Cane toad toxic venoms and pheromones**
Project Number:	5.T.2
Project Leader:	Prof Rob Capon
Lead Agency:	University of Queensland (Institute for Molecular Bioscience)
Objective:	Investigating cane toad chemical ecology for chemical signals with potential as deterrents/attractants.

Images L to R: Feralmone® canid attractant; Ricky Spencer setting up a remote camera (image courtesy of Pestat Pty Ltd); prototype freeze-dried RHDV product.

TERRESTRIAL PRODUCTS AND STRATEGIES PROGRAM

Project Title:	**Daughterless toads**
Project Number:	5.T.3
Project Leader:	Prof Peter Koopman
Lead Agency:	University of Queensland (Institute for Molecular Bioscience)
Objective:	Manipulating sex ratios using genetic technologies.
Project Title:	**Enhancing rabbit haemorrhagic disease virus effectiveness**
Project Number:	7.T.1
Project Leader:	Dr Tony Robinson/ Dr Tanja Strive
Lead Agency:	CSIRO
Objective:	Developing assays and diagnostic tests for avirulent rabbit caliciviruses in Australian rabbits and distinguishing RHDV from avirulent caliciviruses.
Project Title:	**RHD bait**
Project Number:	7.T.2
Project Leader:	Dr Simon Humphrys
Lead Agency:	CSIRO/New South Wales Dept of Primary Industries - National Feral Animal Control Program funded.
Project Title:	**Review of rabbit haemorrhagic disease**
Project Number:	7.T.3
Project Leader:	Dr Brian Cooke
Lead Agency:	University of Canberra
Objective:	Improving understanding of regional variations in timing of outbreaks of RHD and its effectiveness.
Project Title:	**Oral delivery systems for herbivore management**
Project Number:	9.T.1
Project Leader:	Dr Lyn Hinds
Lead Agency:	CSIRO
Objective:	Developing/ modifying carrier formulation(s) that can deliver control agents via ruminant digestive systems of native macropodid species.
Project Title:	**Improving the management of Australia's pest birds**
Project Number:	9.T.2
Project Leader:	Mr John Tracey
Lead Agency:	New South Wales Department of Primary Industries
Objective:	Developing simple & efficient techniques for estimating damage level and cost of damage to horticulture.

Images L to R: Fox DNA test kit (courtesy Dr Oliver Berry); Rob Hunt, NSW DEC demonstrating an M-44 ejector to Dr Tony Robinson & Diane Holloway, (courtesy of Kerryn Molloy); bait station construction (courtesy of N. Endt).

Carp at Sweeneys wetland fishway inlet (image courtesy of SARDI Aquatic Sciences)

The Freshwater Products and Strategies Program aims to develop and deliver short, medium and long term tools and techniques for managing Australia's freshwater invasive fish. This program represents the first national effort to coordinate and utilise skills from Government, Industry and private enterprise in addressing the huge environmental problems stemming from invasive fish in Australia today.

PROJECTS IN THE PAST YEAR Cont'd

FRESHWATER PRODUCTS AND STRATEGIES PROGRAM

Project Title:	**Development of "Daughterless" technology for the control of invasive fish**
Project Number:	4.F.3
Project Leader:	Dr Ron Thresher
Lead Agency:	CSIRO Marine and Atmospheric Research
Objective:	Developing brood lines that have integrated copies of genetic constructs designed to bias sex ratios toward males; which once released into the wild lead to the 'breeding out' of the species.
Project Title:	**Sensory attractants - identifying male and female sex pheromones**
Project Number:	4.F.4
Project Leader:	Prof Peter Sorensen
Lead Agency:	University of Minnesota
Objective:	Determining if adult carp release sex pheromones that attract the opposite gender.
Project Title:	**Identification of "hot spots" of carp reproduction in the Murray-Darling Basin**
Project Number:	4.F.5
Project Leader:	Dr Dean Gilligan
Lead Agency:	New South Wales Department of Primary Industries (Aquatic Systems Research)
Objective:	Data gathering at identified recruitment sites for carp spawning (spatial mapping, temporal variability in spawning success, relationship between spawning hotspots and recruitment hotspots).
Project Title:	**Integrated tagging for determining movement and migration of carp in the Murray-Darling Basin**
Project Number:	4.F.6
Project Leader:	Dr Paul Brown
Lead Agency:	Victorian Department of Primary Industries
Objective:	Information gathering of carp movement patterns - where, when, why carp move and triggers for movement.
Project Title:	**Koi Herpesvirus (KHV): its potential as a biological control agent**
Project Number:	4.F.7
Project Leader:	Dr Mark Crane
Lead Agency:	CSIRO Livestock Industries, Australian Animal Health Laboratory
Objective:	Data gathering on the biological properties of KHV and the diseases it causes for evaluation.
Project Title:	**Tilapia: development of management strategies for control and eradication**
Project Number:	4.F.10
Project Leader:	Mr John Russell
Lead Agency:	Victorian Department of Primary Industries, Queensland Department of Primary Industries and Fisheries.
Objective:	Analysing and simulation modelling of critical ecological and life history data.
Project Title:	**Validating ageing of carp from subtropical parts of the Murray-Darling catchment**
Project Number:	4.F.11
Project Leader:	Dr Michael Hutchison
Lead Agency:	Queensland Department of Primary Industries and Fisheries
Objective:	Validating annulus formation (in otoliths) as age indicator in northern Murray-Darling Basin carp populations.
Project Title:	**Spawning migrations and attractant flow: Achilles heel investigation of carp**
Project Number:	4.F.12
Project Leader:	Dr Benjamin Smith
Lead Agency:	South Australian Research and Development Institute (Aquatic Sciences)
Objective:	Information gathering on environmental triggers stimulating carp movement to spawning sites.

Kangaroo Island goat mustering pens near Parndana (image courtesy of Dr Steven Lapidge)

Uptake aims to capitalise on the research undertaken within the Terrestrial and Freshwater Programs in order to accelerate the delivery of new, innovative and market driven products that have been demonstrated in practice and with scientific rigour, to be effective tools in reducing the impacts of invasive animals in Australasia.

PROJECTS IN THE PAST YEAR Cont'd

UPTAKE OF PRODUCTS AND STRATEGIES PROGRAM

Project Title:	**Western Australian feral predator control**
Project Number:	10.U.1
Project Leader:	Mr Paul de Tores
Lead Agency:	Western Australian Department of Environment and Conservation
Objective:	Investigating indirect or adverse effects of feral predator control on native fauna.
Project Title:	**"Repel the Invaders" Kangaroo Island integrated pest management program**
Project Number:	10.U.2
Project Leader:	Ms Pip Masters
Lead Agency:	Kangaroo Island Natural Resource Management Board
Objective:	Monitoring and trialing eradication of pigs, deer and goats using Judas animals, baits and other control techniques.
Project Title:	**Tasmanian Fox Eradication**
Project Number:	10.U.3
Project Leader:	Assoc Prof Stephen Sarre
Lead Agency:	University of Canberra
Objective:	Developing robust and accurate DNA test for large carnivores of Tasmania via scats.
Project Title:	**Victorian Fox Southern Ark**
Project Number:	10.U.4
Project Leader:	Dr Gordon Friend
Lead Agency:	Victorian Department of Sustainability and Environment
Objective:	Ecology of feral cats (diet analysis, home range etc.) and predator-prey interactions with foxes.
Project Title:	**NSW Nil-tenure dog control**
Project Number:	10.U.5
Project Leader:	Dr Peter Fleming
Lead Agency:	NSW Department of Primary Industries/ Pestat Pty Ltd.
Objective:	Local wild dog management plans, community engagement, product trial and uptake.
Project Title:	**Control of feral pigs in tropical rainforest**
Project Number:	10.U.6
Project Leader:	Prof Iain Gordon
Lead Agency:	CSIRO Sustainable Ecosystems
Objective:	Information gathering on ecological/social impacts, improving trap success, management guides.
Project Title:	**Carp Control in the Logan-Albert catchment**
Project Number:	10.U.8
Project Leader:	Dr Andrew Norris, Dr Michael Hutchison
Lead Agency:	Queensland Department of Primary Industries and Fisheries
Objective:	Improving knowledge, management, community participation and control impact.
Project Title:	**Lachlan "hotspots" targeted carp control**
Project Number:	10.U.9
Project Leader:	Dr Dean Gilligan
Lead Agency:	New South Wales Department of Primary Industries (Aquatic Systems Research)
Objective:	Benchmarking data, testing control options, fish tagging, data collection.
Project Title:	**Tasmanian fox awareness survey**
Project Number:	10.U.12
Project Leader:	Dr Nicholas Fisher
Lead Agency:	ValueMetrics Australia
Objective:	Gaining an understanding of current level of awareness about existence of foxes and threat posed to Tasmania's environment and industry.

Radio-tracking on Kangaroo Island (image courtesy of Dr Steven Lapidge)

The Detection and Prevention Program is aimed at reducing risk of disease transfer from invasive animals to livestock and humans and economic, environmental or social loss or stress, by forecasting and responding to potential, expanding or emerging invasive animal problems.

PROJECTS IN THE PAST YEAR Cont'd

DETECTION AND PREVENTION PROGRAM

Project Title:	**Invasive pest vertebrates: validating and refining risk assessment models**
Project Number:	9.D.1
Project Leader:	Dr Mary Bomford
Lead Agency:	Bureau of Rural Sciences, Department of Agriculture, Fisheries and Forestry.
Objective:	Developing the capacity to predict, using models, likely species and sites of new vertebrate pest establishments or population expansions.
Project Title:	**Development of a national pest animal genotyping facility**
Project Number:	9.D.2
Project Leader:	Assoc Prof Stephen Sarre
Lead Agency:	University of Canberra
Objective:	Developing genetic markers & PCR tests for cats and foxes (initially) to enable identification from scats.
Project Title:	**Invasive fish scoping study**
Project Number:	9.D.5
Project Leader:	Mr Peter West
Lead Agency:	New South Wales Department of Primary Industries
Objective:	Preparing a summary and review of techniques available for measuring and monitoring invasive fish.
Project Title:	**Mapping invasive animals of Australia**
Project Number:	12.D.1
Project Leader:	Mr Peter West
Lead Agency:	New South Wales Department of Primary Industries (funding from the National Land and Water Resources Audit).
Objective:	Collating validated databases of invasive animal distribution to inform management and enable early detection of new problems.
Project Title:	**International workshop on the socioeconomics of invasive animals**
Project Number:	12.D.2
Project Leader:	Dr Elaine Murphy
Lead Agency:	New Zealand Department of Conservation
Objective:	Identifying and reporting methodologies for estimating the socioeconomic impact of invasive animals.
Project Title:	**Evaluation of the impacts from alien pest animals on threatened biodiversity in NSW**
Project Number:	12.D.3
Project Leader:	Dr Paul Downey
Lead Agency:	New South Wales Department of Environment and Conservation (and Climate Change).
Objective:	Quantifying impacts of pest animals relative to other threatening processes, ranking pest animals according to impacts on threatened species.
Project Title:	**International issues and implications of using genetically manipulated organisms for biocontrol**
Project Number:	12.D.4
Project Leader:	Dr Wendy Henderson
Lead Agency:	Invasive Animals Cooperative Research Centre
Objective:	Information gathering on issues involved with genetically-modified biocontrols.
Project Title:	**Review of the social research on invasive animals**
Project Number:	12.D.5
Project Leader:	Dr Elaine Murphy
Lead Agency:	Fitzgerald Applied Sociology
Objective:	Reviewing research on public attitudes towards invasive animals and their impacts.
Project Title:	**Measuring the social, environmental and economic impacts of vertebrate pests**
Project Number:	12.D.6
Project Leader:	Dr Randall Jones and Mr Roger Wilkinson
Lead Agency:	New South Wales Department of Primary Industries/Victorian Department of Primary Industries
Objective:	Updating of the 2004 McLeod "Counting the Cost" report on costs of invasive animal impacts.

Stakeholder Meeting, Education Program, 2006

Field trip, Uptake Program, Northern Jarrah Forests, Western Australia
(image courtesy of Dr Steven Lapidge)

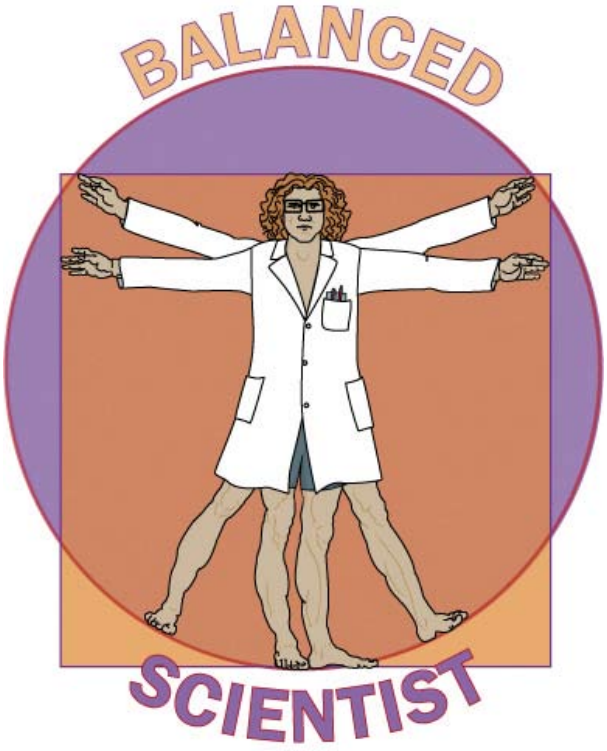
PROJECTS IN THE PAST YEAR Cont'd

PREPAREDNESS THROUGH EDUCATION PROGRAM

Project Title:	**Student scholarships Cohort 1 (2006)**
Project Number:	11.E.1
Project Leader:	Assoc Prof Stephen Sarre
Lead Agency:	University of Canberra
Objective:	Recruiting PhD students to undertake research projects for the CRC.
Project Title:	**Student scholarships Cohort 2 (2007)**
Project Number:	11.E.2
Project Leader:	Assoc prof Stephen Sarre
Lead Agency:	University of Canberra
Objective:	Recruiting PhD students to undertake research projects for the CRC.
Project Title:	**Stakeholder training (Pestplan)**
Project Number:	11.E.6
Project Leader:	Assoc Prof Stephen Sarre
Lead Agency:	University of Canberra
Objective:	Increasing professional / practical skills base through education.

"Postgraduate students play a very important role in Cooperative Research Centres. In the Invasive Animals CRC, students are attached to projects that contribute to one of our 13 operational targets. They are linked with professional supervisors from industry as well as their host universities, through our partner organisations. We aim additionally to give our students a suite of professional skills that will help them be more "balanced" scientists - e.g. media training, mentoring, workshops, and lectures from professionals."

Dr Tony Peacock



SELECTED PROJECT HIGHLIGHTS

ACTA/University of Queensland rodent Infestation control project

The Animal Control Technologies Australia (ACTA) Group is responsible for a key rodent research program within the CRC. In a project managed by Michelle Smith and Linton Staples at ACTA in collaboration with Dr Luke Leung and his rodent team at the University of Queensland (Gatton) campus, they are seeking to improve methods for monitoring and controlling mice and rats. A second priority is to improve the management of rodents in intensive crops where farmers need improved rodent control options, and a third is to achieve environmental management of rodents on islands with reduced non-target impact.

This work builds on ACTA's previous success in managing rats in sugar cane crops and tree plantations in far north Queensland, and controlling plague mice in broadacre crops throughout Australia with MOUSOFF® and RATTOFF®.

The project is:

- surveying industry stakeholders (re: difficulties with rodents, research priorities, suitable trial and test sites)
- sourcing appropriate formulations and presentations of key active ingredients having regard to suitability, safety, regulatory framework, cost, availability and humaneness (if appropriate)
- applying selected rodenticides to intensive crops, and industrial and island situations
- obtaining regulatory data that will support ACTA registration applications for technology specific to certain rodent infestation problems
- developing advisory information to enable improved rodent management in industrial situations, intensive crops and on islands.

Trials are currently under way in mouse-proof enclosures at Gatton campus, with the support of the University of Queensland.

Image above: *Rattus sordidus*, courtesy of Dario Rivera

Spillover benefits

The consolidation of technology for rodent management in the identified situations is also likely to benefit domestic rodent management.

Building research capability, post-graduate training and advisory depth in this area will enhance the technical information transfer, retain key skills and enable best practice approaches in all situations (this has been a feature of all of the ACTA projects in the field).

Reducing large-scale misapplication of certain anticoagulant rodenticides is of great significance in protecting Australia's native wildlife.

Preventing infestations of rats and mice is important for protecting fragile habitat and seed banks.

Project No./s:	3.T.2
Program/s:	TERRESTRIAL
Lead Researcher:	DR LINTON STAPLES
Commercial Partner:	ACTA LTD

Rollout of feral pig control solutions

Despite the worldwide impact of feral pigs, control of the species has somewhat lagged behind that of other invasive animals. In terms of broad-scale management tools, no new control tools have been developed for decades, even though the ecology of the species is well studied.

The "roll-out of feral pig control solutions" project is addressing this by capitalising on our previous Pest Animal Control CRC (the IA CRC's predecessor) research. Both CRCs have collaborated with ACTA in developing a new shelf-stable feral pig bait, PIGOUT®. The matrix has been designed to deter non-target species, yet be especially attractive to pigs. The product is suitable for ground or aerial deployment. PIGOUT® will provide a safe, convenient and cost-effective tool to control feral pigs, and it may be of considerable benefit in instances where large numbers of feral pigs have to be controlled at short notice, such as in an exotic disease outbreak. In addition, investigations into the suitability of the PIGOUT® matrix to carry disease vaccines or contraceptives have been undertaken in New Zealand, the United States and England.

Registration of the product is nearing completion, and commercial availability is expected later this year. The first generation product will carry a 1080 core, however research has already commenced on HOGGONE™, the second generation bait that will contain a new active ingredient. The recently identified and trailed chemical has the potential to make the baits even more effective, quicker acting and specific to the target species.

The potential of synthetic lures to improve trapping and/or bait uptake by the target species is also being examined, as well as pig-tailored bait delivery tools for the establishment of permanent bait stations.

This project links with two of the Uptake Program's demonstration sites — Kangaroo Island and the Daintree Rainforest.

Images above: PIGOUT®; below: pig taking bait, Kangaroo Island (courtesy Dr Steven Lapidge).

Research and development partners:

Animal Control Technologies Australia Ltd.
Pestat Pty Ltd.
NSW Department of Primary Industries
Landcare Research NZ
Qld Department of Natural Resources and Water
Kangaroo Island Natural Resources Management Board
Meat and Livestock Australia.

Project No./s:	2.T.1
Program/s:	TERRESTRIAL
Lead Researcher:	DR STEVEN LAPIDGE
Commercial partner:	ACTA LTD

Facilitating strategic management of wild dogs throughout Australia

Wild dog and fox predation of livestock is continuing in the eastern tablelands and adjacent coastal hinterland of north-east New South Wales.The problem also occurs in other livestock producing areas of Australia. The cost to production has been estimated to be around $66 million annually. Environmental costs have not been estimated.

The strategic approach to improving control of wild dog management is being progressively embraced in New South Wales. In this approach, the regional wild dog problem is first defined and quantified. The stakeholders are then identified and engaged, and the management, research, demonstration, training and education requirements are also identified. A program of correct actions is planned, and outcomes recorded and implemented. Results must be continuously monitored and evaluated, and each component revised and progressed throughout the project.

To facilitate this approach, we have set up a 3-year demonstration project in north-eastern New South Wales and southern Queensland. The IA CRC objectives addressed by the project are to:

1. Demonstrate the strategic approach to wild dog management at the local and regional level.
2. Integrate research with management.
3. Integrate training programs with research and management.
4. Facilitate the adoption by stakeholders of new IA CRC wild dog control products and strategy advances.

A wild dog management facilitator has been appointed to extend the strategic approach nationally. This facilitator, our researchers and PhD students, will assist stakeholders to collect, collate and map data on wild dog distributions, attacks, control applications, and population responses to that control.

Images top to bottom: Wether killed by wild dogs (courtesy Dr Peter Fleming), Wallaby attack (courtesy Dave Jenkins), Wild dog (courtesy Mick Davis).

Project No./s:	1.T.2 /10.U.5
Program/s:	TERRESTRIAL
Lead Researcher:	DR PETER FLEMING
Commercial Partner:	PESTAT PTY LTD

Rabbit haemorrhagic disease virus research

The resulting information will be used to develop iterative local and regional wild dog management plans that cross land tenure and management boundaries.

The CRC is involved in several projects to assess the continuing effectiveness of rabbit haemorrhagic disease (RHD) virus, also known as calicivirus. Latest data appear to support the premise that the disease is of varying virility and effectiveness in different climatic areas, and also that some rabbits appear to have either an inherited or acquired immunity to the virus that causes this disease. Australia's foremost rabbit ecologist and RHD expert, Dr Brian Cooke, is also conducting a literature review and analysis of data to assess this.

Preliminary results are showing that RHD appears to have its biggest impact at the end of the breeding season, going into summer. It causes less mortality in cooler/more humid regions. Regional infection patterns are being analysed, and work is ongoing to try and determine the factors responsible for this seasonal and regional variation. The aim is to identify where and when we should target re-introduction of the virus for maximum knockdown.

A diagnostic test for avirulent rabbit caliciviruses in Australian rabbits has been developed.

Another CRC project is investigating potential methods of enhancing RHD virus' effectiveness. The present virus must be stored and transported on dry ice, and becomes unstable at higher temperatures. It is therefore expensive and cumbersome to attempt re-introduction events in the field. We have applied for registration of a freeze-dried RHD virus product that can be more easily stored and transported.

We are actively seeking to add to the suite of currently available control tools for rabbits. Innovations being investigated include a carbon monoxide (CO) pressure fumigator, which is showing considerable promise. Its rapid action and low emissions of contaminants that could act as irritants mean that it is a humane option.

The IA CRC advocates an integrated management approach to rabbit control. An effective control program will include the use of poisoning and warren fumigation and/or destruction to support the biological control agents myxomatosis and RHD virus.

Images above: rabbit damage to umbrella acacia, Hattah-Kulkyne National Park 2006, rabbit below (courtesy of Dr Brian Cooke).

Project No./s:	7.T.1 /7.T.2/ 7.T.3
Program/s:	TERRESTRIAL
Lead Researcher:	DR BRIAN COOKE/ DR TANJA STRIVE
Commercial partner:	AUSTRALIAN WOOL INNOVATION LTD

Cane toad ecology and control

The spread of feral cane toads through tropical Australia has created major ecological problems, notably by increasing mortality rates of native predators. Thus, we need to find ways to reduce toad densities. Pathogens may play a significant role in affecting toad populations, but the ways in which the pathogens of Australian amphibians affect the behaviour and ecology of toads has been poorly understood. This project is experimentally manipulating parasite (helminth) infestations to examine resultant effects on toad body condition, activity levels, feeding behaviour and performance.

Professor Rick Shine's team from the University of Sydney have selected a species of large lungworms (*Rhabdias* spp.) for this research. These worms occur naturally in high densities in Australian toads and have a direct lifecycle.

To determine whether or not infection with *Rhabdias* affects toad behaviour (e.g. activity level, food intake) or locomotor performance (speed and/or endurance), adult toads were collected from an invasion-front population in the Adelaide River floodplain of the Northern Territory. The parasite did not occur in this area and the study animals had no prior experience of *Rhabdias*. These animals were transported to Townsville (an area with high *Rhabdias* densities) where they were experimentally infected (random control and treatment groups).

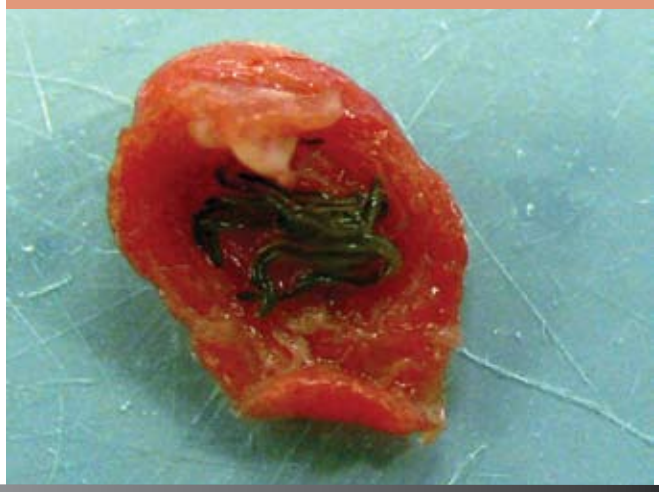
Various behavioural and biological criteria were scored and toads tested for speed and endurance over a three week period under controlled conditions. Half the toad groups were then infected with *Rhabdias*, and the remainder treated with a control. After a period to allow for parasite growth, the toads were all retested for locomotor performance and scored for a number of other criteria.

Results to date:

The parasites were found to strongly affect the survival, growth and speed of small toads, but had no measurable effect on adult toads.

These results are encouraging, and suggest a simple method to reduce the ecological impact of cane toads might be to artificially infect invasion front animals with this parasite. Extensive testing must be done first—continuing in the lab and then later in field trials to ensure there are no impacts on other species.

Image top: *Bufo marinus* courtesy of the Kimberley Toadbusters Inc.
Image bottom: *Rhabdias* on toad lung, courtesy of Chrystal Kellehear, University of Sydney.



Project No./s:	5.T.1
Program/s:	TERRESTRIAL
Lead Researcher:	PROF RICK SHINE
Commercial Partner:	UNIVERSITY OF SYDNEY

Cane toad toxins and pheromones investigation

That cane toads are toxic is well known. That these toxins kill Australian native predators is also well documented and accepted. That if left unchecked cane toads will continue their invasion of Australia, depleting native predator populations as they advance, is also an accepted truth.

Our research program acknowledges these truths and further recognises that while cane toads are effective at using chemical ecology (i.e. toxins), our knowledge of cane toad chemical ecology is incomplete. This observation is based on a careful analysis of cane toad chemical literature, which is largely dated and undertaken by researchers fixated on “toxins” to the exclusion of all other chemical ecologies. That these studies were carried out with little regard to ecological context further highlights an unfortunate bias that does little to advance our knowledge of cane toad chemical ecology, or offer direction for cane toad control.

We hypothesised that greater knowledge of the full extent of cane toad chemical ecology would reveal opportunities for control. In our chemical ecology studies we have looked closely at the chemical composition of parotoid gland secretions, to better understand its molecular complexity. We aim to answer questions such as: what is the relative toxicity of all these chemicals; how does their relative and absolute concentration vary with age, sex, geography, tissue or life cycle stage; and do any or all of these compounds have purposes other than merely being toxic? Can we influence cane toad toxicity and survival? Can knowledge of cane toad chemistry reveal cane toad selective toxins?

Our studies also address the possibility that cane toads use chemicals as sex and/or alarm pheromones, or as egg-laying cues, to improve their reproductive and survival success. Promising preliminary data support the premise that cane toad tadpoles possess a species-specific alarm pheromone and that this chemical may also trigger premature metamorphosis. Efforts to isolate and identify this alarm pheromone are progressing well. A synthetic alarm pheromone (or substitute) could be used to alarm tadpoles into premature metamorphosis (the transition from tadpole to metamorph) and significantly reduce recruitment. Underweight premature metamorphs would be less toxic, and less capable of survival. A synthetic alarm pheromone could represent a valuable tool in cane toad control.

Although our chemical studies are at an early stage, we have identified a number of promising lines of inquiry. We are firmly of the view that a comprehensive understanding of cane toad chemical ecology is a critical element in devising effective control strategies.

Image left: tadpole to metamorph (courtesy of the Kimberley ToadBusters Inc.)

Project No./s:	5.T.2
Program/s:	TERRESTRIAL
Lead Researcher:	PROF ROB CAPON
Commercial partner:	UNIVERSITY OF QUEENSLAND

Improving the management of Australia's pest birds

There are over 100 bird species in Australia and New Zealand that can cause significant losses to fruit, nut, grain, rice and aquaculture industries, create conflicts in urban areas, damage infrastructure, reduce aesthetic values, and pose risks to the environment and to human health. Despite numerous concerns raised by industry and the general public there has been very little objective advice and few simple, universally applicable solutions available.

This project aimed to deliver outcomes from a number of individual sub-projects to improve the management of pest birds and avian diseases in Australasia. Simple and efficient techniques for estimating bird damage have been developed for wine grapes, cherries, peaches, nectarines and apples.

Recommendations for future pest bird research have been developed with industry (including endorsement from Horticulture Australia, Grape and Wine Research and Development Corporation). This follows a lengthy review process facilitated by the Australasian Pest Bird Network and Vertebrate Pests Committee.

Preliminary results from the national pest bird survey indicate that while damage is widely varied between crop types and across geographical regions, perceived bird damage to horticulture is significant. Direct losses to grapes, pomes, stone fruits and nuts alone are costing producers over $290 million. Phone questionnaires indicate that this is representative of the horticulture industry. Comparisons with direct measures are still being conducted.

The national survey also allowed broad scale estimates of the costs of bird impacts and overall costs of current control to Australian horticulture. The survey indicates that upfront and ongoing costs of bird control were also significant. Across all horticulture industries average upfront costs per grower were estimated to be $21,200 ± 3800 (n=1579) with the highest recorded cost to an individual of over $1 million. The estimated ongoing cost of bird control averaged $1,534 ± 530 (n=1554) per year per grower, with the highest recorded annual cost by an individual of $20,000. Further analysis is continuing, including estimating non-response bias, determining overall costs of control, incorporating detailed costs for different management techniques and sensitivity analyses.

Funding has been received from the Bureau of Rural Sciences (Natural Heritage Trust) to evaluate the efficacy of lethal and non-lethal techniques to reduce bird damage.

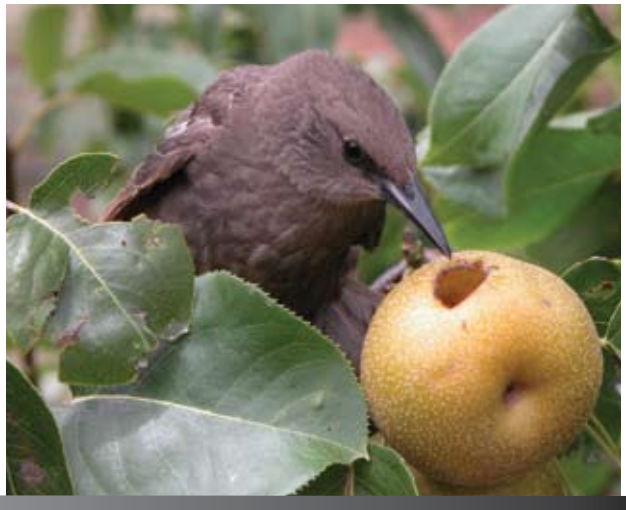
Book launch date: 20 September 2007.

This work has received support from:

The Bureau of Rural Sciences
Wildlife and Exotic Diseases Preparedness Program
Pestat Pty Ltd
Agriculture WA
Animal and Plant Control Commission of SA
NSW Game Council
NSW Department of Primary Industries

Despite numerous concerns raised by industry and the general public about bird impacts and damage, there is very little objective advice and few simple, universally applicable solutions available.

Image below: Starling (*Sturnus vulgaris*) damage to Nashi fruit, courtesy of NSW DPI.



Project No./s:	9.T.2
Program/s:	TERRESTRIAL
Lead Researcher:	JOHN TRACEY
Commercial Partner:	NSW DEPT OF PRIMARY INDUSTRIES

Kangaroo Island integrated pest management project

Kangaroo Island is the third largest offshore island in Australia (after Tasmania and Melville Island) and lies 15 km off the South Australian coast. It is a nationally important site for biodiversity conservation, primary production and tourism with nearly 50% of the native vegetation remaining. The island is free of foxes and rabbits but has an abundance of other feral pests including pigs, goats, deer and cats.

"Repel the Invaders" is a regionally focused package of actions addressing priorities for managing pests, diseases and problem animals threatening biodiversity and primary production across the island. The program aims to prevent and detect new introductions of pests, diseases and problem animals as well as identifying, monitoring and managing pests already present.

The island provides an ideal location to trial feral animal control strategies. Border protection, biodiversity monitoring and management of existing priority feral animals is already underway, providing an important framework for additional projects looking at feral animal control.

The CRC component of the Repel the Invaders program aims to:

- expand the targeted species from cats, pigs and deer, to include goats
- add essential baseline data on the movements, habitat use and social structure of pigs, deer and goats
- trial Judas animals as a control technique
- trial and adopt, where applicable, new control products and strategies for pigs and cats which are being developed by the CRC and partners.

Kangaroo Island will be the first trial site for our new feral pig toxin and will also assess the efficacy and target specificity of the Western Australian feral cat bait ERADICAT® later in 2007.

Work to date:

The pig control program has coordinated shooting and trapping with the Kangaroo Island Natural Resource Management Board, local hunters, Department of Environment and Heritage (DEH) and forestry all participating.

Genetic samples from pigs across the island have been collected for analysis to determine genetic diversity, population size and movements.

Genetic samples have also been taken across the site to determine whether it is possible to estimate population size of the new invader, fallow deer. A feeding trial has been implemented to determine if corn feeders can be used to attract this species.

Two trial goat eradication sites are currently underway. 90% of the goats have been removed from a site at Parndana and at least 50% from the Flinders Chase National Park. A third site has four satellite collars ready for deployment once goats are obtained. Vegetation monitoring plots have also been established to track changes following a reduction in goat numbers.

Image above: Brenton Florance and Nick Markopoulos with deer feeder, Kangaroo Island (courtesy of Dr Steven Lapidge).

This project is a collaboration between the Kangaroo Island Natural Resources Management Board and the South Australian Department of Land, Water and Biodiversity Conservation and DEH.

Project No./s:	10.U.2
Program/s:	UPTAKE
Lead Researcher:	PIP MASTERS
Commercial partner:	KANGAROO IS NATURAL RES. MGMT BOARD

Supporting eradication of the fox from Tasmania

Foxes pose the most dramatic new threat to agriculture and Tasmania's unique mammalian wildlife in modern history. Their establishment is predicted to have an ongoing multi-million dollar impact on the Tasmanian sheep industry alone. Goat, poultry and other livestock industries would also incur damage, as well as control and protection costs.

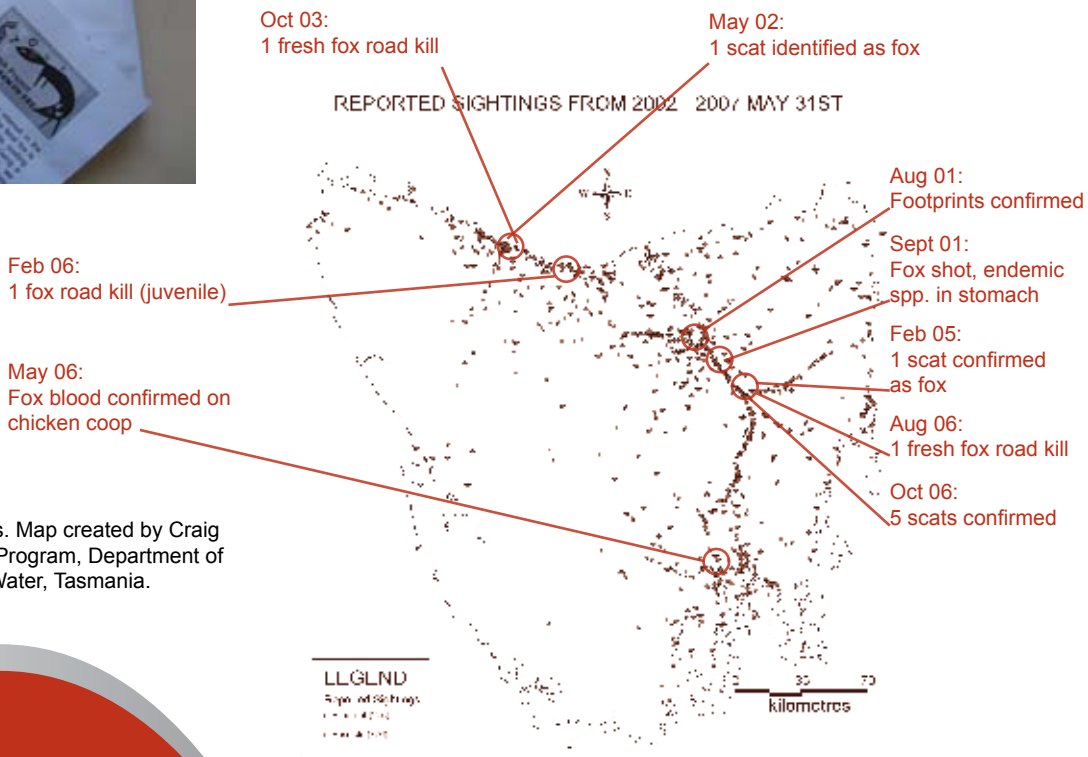
Foxes also pose a biosecurity threat to Tasmania, as they carry a range of diseases including hydatids. An established fox population is predicted to have an impact on as many as 77 native animal species.

The main problem in mounting an effective eradication campaign is the low density of foxes in the state. This makes the identification of fox populations difficult and comprehensive targeting of eradication measures virtually impossible.

Whilst the density of reported sightings may provide a general idea of where foxes may be, greater accuracy is needed to inform concentrated baiting effort, targeted use of lures, baits and other technology, and a more accurate assessment of the task and cost of eradication. The use of scats is a better indicator of presence. These are easy to find, long lasting, and contain DNA that can be analysed.

This project is undertaking a comprehensive survey of predator scats in Tasmania, and uses DNA-based species identification tests to identify scats that contain fox DNA. Scats identified as originating from foxes will serve as a trigger for fox control measures and increased surveillance in the surrounding area. The project also involves training selected community groups in the identification and collection of predator scats, and coordinating those groups in undertaking systematic scat collection across Tasmania.

Left: Fox DNA test kit, available by contacting Dr Oliver Berry, University of Western Australia http://www.foxdna.animals.uwa.edu.au



Right: Evidence of foxes. Map created by Craig Bester, Fox Eradication Program, Department of Primary Industries and Water, Tasmania.

Key results:

- Blood samples from a chicken coop at Old Beach (near Hobart), a blood stain on a road where a fox road kill had been found (but moved) and six predator scats have been positively identified as containing fox DNA. 1597 scats have also been screened for fox DNA, including 601 since May 2006.

- Five positive scat samples and the fox road kill were clustered in a single region in the northern midlands and represent strong evidence for a hotspot of fox activity. The blood sample from the chicken coop represents the first hard evidence of fox activity near Hobart and implies that the range of foxes in Tasmania may encompass most of the northern, midland and southeast regions. That finding was one of the two main items of evidence cited in support of the substantial increase in funding to the Fox Eradication Program announced by the Tasmanian Government in November 2006.

- Following the success of the fox identification DNA test, the University of Canberra in collaboration with Pestat, the Fox Eradication Branch (formerly Fox Free Tasmania Taskforce) and Environment ACT has developed a new DNA test that distinguishes the scats of all large Tasmanian carnivores (foxes, cats, dogs, eastern quolls, spotted quolls and Tasmanian devils). This process takes advantage of the fact that before defecation, the outside of a scat accumulates epithelial cells as it moves through the digestive tract. DNA technology finds and copies this target DNA and then uses lasers to identify the unique DNA sequences that distinguish each species.

- Testing of the multi-species test that discriminates between the DNA of the six carnivores is proceeding in two phases. Phase 1 involved blind trials on samples of known origin and species. Those trials have been completed and the results published (Berry, Sarre, Farrington and Aitken, 2007). That work indicates that the test has a high probability of distinguishing the six large carnivores extant in Tasmania from good quality tissue samples and that the approach works on scats of known species origin.

- The second phase of testing involves trailing the multi-species test on scats collected in the field to identify their species of origin. DNA sequence analysis of the same sample is then employed to independently identify the species of origin. Results thus far have indicated a high success rate in identifying the scats of cats, dogs and Tasmanian devils and work is continuing to improve the test.

Image above: Fox fitted with radio tracking collar (courtesy of Alex Diment, IA CRC).

Key partners:

University of Western Australia
Tasmanian Government
University of Canberra
Pestat Pty Ltd

Project No./s:	10.U.3/ 9.D.2
Program/s:	UPTAKE/ DETECTION & PREVENTION
Lead Researcher:	DR STEPHEN SARRE
Commercial partner:	UNIVERSITY OF CANBERRA

Development of sensory attractants for carp

Since its introduction into Australia, the common carp (*Cyprinus carpio*) has inflicted severe environmental damage to many of our region's shallow freshwater lakes, wetlands and rivers. This species is a bottom feeder that disturbs large quantities of sediments, nutrients, and rooted aquatic plants; thereby causing eutrophic conditions unsuitable for other fishes, birds, or plants. They are also a threat to river-based industries such as fisheries, aquaculture, tourism and agriculture. In some parts of Australia carp form up to 80% of the fish biomass. The same is also true in many regions of the United States.

It is well established that many freshwater fishes rely heavily on chemical cues to find food, mates, conspecifics, and specific locales. This has been the subject of long-term research by one of our participant organisations, the University of Minnesota. Professor Peter Sorensen and his team have studied closely related species such as the crucian carp (*Carassius carassius*) and goldfish (*Carassius auratus)* and determined that they are extremely sensitive and responsive to both pheromones (potent odour signals that pass between members of the same species) and food odours. A series of distinctive steroidal compounds have been identified that appear to be part of complex but potent species-specific pheromones released by males.

We are now taking this research a step further to confirm the role of these signals in the male carp pheromone signal and to identify others that also appear to be present (the cue is a mixture). Preliminary results are promising. If successful, the development of this technology will allow biologists to attract large numbers of carp to removal sites, with relatively little effort and in an environmentally benign manner.

Image (below): Carp at Sweeney's wetland; (right): Carp on measuring board, courtesy of SARDI Aquatic Sciences.

This project may have important links with our "hotspots" work (next page). The discovery by our scientists that carp breed in relatively few sites along a river system means that control effort can be directed to places where it will have the maximum impact. This research also suggests that carp are stimulated to breed through environmental and sexual cues. "Sensory assisted removal is realistic" says Professor Sorensen. "I think we are on the verge of having a real way of controlling carp".

Project No./s:	4.F.4
Program/s:	FRESHWATER
Lead Researcher:	PROF PETER SORENSEN
Commercial Partner:	UNI OF MINNESOTA

Carp "hotspots" of reproduction in the Murray-Darling Basin

The Lower Lachlan catchment provides a unique opportunity for implementation of a carp (and other pest fish) control program in the Murray-Darling Basin. The basin supports what is believed to be the most abundant carp population in Australia. Therefore, the site provides the high carp densities necessary to undertake research trials in replicate sites and control sites. Importantly, the Lachlan is typically an endorheic system (largely isolated from the remainder of the Murray-Darling Basin) and only ever connects with the Murrumbidgee River during periods of exceptionally high flow (1 in 20 year floods). As a result, the carp population within the Lower Lachlan catchment is not exposed to continual immigration from carp populations in other catchments.

This project builds on earlier work by our predecessor, the Pest Animal Control CRC, and a current CRC Freshwater Products and Strategies project that together have identified seven potential "hotspots" of population recruitment within New South Wales. This research shows that a majority of carp recruits within the system originate from these sites. As a result, carp control activities concentrated at these seven locations could potentially have a much greater impact on the carp population than trying to implement control over tens of thousands of kilometres of river. If we are able to predict when and where carp will aggregate to spawn, we can use the knowledge to target our management efforts. We are now expanding our existing knowledge base to analyse the whole catchment for other major "hotspots". From this earlier work, the carp population in the Lower Lachlan is already known to contain two "hotspots" and two others are considered to have potential: the Great Cumbung Swamp, Lake Brewster, Lake Cargelligo and Lake Cowal, each having features amenable to trailing of control options.

This project is still in the initial (benchmarking) phase, with the focus being on assessing the status of carp populations and aquatic ecosystem health at sites throughout the Lower Lachlan River. Variables being measured include carp abundance, carp recruitment, water quality, algal densities, river bank stability, aquatic vegetation cover, and composition of native fish and macro-invertebrate communities. We are also interested in social attitudes towards carp and their perceived impact, and also community attitudes towards the project itself. Ten thousand carp will also be tagged in order to enable assessments of the cost efficiency of subsequent removal activities once the implementation (control) phase begins in 2008.

To date, we have collected benchmark data for carp abundance and recruitment, native fish, water quality and algal densities. We have started carp tagging and have tagged several hundred fish. Plans are in place to trial control works at Lake Brewster and the Great Cumbung Swamp in the upcoming 07/08 irrigation season. Fishway traps (carp separation cages) are being designed for installation within existing fishways on Island Bend and Bumbuggan Weirs near Condobalin. The project's communications strategy has been prepared and will be implemented as soon as the social research benchmarking community attitudes towards carp and their impacts has been completed.

Image: Andrew Norris and Michael Hutchison, QLD DPI and Fisheries (courtesy of Chris Buller).

Project No./s:	4.F.5
Program/s:	FRESHWATER
Lead Researcher:	DR DEAN GILLIGAN
Commercial partner:	VIC DEPT OF PRIMARY INDUSTRIES

"Daughterless" carp project

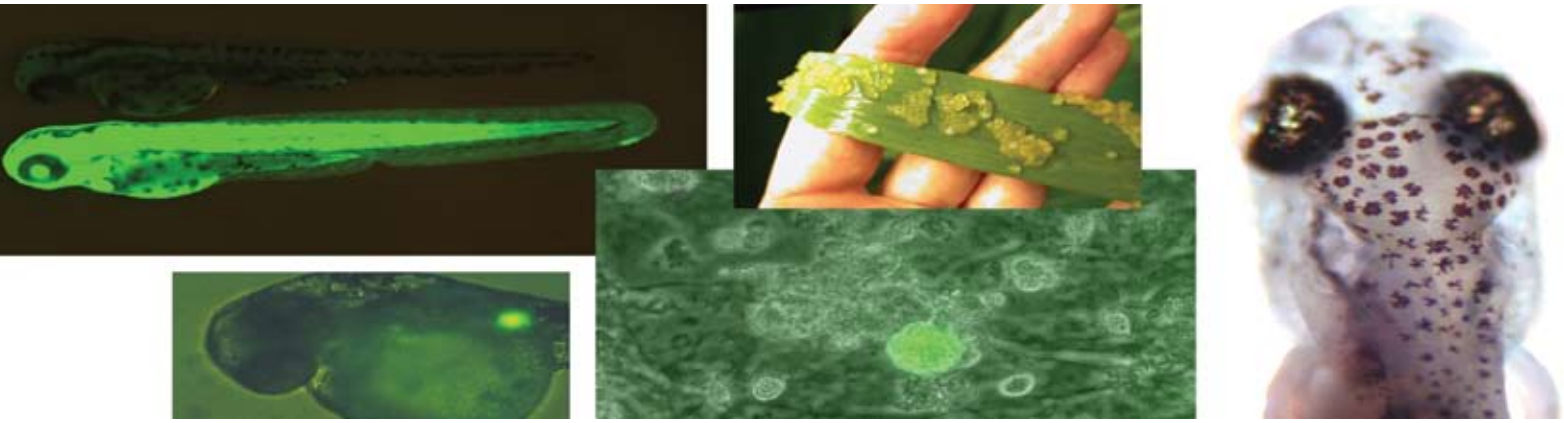
This is a long-term project, carried over from our predecessor the Pest Animal Control CRC, and is being conducted by CSIRO Marine and Atmospheric Research laboratories in Hobart, with financial support from the Murray-Darling Basin Commission. The 'daughterless' concept involves using cutting-edge genetic recombinant technology to produce an inherited construct that biases offspring sex ratios toward males. Detailed modelling of the effects of such a construct has been completed and confirms that, once stocked into a target population, this technology would have the capacity to lead to extinction of the species.

The project has now successfully proceeded to proof of concept in Medaka, the Japanese rice fish. This species has been used as the test subject because of the ease of breeding, and its short life cycle.

Two suitable constructs have been engineered in carp that successfully produce neo-males (phenotypic males/genetic females). 22 offspring are now close to sexual maturity—approximately half are expected to carry the modified gene according to Mendelian genetics. This is exciting progress, but a lot of work remains before the technology is proven.

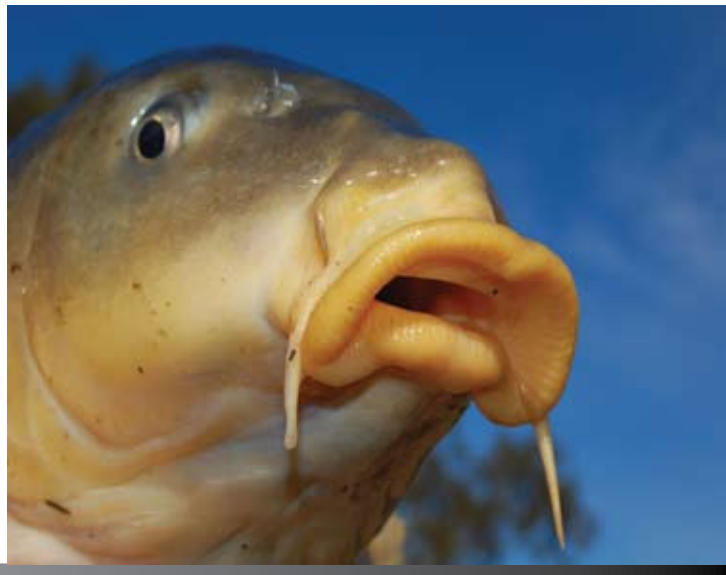
The next step is to establish a PC2-certified hatchery so that large brood lines can be developed that have integrated copies of the chosen construct. Successful integration rates need to be improved.

Images below: (upper) Carp spawn and fingerlings (courtesy of Jawahar Patil); (lower) Carp (couresy of Victorian DPI).



The Murray-Darling Basin Commission has included further development of daughterless technology as part of its 50-year Native Fish Strategy.

Carp are the most abundant large freshwater fish in the Murray-Darling basin and the dominant fish species in many of Australia's river systems.



Project No./s:	4.F.3
Program/s:	FRESHWATER
Lead Researcher:	DR RON THRESHER
Commercial Partner:	CSIRO MARINE AND ATMOSPHERIC RESEARCH

Reviewing public attitudes to invasive animals

The need for a review of the research literature on public attitudes was identified by participants in the CRC's socioeconomic "Costing the Impacts" workshop, held in Canberra in November 2005.

The review aimed to maximise the use of existing knowledge, to identify knowledge gaps, to identify suitable social research approaches, and to help focus research efforts across the work of the CRC.

Animals covered in the Australasian literature include: foxes, wild dogs, rodents, cane toads, rabbits, horses, pigs, deer, goats, kangaroos, possums, stoats, bandicoots and flying foxes.

The review observed that little primary research has been done on attitudes and perceptions of invasive animals in Australia. Studies to date have generally been reactive and not well informed by previous work. The geographical coverage is patchy, and no national Australian picture for pest animals is available. The species coverage is variable, as is the quality of the work, with almost no coverage of perceived or experienced social impacts.

Perceptions and attitudes to invasive animals were found to vary with:

- gender — males are generally more likely to consider invasive animals a 'serious' problem, and more likely to support intervention and the use of lethal controls
- age — older people are generally more likely to regard an animal as a pest (and a more serious problem) than younger people are
- residence — rural residents generally perceive invasive animals as being more of a problem than urban residents do
- species of invasive animal — animals that are capable of being companion animals or are large, attractive mammals, are generally considered more favourably than rodents and non-mammalian species
- interest — attitudes vary between people with ethical or conservation interests, animal industry practitioners, conservation groups, scientists and health professionals
- personal situation — attitudes towards species that are seen as a pressing national or local problem tend to be more negative than towards species that are seen as being less pressing, or farther from home
- culture — certain species of animals are seen as companion animals in one culture but as pests and/or food in other cultures.

Brushtail Possum (courtesy of Australian Wildlife Conservancy).

Differing perceptions:

The brushtail possum
- an established pest in New Zealand
- iconic native in Australia.

The review recommended that a national-level survey of the Australian public's attitudes towards and understanding of, the main invasive animals be undertaken. It also recommended that a review of the literature on social attitudes to pest control methods be done to complement the current review.

Project No./s:	12.D.5
Program/s:	DETECTION & PREVENTION
Lead Researcher:	GERARD FITZGERALD
Commercial partner:	FITZGERALD APPLIED TECHNOLOGY

A national facility for genotyping invasive animals

The primary aim of this project has been to develop and apply molecular techniques to the analysis of invasive animals in Australia to better inform their management. In particular, the team is focusing on DNA detection and identification approaches for foxes, cats and other animals. The emphasis is on working with trace samples such as faeces (scat), fur or blood. DNA markers called microsatellites and single nucleotide polymorphisms (SNPs), are being developed to allow a quick and definitive test for animal identification. From a tiny amount of animal remains, genotyping can reveal which species the animal is, how it's related to others in the species/population, and potentially even what it has recently eaten. Such information could have powerful application to field ecological study and management by defining mating systems, enabling mark-recapture studies using trace samples, estimating dispersal and defining the spatial units of control.

Once developed, the genotyping facility will be available to all pest animal managers and researchers, to assist in the analysis and management of feral animal populations.

The techniques the team have developed so far have been demonstrated to be highly efficient, robust and accurate. Trials have shown that single hairs contain sufficient DNA for individual identification. Numerous researchers inside and outside the CRC are keen to apply the technology.

The new marker techniques were used to identify fox remains in Tasmania, contributing to the state government's decision to provide $56 million to eradicate foxes. Testing of over 1600 scats and other samples in Tasmania (with Department of Primary Industries & Water) identified foxes from scats, a blood spot, carcasses and roadside blood spatters. DNA-based scat detection is now central to the surveys being conducted by the DPIW.

The team has tested their multi-species identification approach in Tasmania and found it also to be robust and accurate for cats, dogs, devils and quolls (see "supporting the eradication of the fox from Tasmania" project). They have also adapted and optimised DNA markers for fallow deer, possums and feral pigs.

Collaborative field trials to further test the markers for identifying animals are being organised across Australia. The WA Department of Environment and Conservation, Arthur Rylah Institute, Phillip Island Nature Park, and NSW Department of Primary Industries are all involved. These studies will mainly focus on the integration of fox and cat genotyping into mark-recapture population size estimates.

The team has initiated a nationwide collection of tissue samples from foxes through an extensive media campaign and development of an associated web site (http: www.foxDNA.animals.uwa.edu.au). Thus far they have accumulated over 2200 samples Australia-wide from a wide range of landscape types. Cat sampling has been more targeted but has so far collected 77 samples from 14 sites across Australia including the ACT, French Island, East Gippsland, Roxby Downs, Kangaroo Island and Western Australia.

Research partners: Tasmanian Department of Primary Industries and Water, University of Canberra, University of Western Australia

Project No./s:	9.D.2
Program/s:	DETECTION & PREVENTION
Lead Researcher:	ASSOC PROF STEPHEN SARRE
Commercial Partner:	UNIVERSITY OF CANBERRA

Risk assessment modelling

This project aims to validate and refine Australia's risk assessment models for exotic animals, to protect Australia from new invasive species. Risk models for the import and keeping of exotic animals in Australia have been developed, but need to be rigorously tested. Our researchers have assessed data on the preferred habitat and 'invasiveness' characteristics of already established pests, to test the current models. The information gained will allow for more accurate predictions of whether an exotic animal species could become invasive here. The models will be used to guide Commonwealth and state governments in their decisions to import, trade, or keep exotic vertebrates in Australia.

Establishment success prediction:

A draft risk assessment model for establishment success of exotic birds and mammals introduced to New Zealand has been produced. Climate match, introduction success elsewhere, and overseas range size, were variables used to obtain an Establishment Risk Score for the model. For birds, migratory or non-migratory status was also used. The climate match data has initially come from individual meteorological stations in New Zealand and Australia. Plans to upgrade this to a splined surface (from WorldClim) have been hampered by problems with rainfall data from the east coast.

A table of habitat types for successful birds introduced to New Zealand has been completed. Similar tables for birds introduced to Australia and mammals to Australia and New Zealand have also been compiled. These will be used together with land-use cover maps to produce new maps showing where potential sites for successful establishment of new or existing invasives could be. To determine the actual distributions of the introduced species, some pre-publication distribution data for 14 birds from the 2007 Atlas of New Zealand Birds (due to be published in July) was used, along with distribution data from the 1985 atlas. Recent maps of mammals in New Zealand, birds in Australia, and possibly other maps for mammals in Australia (from another Detection and Prevention project) will also be used to determine actual distributions of species. This work will be extended to compare the maps of preferred habitat to the maps of each species' actual distribution, to see if areas with both suitable climate and habitat are significantly correlated with the areas where each exotic species is present, for both New Zealand and Australia. If so, this should be a robust predictive tool for distributions of other exotic species proposed for introduction, or for those that escape captivity or are still spreading from their site of introduction. The habitat comparison is a new research direction for this project.

Of the exotic mammals that are known to have been introduced to New Zealand, 27 successful ones and 12 that failed have been analysed to date. For birds, 26 successful species and 53 failed ones were run through the model. Overall, very good discrimination was found between successful and failed species when the identified variables were used to rank species according to their establishment risk: the higher the score, the more likely that species was to have successfully established in New Zealand. The model has also been tested on an independent data set obtained from 21 extra bird species (9 successful and 12 failed), including the eastern rosella, rock dove and peafowl. The model showed good discrimination between the successful and failed species in this data set.

Image left Nicky Aitken in lab, University of Canberra (courtesy Kerryn Molloy).

Project No./s:	9.D.1
Program/s:	DETECTION & PREVENTION
Lead Researcher:	DR MARY BOMFORD
Commercial partner:	BUREAU OF RURAL SCIENCES

STRATEGIES AND ACTIVITIES

In the case of centre intellectual property (IP) deemed to be commercially valuable, it is the aim of the CRC to sub-licence rights to exploit the IP to commercial participants early in the commercialisation pipeline. Under this scenario, both the commercial participant and the CRC have security that the commercialisation pipeline, value chain and commercial arrangements (terms of agreement) are defined prior to developmental costs being committed by the partnership. This strong focus on development in partnership is reflected in the strong and mutually beneficial relationships that the CRC is building with its commercial participants and will facilitate the commercialisation process to deliver greater market outcomes.

The CRC's focus is in promoting utilisation centres around the adoption of technology by our commercial participants, rather than creating new spin-off enterprises that would ultimately compete with existing small- to-medium enterprises (SMEs), in what is already a comparatively small and niche market.

The collaboration between SMEs and end-users in creating new products means that all stakeholders buy in to any successful outcome early in product development and this translates into greater adoption once the product or service is available commercially.

Commercialisation activities grouped by IA CRC operational target

1. A benefit of $29 million p.a. by reducing the impacts of fox and wild dogs by 10%

EC470

This project aims to deliver a new active ingredient (PAPP) for incorporation into baits that are used to control foxes and wild dogs. We expect that PAPP should enhance participation in control programs where perceptions regarding 1080 adversely impact cooperative efforts to combat fox and wild dog control. For example, baits containing PAPP will exhibit relatively high target specificity and an antidote exists for treating poisoned non-targets such as farm-working dogs and pets.

Pestat Pty Ltd, a commercial participant of the CRC, has managed this project with inputs from the CRC over the past 12 months. The project has seen the formulation and quality assurance of product manufacture finalised, in addition to completing small-scale fox efficacy studies, non-target risk assessments, environmental safety studies and antidote testing, which proved remarkably effective.

Over the next 12 months our efforts will be directed at proving the efficacy of the product in the field for fox control and compiling all the data into a regulatory application for approval. We anticipate finalising field studies during this calendar year and submitting a registration application before 2008, with the proviso that efficacy is sufficiently proven. The review of this registration application by the Australian Pesticides and Veterinary Medicines Authority (APVMA) and an approval is expected to take up to 24 months prior to Animal Control Technologies Australia Pty Ltd (ACTA) marketing and selling the new baits.

STRATEGIES AND ACTIVITIES CONT'D

Commercialisation activities grouped by IA CRC operational target cont'd

2. A benefit of $16 million p.a. by reducing feral pig damage by 20%

PIGOUT®

PIGOUT® is a totally new manufactured feral pig bait containing 72mg of the poison 1080. Currently the majority of feral pig baiting utilises fermented grain or fresh meat cut into chunks that is dosed with 1080 prior to being ground (grain and meat baits) or aerially deployed (meat baits). These methods are arguably effective but equally they represent a great risk to non-targets, and a manufactured bait with better target specificity has been a priority for feral pig control for decades.

The CRC in collaboration with ACTA has addressed this market need with an application for approval of PIGOUT® submitted to the APVMA in September 2006. We have eagerly followed its progression through the regulatory process and are expecting provisional approval late in 2007. A launch is planned cooperatively with Meat and Livestock Australia and ACTA soon after registration.

NEW FERAL PIG ACTIVE

While we advocate 1080 as the best option currently available to us we also recognise its limitations for effective pig control. In an effort to identify actives that will enhance the effectiveness of pig control programs and reduce their risk to non-target species we have invested significant resources to the small-scale testing of several chemical candidates. This effort was rewarded during the year and we have applied for this CRC's first provisional patent in order to protect our investment and maximise our capacity to benefit from the effectiveness of the active and its attractiveness to global omnivore-control markets.

Australian Provisional Patent No. 2007901050

United States Provisional Patent Application 60/903891

"Feral Omnivore Bait and uses thereof"

Most recently our attention has turned to securing the funding that will underpin the studies required to test HOG-GONE™ – a feral pig bait containing the new active and based on the PIGOUT™ matrix.

4. A capacity to deliver improved quality and availability of inland water through reduced impacts and rates of spread of carp and other pest fish species

DAUGHTERLESS CARP

The objective of the project remains to develop a practical option for controlling, if not eradicating, carp from the Murray-Darling Basin, using as a core technology a genetic construct that biases population sex ratios and drives population fertility to zero. This core technology is protected by Australian Patent Application No. 2001291520 and United States Patent Application 10/398482 titled "Genetic control of sex ratios in animal populations".

STRATEGIES AND ACTIVITIES CONT'D

INTEGRATION OF THE CONSTRUCT

Principal effort has been directed at producing integrated "carriers" of the constructs, which can be used to assess the efficacy of the construct in causing sex change, and to begin experiments in laboratory populations to test the effects of a daughterless construct on population viability. We have succeeded in producing at least one carrier, and are checking several more fish that show indications of being carriers. Less than a third of potential carriers have been screened to date, so more are possible. We estimate it will take 4-6 months to complete screening.

THE CARP DAUGHTERLESS CONSTRUCT

Given the success of the Mark 2 and Mark 5 constructs to turn genetic female medaka into functional males, we commenced the program to produce a Mark 1 carp construct. The construct uses wholly native carp genes, and is modelled on the medaka Mark 5. The construct has been completed, and tested successfully for preliminary functionality in zebrafish (i.e. we have verified the construct is turning on as predicted, though its impacts on sex change can only be tested in carp). The construct is ready to be injected into carp eggs, once suitable facilities are available.

SPECIFICITY TRIALS

We have developed an experimental strategy to undertake the specificity trials, and commenced the experimental set-up to test the specificity of the carp construct in a species of rainbowfish. First experiments have been undertaken to test our ability to insert the gene into their eggs; the trial was successful. We have also arranged for specimens of gudgeons to be sent to the laboratory, which we will shortly also commence to breed. Finally, we have had preliminary discussions with hatchery managers at Snobs Creek, Victoria, about starting a program to produce Murray cod for testing.

7. Increased agricultural profitability through improved integration of existing biological, conventional and newly developed control options for rabbits

CARBON MONOXIDE (CO) FUMIGATOR

This project has demonstrated the highs and lows that is research, even in its latest stages. The prototype performance in July 2006 that exceeded expectations was quickly followed in September/November 2006 by disappointing results that meant reconfiguring the unit. Reconfiguring required the identification of new components that would maximise the unit's operation and reliability in the field. This process of component identification and validation has only just been completed and we are now looking to the manufacture of new field-ready prototypes and the completion in this calendar year of the field testing prior to submitting a registration approval application with the APVMA.

STRATEGIES AND ACTIVITIES CONT'D

FREEZE-DRIED RABBIT HAEMORRHAGIC DISEASE VIRUS

This project has progressed well, with the development of a freeze-drying formulation and protocol that maintains rabbit haemorrhagic disease virus viability, antigen presentation and pathogenicity. Two freeze-dried batches have been prepared and tested. The results were comparable to the currently available viral suspension. The stability study on freeze-dried RHDV has begun and field testing carrots or oats inoculated with freeze-dried virus will occur early in the new financial year 07/08. Field testing data from carrot or oat inoculated with freeze-dried virus that had been stored under accelerated shelf-life conditions for greater than three months will be used to support a registration approval package and lodged with the APVMA late in 2007 (pending successful field-test results).

10. Growth in Australian invasive animal pest control industries

ORAL FERTILITY CONTROL

Two technologies have been in-licensed by the CRC, one from a small United States company SenesTech Inc and a second from the University of Newcastle. Both focus on de-populating the ovary of primordial follicles to induce sterility in female mammals, although the mechanism for achieving this is distinct for each technology. Both technologies have the potential to be delivered orally, with the target species being browsing herbivores such as eastern grey kangaroos or brumbies. We have balanced the risk in this area of research/development by targeting two sets of IP that are at very different stages of development. The SenesTech technology is not species specific but has proven effective at inducing sterility without significant side effects in rodents, cats and dogs and is orally active (late stage research/early development stage). In contrast, the University of Newcastle technology is significantly less mature and, although potentially an exquisitely species-specific technology platform and orally deliverable, is yet to prove effective in rodent models.

SENESTECH INC TECHNOLOGY

Dose determination studies in Tammar wallabies are currently underway and due for completion by the end of July 2007. Oral efficacy experiments are planned later this calendar year in kangaroos (dependant on dose determination results). Extending this work to brumbies will require additional external funding.

UNIVERSITY OF NEWCASTLE

This technology development was dependant on the initiation of an ARC-linkage project between Pestat Pty Ltd (commercial participant of the CRC) and the University of Newcastle (CRC participant). This occurred in May 2007 after significant negotiation and as such there has been no development of the technology. Development work is slated to begin next financial year where the technology will be aimed initially at inducing infertility in rodents, and then moving to browsing herbivores.

Both of these technologies may result in products that can be offered to our commercial participants to assist in the growth of their core businesses.

STRATEGIES AND ACTIVITIES CONT'D

COMMERCIAL PARTICIPANT BENCHMARKING

Our effort is focused on engaging the centre's commercial participants to better understand their expectations of the CRC. We have highlighted how their continued involvement can add value to their core businesses. Specifically, we are concentrating on how the significant resources of the CRC can be used to effectively leverage additional funding opportunities through AusIndustry and other initiatives aimed at growing SMEs and their capacity to feed back into Australia's national interests (e.g. pest animal management, increased employment, export earnings).

IA OFFSHORE

The Uptake Program's offshore focus concentrated on configurations of PIGOUT® matrix and the CO pressure fumigator:

- In the United States, baits were attractive to wild hogs but lacked target specificity and we are now focused on improving the target specificity of PIGOUT® using repellents. Recently a repellent has been found and further field trials are planned for late 2007.
- In New Zealand, Landcare Research demonstrated that PIGOUT® was one of the most palatable feral pig baits. Immune Solutions showed that PIGOUT® baits were a suitable carrier for disease vaccines, such as a mock pseudorabies virus.
- In England, Central Science Laboratory has reported that their captive boar were not particularly attracted to PIGOUT®, a result similar to that reported by Veterinary Laboratory Agency (VLA) on captive badgers. Fortunately VLA will be testing the baits, as well as FOXOFF®, with wild badgers in the coming months.
- Also in England, the fumigator prototype exceeded expectations in trials that examined the composition of exhaust emissions and the dynamics of gas movements and CO concentrations throughout an artificial warren. Further development of the fumigator in Australia and efficacy field testing in rabbit warrens will only enhance the probability of its adoption in offshore markets.

13. Efficiently manage resources to achieve the CRC's research, education, commercialisation and technology transfer outcomes

GRANTS

Five grants have been applied for over the past twelve months with two being successful and one still pending (NFACP, International Science Linkage x two and Alternatives to 1080).

COMMERCIALISATION COMPONENT OF THE "BALANCED SCIENTIST" WORKSHOP

This workshop comprised the basic information about IP, types of IP, protecting IP, the methods used to value and add value to IP and the importance of IP in the realm of capital investment in research.

STRATEGIES AND ACTIVITIES CONT'D

The concept of this component of the Balanced Scientist workshop was to convey the message that as researchers in a CRC, their research can just as easily be viewed as developing IP, and to have them appreciate their research project in this context.

INTELLECTUAL PROPERTY AUDIT

An IP audit of the four research programs will be completed following this year's reviews and used to formulate an appropriate search string for an international IP search. Results of the IP search should allow the centre to position its research strategically to maximise potential opportunities and collaborations and minimise risk of possible infringement across our multi-disciplinary research fields.

INTELLECTUAL PROPERTY MANAGEMENT

The CRC's management of IP encompasses a balanced strategy based on the following parameters:

- resources
- maximising value of the CRC to participants
- benchmarking background IP and maximising the added value to centre IP
- priority for CRC IP management
- enhancing commercial awareness of centre staff and students
- minimising the risk of inappropriate IP disclosure.

The IP Management Plan was tailored to take into account the unique qualities of the CRC and the focus of its activities. This strategy balanced a requirement for IP identification, while recognising that university researchers commonly saw little prospect of their outputs having value which required IP protection.

Managing the intellectual property of the CRC is critical to achieving an organisation that maximises the value created through applied research and innovation. For this to occur, a capacity to foster invasive animal research and development must be created, whereby innovative methods of controlling invasive animals within Australasian communities and ecosystems are brought to market for the benefit of all stakeholders. The Board and executive of the CRC recognise this key dynamic and have pre-empted the importance of value-adding to participant background intellectual property (BIP) in creating centre intellectual property (CIP), by resourcing the Uptake Program to effectively plan for and manage the IP encompassed within all projects.

Broadly speaking, managing IP can be divided into internal and external IP management. In the context of the CRC operations, internal IP management encompasses all activities required to audit, assess, develop, protect and exploit BIP and CIP, while external IP management encompasses all activities required to identify, evaluate and interpret the relevance of global non-participant IP to the BIP and CIP. Depending on the field and jurisdiction of the relevant global non-participant IP, it will be interpreted as an opportunity or a threat to centre activities and potential CIP. In this way, the CRC can readily pinpoint its IP strengths and weaknesses within the relevant global IP environment and plan strategically how best to establish a world-leading footprint within the field of invasive animal control techniques—not only in Australia, but on a global scale. This has the

INTELLECTUAL PROPERTY MANAGEMENT CONT'D

advantage that the CRC can be confident that the value it adds to participant BIP in progressing projects is not placed at unacceptable risk. Also that it builds the profile and brand of the CRC in attracting new research partners and with them opportunities. Management of these types of IP by the CRC encompasses risks that must be managed in order to maximise the value of BIP and CIP to the company and CRC participants.

This IP management plan aims to describe the processes that the CRC will use to effectively manage these risks.

Key IP risks to the CRC and its participants are:

1. Failing to identify and capture the value in project BIP, assignment of IP and the potential CIP arising from projects.
2. Failing to identify new opportunities within non-participant IP that can be enhanced through the value adding activities of the centre.
3. Failing to identify non-participant IP that is most relevant to centre activities and the potential for infringement.
4. Failing to commercialise centre IP.

More specifically, the CRC IP Management Plan has been designed to accomplish the following key operational outcomes:

1. Conduct an IP audit of all project BIP that defines the IP asset class of BIP in each project, pre-emptively identifies the potential CIP, and highlights project CIP of probably commercial value (internal IP management).
2. Identify BIP that is likely to be commercially valuable and should be (if not already) protected (internal IP management).
3. Predict from BIP and project milestones potential centre IP that will be commercially valuable, so as to pro-actively manage value-adding activities and the researcher's motivation and goals (internal IP management).
4. Identify relevant non-particpiant IP such that CIP is positioned within the broader global context, in order to highlight infringement risks and future opportunities for collaboration and value adding.
5. Increase the awareness of centre staff and students of the critical processes that underpin commercialisation of research (appropriate record keeping, protecting confidentiality, disclosure, IP asset classes, IP protection methods and the value their research adds to the IP they are working with or developing.
6. Plan and implement procedures that capture the value of centre IP without adversely affecting research collaboration, a researcher's personal motivations, or the unique selling points of the CRC.

The IP Management Plan and how it will operate is conceptualised in the schematic following (Figure 2), which broadly outlines those activities critical to achieving the six operational outcomes. Each of the four segments of this plan are detailed separately, allocating tasks and staff responsibility.

INTELLECTUAL PROPERTY MANAGEMENT CONT'D

FIRST SEGMENT – PROJECT AGREEMENTS

The Commercialisation Manager is responsible for conducting the IP audit, during which BIP is benchmarked. Benchmarking BIP defines the asset class of the IP, all assignments and ownership of the IP and relevant IP. The Commercialisation Manager is responsible for coordinating with program leaders, project managers and the Business Manager to pre-empt and classify all potential CIP. This information is critical in forward planning for appropriate protective measures and the resources that any protection will require. Specifically, this information is used to flag projects within CENTRIC (our data management system) that are likely to generate commercially valuable IP, such that milestones comprising the critical path in these projects are used as trigger or decision points for the executive in considering an IP plan for the specific project.

SECOND SEGMENT – NATIONAL AND INTERNATIONAL IP RESEARCH

Using information from the IP audit, the Commercialisation Manager in concert with the Business Manager is responsible for developing an optimal search string that is used to search global IP databases for IP relevant to the CRC activities. The Commercialisation Manager is responsible for coordinating and out sourcing to Pestat Pty Ltd patent searches. Pestat was chosen for its expertise in IP law (Dr David Dall) and IP management and access to IP databases (Prof Joan Dawes). This expertise and access to information systems is critical to successfully achieving this segment of the IP Management Plan and a project agreement has been negotiated with Pestat Pty Ltd to secure its services in this regard under commercial terms.

THIRD SEGMENT – PUBLICATIONS, PRESENTATIONS AND CONFERENCE ATTENDANCE

The Commercialisation Manager is responsible for coordinating with project leaders, project coordinators and the CRC executive to plan and implement procedures that are designed to minimise the risk of IP disclosures that would adversely impact the CRC, the public's perception of the CRC or its operational outcomes. These procedures result in an outline of the project's IP asset class, the disclosure content, the disclosure forum and dates. The standard operating procedures also encompass staff/student submissions for publication and media releases. All requests for disclosure need to be reviewed and signed off by the executive prior to the disclosure, wherever possible.

The Commercialisation Manager is also responsible for planning and conducting (with commercial participants) workshops for staff and students that increase the awareness of the importance of IP disclosure (see fourth segment) and the ramifications of inappropriate disclosure to themselves, the centre and its participants.

INTELLECTUAL PROPERTY MANAGEMENT CONT'D

Figure 2: Intellectual Property Management Plan

INTELLECTUAL PROPERTY MANAGEMENT CONT'D

FOURTH SEGMENT – COMMERCIALISATION WORKSHOPS

The Commercialisation Manager is responsible for coordinating with Pestat (David Dall – IP law, Joan Dawes – commercialisation of research) to plan and conduct commercialisation workshops for staff and students. The workshops are designed to increase the awareness of staff and students to the importance of IP, IP protection, IP disclosure and the commercialisation process more broadly.

These workshops focus strongly on the methods that should be used to collaborate and communicate effectively within the research community, without undermining the value being created by the research. The methods are demonstrated practically. The aim is to develop a culture within the CRC that values the strategic importance of IP and recognises how it compliments our research. Post-graduates receive the training (and personal advice) at an annual training camp.

New IP developed and sold, transferred or licensed for commercialisation during the reporting period

New pig toxin – rights to commercialise have been sub-licensed to ACTA.

Extension of label claims generated from research outcomes in project 3.T.2 (control of rodent infestations in intensive crops, industrial and island situations) have been sub-licenced to ACTA. This commercial participant is providing all the necessary background IP for the project.

How the IP arrangements will accrue maximum national benefits to Australia, including whether the CRC has imposed conditions on the licensing of its IP that ensures the end-user maximises the commercial potential and return to Australia

CRC IP arrangements require a return on investment from the assignee and these generally take the form of increasing royalties on a guaranteed minimum number of product sales. This approach maximises the value of centre IP and the benefits that flow back to Australia, because it recognises that the potential markets and product margins for pest animal management products are comparatively small, minimises the upfront capital outlay for entering a market for assignees, and maintains an upside should product sales exceed forecasts.

Table 6: education and training outputs and/or milestones

Output/Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestone
11.1 Output	Increased professional and practical skills base in invasive animal management through education, training and community awareness	2012	Partly.		
11.1.4 Milestone	Thirty honours degree candidates (1 year full-time, 2 years part-time) enrolled in the life of the CRC. (Our students may be enrolled at any CRC partner university) each year in 2006 - 2010	28 February 2006 and annually.	No.	Due to budget constraints the honours program will not achieve this milestone - only two honours students so far.	None
11.1.5 Milestone	Short course and online teaching units developed for the PhD program offered routinely to employees in the pest animal industry.	30 June 2007	Yes.		
11.1.6 Milestone	Extension practitioner workshop held to enhance skills and knowledge to effectively deliver strategic, best practice invasive animal management strategies.	01 December 2007	Yes. DPI Orange held two courses this year.		
11.2 Output	Stakeholder training: delivery of workshops, training courses and community awareness to increase practical skills and knowledge, and ensure consistent national management strategies of invasive species.	2012			
11.2.2 Milestone	A series of five 'training the trainer' courses, delivering consistent national approaches to knowledge, management and practical skills training, presented to facilitate a rapid uptake of new technologies, and provide the opportunity for two-way information flow.	01 June 2007 and ongoing	Partly.		This activity will be covered by the Diploma in Conservation and Land Management course due to start 2008.
11.2.3 Milestone	Specialist training presented to national and international students, researchers and land managers for each key invasive species targeted by the CRC.	30 June 2007 and ongoing.	Partly.	Ongoing project.	Ongoing - Wee Jasper workshop and DPI Organge courses covered this.

Output/Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestone
11.2.4 Milestone	Awareness training presented for councillors and staff at a minimum of 14 urban electorates to facilitate informed policy making.	30 June 2007 and ongoing.	Partly.		Ongoing - many staff have presented best practice management advice at various venues.
11.2.5 Milestone	Invasive animal management training presented for local government land managers and rangers at a minimum of 14 urban electorates.	30 June 2007 and ongoing.	Partly.	Ongoing project.	Diploma in CLM course due to start 2008 will address this milestone in full.
11.2.7 Milestone	Land and water areas currently under strategic best practice, invasive animal management plans identified.	December 2006.	Yes.		
11.2.9 Milestone	Host workshops held for each key invasive species (including native species) targeted by the CRC, to ensure consistency of national management strategies.	30 June 2007 and ongoing.	Partly.	Ongoing project.	
11.2.12 Milestone	Training provider workshop held to update and discuss future directions, issues, and requirments of training providers.	01 December 2007	Yes.		

Image below: Participants' Committee Meeting 2006 (courtesy of Kerryn Molloy)

INVOLVEMENT OF INDUSTRY IN RESEARCH SUPERVISION

There is good industry involvement in student supervision. In Cohort 1, four students are based with and are directly supervised by industry partners (New South Wales Department of Primary Industry [DPI], CSIRO and WA DEC) and the remaining seven students collaborate with industry partners as part of their research activities. A similar demographic exists within Cohort 2, with five students being based with industry partners (NSW DPI, Lowe Ecological Services, Victorian DPI and CSIRO), five more collaborate with industry as part of their research projects and one student holds an industry (Australian Pork Limited) scholarship.

END-USER INVOLVEMENT IN DEVELOPING UNDERGRADUATE COURSES

Two of our projects cover the development of undergraduate courses in invasive animal management. New South Wales DPI has been funded to explore skills gaps in the industry and identify appropriate accredited training to address these gaps through collaboration with Tocal College. Additionally, the first project is working on mapping the annual training course run out of NSW DPI on invasive animal management to units in the Conservation and Land Management (CLM) Training Package at levels II-IV. The second project, run directly by Education Program staff and funded in part by the National Heritage Trust, is developing a Diploma-level training course for mixed mode (web and face-to-face) delivery. The course will teach a skills set comprising six units from the CLM training package (specialising in invasive animal management) at Level V. Demand for the training course has been established through extensive consultation with national natural resource management and catchment management boards, rural lands protection boards, State agencies and the Vertebrate Pests Committee. The course supports the principles of pest animal management as described in the recent series of pest animal guidelines that have been developed by the Bureau of Rural Sciences and will be ready for delivery at the beginning of March 2008.

SEMINARS /WORKSHOPS/ COURSES RUN FOR INDUSTRY

CRC staff from all our programs have participated in a number of industry seminars and workshops. The Education Program has participated in three pest animal management workshops in Dubbo (run by Dubbo Rural Lands Protection Board), Eyre Peninsular (West Coast IMP program - Eyre Peninsular Natural Resource Management Board) and the Lachlan Catchment Management Authority, to advise on pest management issues and management plans. Courses are being developed for industry in Conservation and Land Management at levels II-V as described above.

CONTRIBUTION TO SKILL DEVELOPMENT IN THE INDUSTRY

The Education Program is contributing to skill development through the development of vocation and education training (VET) courses and participation in pest management meetings. Through its postgraduate program, the Education Program of the CRC is contributing to the skills base through the training and development of its postgraduate students. The 'Balanced Scientist program' aims to develop students' skills in self awareness, team building, intellectual property and commercialisation, in addition to specific skills for the research environment. Students participate in industry placements and annual training camps, during which they attend workshops and participate in team-building activities. Students also benefit from the social opportunities presented at the camps and develop networks of contacts that will likely benefit their future careers and their contribution to the industry.

Recruitment and supervision of PhD students is ahead of schedule with 11 postgraduate students in the first Cohort of PhD candidates and 11 students in Cohort 2. Recruitment of the third and final Cohort of students is underway, with a total of eight projects being offered.

Students in the IA CRC's education program benefit from skills training and up to six months longer scholarships.

MEET OUR STUDENTS:

Education Program leader
Associate Professor
Stephen Sarre

Education Program
coordinator:
Dr Nina Jenkins

Cohort 1 PhD students

Name	Project	Partner
John Abramyan	'Daughterless' cane toads.	University of Qld
Andrew Bengsen	Control of feral pigs in tropical rainforest.	University of Qld
Tony Buckmaster	The response of feral cats to broad scale fox control measures in East Gippsland.	University of Sydney
Tarnya Cox	Assessing animal attractants and repellants.	University of Qld
Jennyffer Cruz-Bernal	Effects of fox control on abundance, survival and recruitment of the common brushtail possum.	University of Qld
Alex Diment	Interactions between predator reinvasion rates and thresholds of prey species response to fox control in south-eastern Australia.	University of Sydney
Amanda Elledge	Impacts of feral pigs on biodiversity in Australia's wet tropics.	University of Qld
Gwilym Haynes	Population genetics of carp in the Murray-Darling Basin.	University of Sydney
Eve Macdonald-Madden	Modelling optimal monitoring techniques.	University of Qld
Maija Marsh	Social organisation of rabbits and the impact of RHDV.	University of York, UK
Carla Meurk	Critical considerations affecting uptake of feral pig management strategies in the wet tropics, North Qld (sociology).	University of Qld

Cohort 2 PhD students

Danielle Carey	Improved dog control via DNA-based monitoring systems.	University of WA
Katie Doyle	Impact of increased predator presence through stocking on carp populations and the implications for management.	University of Qld
Aaron Elkins	Identifying and isolating natural environmental attractants for common carp control.	Australian National University
Peter Elsworth	Host-parasite coevolution: is genetic resistance developing in wild rabbit populations affected by the RHD virus?	University of Canberra
Jess King	Are wildlife and particularly wild canids associated with Neospora abortion in cattle? Investigating the prevalence, life cycle and risk to cattle and wildlife of *Neospora caninum.*	University of Sydney
Penelope Marshall	Economic and other social impacts of wild dogs and foxes.	University of Canberra
Lindsey McFarlane	Regulation and manipulation of sex in the carp *Cyprinus carpio* (L) - Exploring RNAi and microRNA pathways.	University of Qld
Tom Newsome	Strategic management of wild dogs: how it affects ecosystems in north-eastern NSW.	University of Sydney

Left to right, top to bottom: John Abramyan, Megan Barney, Andrew Bengsen, Tony Buckmaster, Tarnya Cox, Danielle Carey, Jennyffer Cruz-Bernal, Alex Diment, Katie Doyle, Amanda Elledge, Aaron Elkins, Peter Elsworth, Gwilym Haynes, Jess King, Penelope Marshall, Eve Macdonald-Madden, Maija Marsh, Carla Meurk, Hayley Pearson, Lindsey McFarlane,Tom Newsome, Kylie Singh, Scott van Berneveld

Cohort 2 PhD students		
Hayley Pearson	Understanding and mitigating domestic pig and invasive animal interactions.	University of Sydney
Kylie Singh	Conservation benefits resulting from the commercial use of kangaroos, feral goats and feral pigs in the Australian rangelands.	University of Canberra
Scott van Barneveld	Ecology behaviour and physiology of the highly invasive Australian lizard *Lamproholis delicata.*	University of Sydney
Linked student		
Megan Barney	Sex differentiation and determination in Carp	University of Tasmania
Honours students		
Ben Allen	Urban dingoes and zoonotic diseases (completed 2006).	University of Qld
Mellissa Snape	Assessment of the effects of VCD, and of behavioural responses to novel bait items in the brush-tail possums.	Australian National University

COMMUNICATIONS

In our first year (2005-06) we focused on developing linkages with businesses, including SME's. The CRC implemented activities to develop a sense of unity and shared purpose, bringing our participants together to address our 13 goals. We encouraged:

- collaboration not competition (team approach)
- acknowledgement of the significance of research objectives and outcomes
- the importance of all researchers understanding the work of others in the CRC, not just their own project
- the importance of publishing research results, and actively promoting their own work.

In this financial year, we have met our key objective of 'ensuring effective external communication of our activities and outputs to targeted end-user groups, stakeholder and industry', by:

- increasing the circulation of our newsletter, the *'Feral Flyer'*, which is now received by around 750 people. Readers include not only our own research staff and at least one delegate from each of our participant organisations, but also the wider wildlife management community and individuals interested in invasives issues. In response to a participant survey, more information on our research results, profiles of staff and Board members has been added to the '*Flyer*'.
- hosting stands at the Pest Animal Symposium in Toowoomba, and the 5th World Conference of Science Journalists in Melbourne. We have sent delegates to the CRCA conference, and the first National Workshop for Regional Natural Resource Management held in Queensland.

Another objective of our communications program is 'raising awareness of pest animal issues and IA CRC activities and outputs in the broader community'. Initiatives towards this objective include:

- Our CEO, Tony Peacock, hosting a regular gig on ABC Radio, where he talks on a new 'feral focus' topic each fortnight, followed by answering questions from the community.
- Our Freshwater Program has added a new team member, whose role is to bring our research results and new tools/strategies to the attention of community groups and the Murray-Darling Basin Advisory Committee, to facilitate adoption and increase awareness of the issues needing our attention.
- Sponsoring an expert review of the Tasmanian fox incursion. Dr Glen Saunders chaired an expert panel, and developed recommendations for future monitoring and management, and publication of the report which documented the evidence in support of the presence of foxes in that State. National and local news media carried stories following this publication, as well as a dozen regional newspapers. The IA CRC then set up a project to provide a link between fox presence and control - with a facility for local groups to be trained in fox scat identification and collection techniques. Dr. Peacock now sits on the Fox Eradication Steering Committee and Drs. Saunders and Lapidge and Assoc Prof. Sarre all sit on the Technical Advisory Group.
- Our Education Program is developing curriculum-based teaching materials for secondary schools. Lesson plans and activities for students will be uploaded to the www.feral.org.au website.
- Our Uptake Program has appointed a National Facilitator to work with stakeholders and the community, and support the work of our wild dog demonstration site project. We aim to foster collaboration, increase awareness, assist data collection efforts, and facilitate the work of our researchers as they interact with stakeholders and end-users to develop regional wild dog management plans.

- In May we launched our new 'Breakthrough Seminar Series'. The first event showcased the work of Professor Peter Sorensen of the University of Minnesota, and his work on 'significant new discoveries in pest carp management'. The second seminar, in Perth, presented discoveries from our researchers on cane toad control. This event generated significant media and community interest, including from ABC Bush Telegraph, Southern Cross Ten 'State Focus' program, Ten News, Sunrise, 4BC Breakfast Program, and various regional news bulletins, newspapers and radio interviews. Features appeared in the Financial Review, Sydney Morning Herald and the Canberra Times. Further seminars are planned.
- Further development of the website www.invasiveanimals.com as an external communications tool.

To meet our objective of 'ensuring effective internal communication and a sense of corporate identity', we have invested in corporate clothing, document folders and promotional materials to be exhibited at expos and community events, and handouts such as lanyards and sticki-notes for distribution. We have developed cooperative arrangements with a number of participants, to deliver our partners' R&D findings through their communications vehicles.

Acting on initiatives suggested at review meetings over the past year, we have implemented our first internal e-mail newsgroup. The aim is to get our researchers talking to each other across project areas to recognise synergies, increase collaboration, and share expertise.

We have been working to improve our publications vetting process, and educate staff and students about the importance of promoting their work, while protecting centre IP. Our PhD students (Cohorts 1 and 2) have been brought together for a workshop, providing opportunities not only to increase their skills base, but also to foster a sense of belonging and promote opportunities for collaboration and expertise-sharing.

A final objective is 'raising awareness of pest animal issues and our activities with government, policy makers and regulatory authorities...'. We have participated in a 'Science meets Parliament' expo at Parliament House, and briefed our local member Bob McMullen. During the year Tony Peacock has met with Ministers Bishop, McGauran, Abetz, and advisers to a number of other Federal Ministers. Consultations have been held with various State Government Ministers and policy makers.

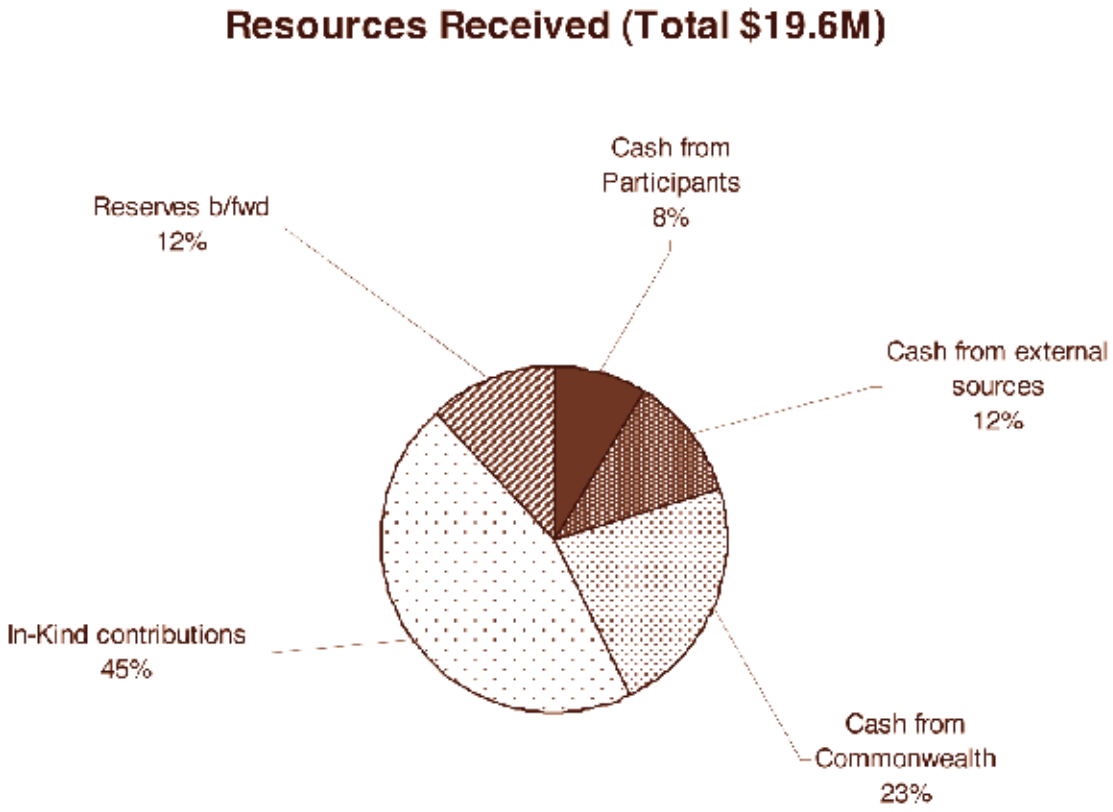
Chris Buller has been a prominent member of the Australian Animal Welfare Strategy's implementation committee. Particularly in the 'Animals in the Wild' sector, the CRC's research interests have been promoted and opportunity sought for innovative R&D applications.

Images

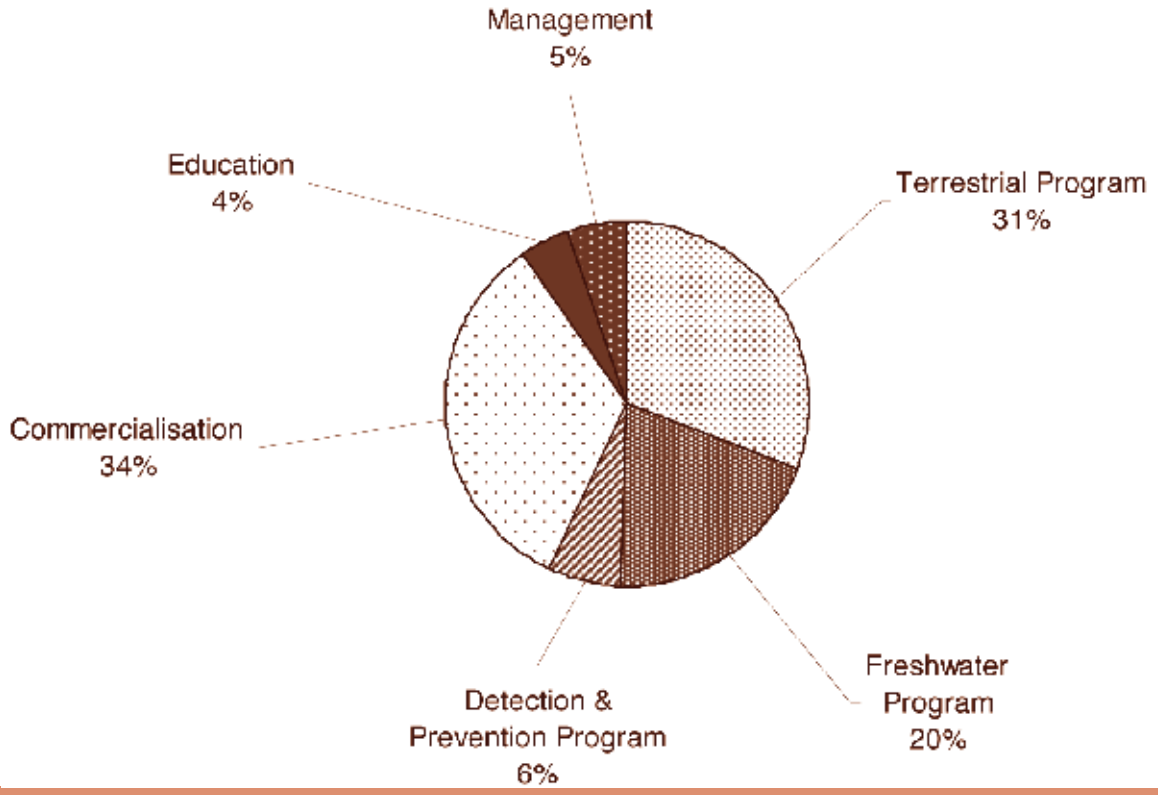
Left: Communications Manager Kerryn Molloy hosting a booth at the 5th World Conference of Science Journalists, Melbourne, 2007.

Right: Wendy Henderson, Program Coordinator, Detection & Prevention Program, models our corporate clothing.

Summary of resources received and applied for the 206/07 financial year:



Resources Applied (Total $17.4M)



The Financial Statements are prepared in accordance with Australian Accounting Standards (including Australian Accounting Interpretations) and the Commonwealth Government reporting requirements, and are available on request.

GLOSSARY

AusBIOSEC	Framework of guidelines for biosecurity arrangements in Australia
annulus	Latin for 'ring' - in fish research, refers to annual rings that form in fish scales or bone sections
avirulent	not virulent - refers to lack of competence of an infectious agent to produce pathological effects
biodiversity	variety of taxonomic life forms
biosecurity	protective measures to prevent a country from the entry and spread of unwanted animals, pests, diseases and weeds
conspecifics	members of the same species
CIP	Centre Intellectual Property
CRC	Cooperative Research Centre
daughterless	genetic engineering technique using species-native genes that are inheritable and bias offspring sex ratios towards males
DNA	Deoxyribonucleic acid
efficacy	the ability to produce a desired amount of a desired effect
endemic	unique to its own place or region – found only there and not naturally anywhere else
endorheic	closed watershed – no outflow
eutrophic	high primary productivity resulting from high nutrient content
inoculate	placement of something where it will grown or reproduce, most commonly in relation to sera
invasive	usually non-indigenous species that adversely effect the habitats they invade economically, environmentally or socially. We include some native animals where altered environments have caused their numbers or range to increase artificially
Judas animal	captive animal used to attract others, or which is fitted with a transmitter and released, leading researchers or hunters to a herd

KHV	Koi Herpes Virus
macropodid	member of the Macropodidae family, which includes kangaroos, wallabies, tree-kangaroos, pademelons and several others
macro-invertebrate	refers to aquatic invertebrates, including insects, crustaceans, molluscs and worms
myxomatosis	a virus specific to rabbits causes by the myxoma virus
otolith	structure in the inner ear
PAPP	Para-aminopropiophenone
parotoid	external skin gland of toads and salamanders
pathological	related to or caused by disease
PCR	polymerase chain reaction
pheromone	chemical that triggers an innate behavioural response in another member of the same species
primordial follicles	follicles within the ovaries from which eggs arise
RHD	Rabbit Haemorrhagic Disease
RHDV	Rabbit Haemorrhagic Disease Virus
RSPCA	Royal Society for the Prevention of Cruelty to Animals
scat	faeces, droppings
SMEs	small to medium enterprises
spawning	production or depositing of large quantities of eggs in water
sylvatic	referring to diseases or pathogens affecting only wild animals
terrestrial	land based
toxin	poisonous substance produced by living cells or organisms.

OUR PARTICIPANTS

Animal and Plant Control Commission of South Australia
Animal Control Technologies Australia Ltd
Australian National University
Australian Veterinary Association Ltd
Australian Wildlife Conservancy
Australian Wool Innovation Ltd
Bureau of Rural Sciences
Carpbusters Inc
Cattle Council of Australia
Central Science Laboratory, UK
Commonwealth Scientific and Industrial Research Organisation
Connovation Pty Ltd
Environment ACT
Grains Research and Development Corporation
K&C Fisheries Global Pty Ltd
Landcare Research International Ltd
Meat and Livestock Australia Ltd
Murray-Darling Basin Commission
New South Wales Department of Environment and Climate Change
New Zealand Department of Conservation
Parasitech
Pestat Ltd
Queensland Department of Natural Resources and Water
Queensland Department of Primary Industries and Fisheries
Scientific and Industrial Research Organisation
South Australian Department of Primary Industries, Water and Environment
South Australian Research and Development Institute
State Council of Rural Lands Protection Boards
Tasmanian Department of Primary Industries, Water and Environment
University of Canberra
University of Minnesota
University of Newcastle
University of Queensland
University of Sydney
University of Western Australia
University of York
ValueMetrics Australia
Victorian Department of Primary Industries
Victorian Department of Sustainability and Environment
Western Australian Department of Environment and Conservation
World Wildlife Fund

APPENDIX 1: PUBLICATIONS

PUBLISHED JOURNAL ARTICLES

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APPENDIX 1: PUBLICATIONS CONT'D

PUBLISHED JOURNAL ARTICLES CONT'D

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Urban, M.C., Phillips, B.L., Skelly, D.K., and R. Shine (2007). The cane toad's (*Bufo marinus*) increasing ability to invade Australia is revealed by a dynamically updated range model. Proc. R. Soc. B. 274(1616). June.

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(2006). Demonstrating the benefits of a strategic approach to managing wild dogs. Australasian Wildlife Management Society Conference, 4-7 December 2006, Auckland, NZ. pp. 115. Available Online at: http://www.awms.org.nz/Files/proceedings_2006.pdf

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APPENDIX 1: PUBLICATIONS CONT'D

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APPENDIX 2: MILESTONE REPORTING

Table 7: Research outputs and/or milestones

Output/Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestone
1.1 Output	Fox and wild dog management packages that include new and existing toxins, application strategies and end-user training	2012			
1.1.1 Milestone	Laboratory experiments and assessments to ensure safety of new toxins for field trials completed. Testing for species-specificity included.	01 June 2007	Yes		
1.1.4 Milestone	Ecological studies commenced to identify interactions with other processes threatening wildlife or damaging production, and new wild dog and fox management technologies and strategies tested and refined. Issues not covered at demonstration sites targeted in these studies.	31 July 2005	No for Ecological Studies. Yes for management strategies	1. Delayed CRC start due to MDBC negotiations in 05/06. 2. Further funding shortfall in 2007 experienced from major funding partner.	
1.2 Output	Fox and wild dog management packages that include new and existing toxins, application strategies and end-user training	2008 (Registration) 2010 (Marketing & Adoption)			
1.2.1 Milestone	End-users of package engaged & involved in its development.	July 2006	Yes		
1.2.3 Milestone	30 June 2007	Education and training package linked to demonstration sites developed for end-users.	No	Terrestrial and Education Programs making head way into utilising the NSW Vertebrate Pest Management Course & the various states Vertebrate Pest Control Manuals. Demonstration sites in most cases only in their infancy, but stakeholder/end user collaboration already strong. Extension and roll out of PAPP needs to also be considered.	Continue working party efforts in structuring package and foster demonstration site stakeholder relations. Extension and roll-out of PAPP needs to be considered.
1.3 Output	Additional registered fox and wild dog management tools, including lures and new toxin delivery methods.	2008 (Registration) 2010 (Marketing			

Table 7: Research outputs and/or milestones

Output/Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestone
1.3.1 Milestone	National market potential and registration requirements of fox and wild dog lures and novel toxin delivery systems (e.g. M-44 mechanical ejectors) assessed.	30 June 2007	Partly	Stakeholder involvement in M-44 mechanical ejectors is varied, independent and complicated. Stakeholders involved know there is limited potential for profitable outcomes on an individual basis, let alone a group basis. Any project will look more like filling a niche management situation only.	Proposed review of mechanical ejector utility in the field of vertebrate pest management will draw upon international experience and that of Australian researchers, with particular attention paid to ACT/NSW (DEC) data, QLD (DNRW) data and Pestat's SA data. Determine next step after the review findings have been considered.
2.1 Output	Management packages for feral pigs, including new & existing toxins, application strategies & end-user training	2012			
2.1.4 Milestone	Ecological studies commenced to identify interactions with other processes threatening wildlife or human health or damaging production, & new feral pig management technologies & strategies tested & refined.	July 2006 & ongoing			
2.2 Output	Humane and target specific feral pig baits.	2006 (Sodium fluoroacetate bait) 2008 (Marketing & adoption) 2012 (Achilles heel baits) Humane & target specific feral pig baits			
2.2.1 Milestone	Registration & market delivery of sodium fluoroacetate feral pig baits.	December 2006	No	Product registration package submitted to APVMA in Aug 06. Registration approval anticipated in mid to late 2007. Awaiting APVMA decision .	
3.4 Output	Technology and products for the control of mouse plagues transferred to commercial partners.	2010 (Field release) 2012 (adoption)			

Output/Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestone
3.4.1	A business plan showing economic viability, strategic uses and risk assessments for mouse virally-vectored immunocontraception (VVIC). Determination of proponents finalised.	June 2007	No		No plans at this point to pursue research any further.
3.4.2 Milestone	Approval for controlled pen releases obtained from State and Federal authorities (delays possible subject to requests for additional info).	June 2007	No	Approvals not required due to inability of natural transmission of infertility occurring.	No plans at this point to pursue research any further.
3.5 Output	New and improved rodent control options to protect produce in agricultural areas and bulk storage facilities	2012			
3.5.1 Milestone	Extent of problem and market opportunities scoped for new products.	01 June 2007	No		To be discussed with ACTA in June/July 07 (as part of commercial participants benchmarking - Milestone 10.U.14 Commercialisation project).
3.5.2 Milestone	Explore opportunities to license technologies from international partners.	01 June 2007	Yes		
4.1 Output	Business Plan for the Murray-Darling Basin Commission for the control & possible eradication of carp in the Basin, and the operational tools to make the plan feasible.	2012			
4.1.6 Milestone	Annual meetings of “Daughterless” Consultative Committee held to evaluate progress towards Business Plan & facilitate development of the policy & legislative frameworks required.	June 2007	Partly. ongoing.		
4.2 Output	Improved technologies for reducing rate of spread of pest fish species.	2012			

APPENDIX 2: MILESTONE REPORTING CONT'D

Table 7: Research outputs and/or milestones

Output/Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestone
4.2.3 Milestone	Risk and hazard analyses for new pest fish and significant range extensions of existing pests completed.	01 June 2007	No	Milestone to be modified in 2008.	Milestone to be modified in 2008.
4.4 Output					
4.4.2 Milestone	Joint R&D with pest control companies & liaison with overseas agencies initiated to assess market opportunities directly & via international biotechnology conferences.	30 June 2007 ongoing.	Yes		
4.5 Output	Improved technologies for reducing rate of spread of pest fish species.	2012			
4.5.1 Milestone	Hazard analysis workshop held for water managers, community groups & local, national & international biologists on reducing risks of spread of pest fish from water storage & irrigation impoundments.		No	Milestone to be modified in 2008.	Milestone to be modified in 2008.
6.2 Output	Humane and target-specific feral cat baits.	2011			
6.2.2 Milestone	Assessment of ecologically-sound feral cat colony control project.	01 June 2007	No		Late appointed PostDoc now onboard. Milestone will be met in 2008.
7.1 Output	The mechanisms behind the lack of effectiveness of Rabbit Haemorrhagic Disease (RHD) in higher rainfall areas understood.	December 2010			
7.1.2 Milestone	Field studies, sample collection & laboratory analysis commenced.	June 2006 & reviews in June 2007, 2008, 2009 & 2010	Yes		
7.5 Output	Rabbit haemorrhagic Disease bait delivered product made available to end-users.	2012			

Output/Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestone
7.5.3 Milestone	The use of bait delivered Rabbit Haemorrhagic Disease virus demonstrated to pest control managers.	01 June 2007	Yes		
7.5.5 Milestone	Protocols for delivery of Rabbit Haemorrhagic Disease Virus bait to landholders established in consultation with state agencies responsible for pest management.	01 June 2007	Yes		
8.1 Output	Management recommendations for endemic & exotic diseases of invasive animals.	2009 (Registration) 2011 (Uptake)			
8.1.1 Milestone	Current information relating to invasive animal diseases (exotic & endemic) collated, published & disseminated, & potential risks to Australasia assessed.	30 June 2006	No	No budget has been allocated for this project. Reports collated Feb 07 but only very limited time has been able to be spent reviewing them.	Have applied for WEDDP funding.
8.2 Output	Remote vaccine delivery systems (RVDs), such as species-targeted baits & feeders (linked to output 2.2).	2010			
8.2.2 Milestone	Economic & feasibility analysis of developing new or improved invasive animal disease vaccines conducted.	01 June 2007	No	This task is currently on-going and will depend very much on the results of the existing pen and field trials occurring around the world. Trial progress is continually tracked by Dr Steve Lapidge.	Maintain work liaison & work schedule with international collaborators.
9.1 Output	Comprehensive package of generic management strategies & policies synthesised from species-specific outputs in Programmes 1 and 2, demonstration projects in Program 3, and outputs relating to risk assessment, community participation in pest management, development of information systems, and approaches to damage control in Programme 4.	2012			

Table 7: Research outputs and/or milestones

Output/Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestone
9.1.1 Milestone	Pest physiology and potential delivery systems investigated for a range of species to increase effectiveness of anti-fertility agents/vaccines/toxins likely to significantly increase agricultural productivity of protect human health.	01 June 2007	No	Through project 3.T.1 delivery of an infertility vaccine for control of mouse plagues, key experiments with immunocontraceptive MCMVs have been completed. However, whilst infertility was observed in directly inoculated mice, no infertility as a result of natural transmission occurred. Through project 9.T.1 oral delivery systems for herbivore management, a research agreement was signed with Senestech Inc in order to undertake proof of concept research on a potential chemical sterilant, 4-Vinylcyclohexene Diepoxide, (VCD). An initial experiment using a standard dose which has effects on primordial follicle development in eutherian species has been completed. In wallabies, VCD was toxic at this standard concentration and a lower dose (4-fold less) did not induce a marked depletion in follicles after 30 days. A second experiment in which VCD is presented in a different formulation and as a different dosing regime is being undertaken. Despite this progress, the project has hit funding stumbling blocks which hope to be rectified by July 2007.	A grant proposal has been submitted to DEST ISL Round 12 (outcome will be known July/August 07), which would bring the project back on track.

Output/Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestone
9.4 Output	The development of information systems that will improve coordination & evaluation of effort on a national, regional & local level.	2011			
9.4.2 Milestone	Web-based data entry systems for abundance, density & damage information developed & evaluated.	30 June 2007	No	Development of a system exclusively by CRC is unlikely to be adopted.	CRC to stay involved in discussions to progress matters.
9.4.4 Milestone	Pest density-damage relationships for invasive animals assessed to optimise benefits from control.	30 June 2007	Yes		
9.5 Output	Development & implementation of improved, cost-effective risk management strategies & response options to restrict introductions or the range of invasive animals.	2011			
9.5.1 Milestone	Risk analysis & identification of hazards (i.e. expansion of range of existing pests, new incursions) completed.	30 June 2007	Yes & ongoing		
9.7 Output	National responses to reducing adverse impacts caused by invasive pest animals	2012			
9.7.2 Milestone	A national pest animal genotyping facility developed.	June 2007	Yes & ongoing		
10.1 Output	A registration, marketing, export & community uptake package for reducing the impacts of invasive pest animals.	June 2010			
10.1.1. Milestone	A team of professionals, skilled in the areas of registration, marketing, export & community uptake, established to be consulted for advice.	01 June 2007			
10.1.2 Milestone	Generic protocols & processes prepared for managing the registration, marketing & export of invasive animal pest control products.	01 June 2007			

Table 7: Research outputs and/or milestones

Output/Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestone
12.1 Output	Assessment of the overall impact of the Invasive Animals CRC throughout its life, and recommended directions and requirements into the future.	Reviewed annually			
12.1.1 Milestone	Agreed benchmarks established for invasive animal impacts, density and distribution in Australasia. This information portrayed to the public and changes in community attitudes to invasive animals monitored.	June - Annual review	Yes & ongoing		
12.1.2 Milestone	Invasive animal distributions and impacts in Australasia, and community attitudes towards current and potential invasive animals species evaluated.	June - Reviewed annually	Yes & ongoing		
12.1.3 Milestone	Reductions in pest animal impacts (and associated gains in production) through the various activities of the IA CRC demonstrated through rigorous science.	June - Reviewed annually	Yes & ongoing		
13.1 Output	Effective & accountable management.	Ongoing			
13.1.1 Milestone	Achieve compliance with reporting requirements required by ASIC.	December 2006	Partly. Ongoing		
13.1.2 Milestone	Board performance and annual review.	June 2007 & annually	Yes		
13.1.4 Milestone	Finance & Compliance Committee convened to review adequacy of financial & operating controls.	31 July 2006 & biennially	Yes		
13.1.5 Milestone	Draft & implement a board-approved Procedures, Protocols & Operating Manual.	July 2006 & ongoing	Partly		Ongoing Project
13.2 Output	Engagement & communication with partners & community.	Ongoing	Yes		
13.2.2 Output	News brokering arrangements with at least six partners.	July 2006 & ongoing	Yes		


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